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When Good Is Stickier Than Bad: Understanding Gain/Loss Asymmetries in Sequential Framing Effects

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Considerable research has demonstrated the power of the current positive or negative frame to shape people's current judgments. But humans must often learn about positive and negative information as they encounter that information sequentially over time. It is therefore crucial to consider the potential importance of sequencing when developing an understanding of how humans think about valenced information. Indeed, recent work looking at sequentially encountered frames suggests that some frames can linger outside the context in which they are first encountered, sticking in the mind so that subsequent frames have a muted effect. The present research builds a comprehensive account of sequential framing effects in both the loss and the gain domains. After seeing information about a potential gain or loss framed in positive terms or negative terms, participants saw the same issue reframed in the opposing way. Across 5 studies and 1566 participants, we find accumulating evidence for the notion that in the gain domain, positive frames are stickier than negative frames for novel but not familiar scenarios, whereas in the loss domain, negative frames are always stickier than positive frames. Integrating regulatory focus theory with the literatures on negativity dominance and positivity offset, we develop a new and comprehensive account of sequential framing effects that emphasizes the adaptive value of positivity and negativity biases in specific contexts. Our findings highlight the fact that research conducted solely in the loss domain risks painting an incomplete and oversimplified picture of human bias and suggest new directions for future research.

Keywords: positivity bias, negativity bias, negativity dominance, framing, reframing

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Positive and negative frames can play a pivotal role in shaping people's attitudes and decisions. People tend to evaluate the exact same object more favorably when it is described in positive rather than negative terms, with critical implications for outcomes such as economic decision-making, political preferences, and health behavior (e.g., Linville, Fischer, & Fischhoff, 1993; Quattrone & Tversky, 1988; Tversky & Kahneman, 1981; Wilson, Kaplan, & Schneiderman, 1987; see Kühberger, 1998; Levin, Schneider, & Gaeth, 1998, for reviews). The impact of positive and negative frames on people's current judgments and behavior is one of many instantiations of the general human tendency to attend to valence (Allport, 1935; Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Katz, 1960; Markus & Zajonc, 1985; Rozin & Royzman, 2001; Schultz, 2000). Humans' evolved cognitive architecture enables them to learn about positive and negative features in their environment and to integrate that information over time in a way that helps them attain rewards, avoid punishments, and interact effectively with their social world.

Of course, such learning occurs over time, in sequence, rather than all at once. Thus, any serious consideration of how humans learn and think about positive and negative information must acknowledge the potential importance of the order in which that information is encountered. Indeed, sequencing has proven to be crucial for understanding psychological processes in a number of domains (Asch, 1946; Gawronski, Rydell, Vervliet, & De Houwer, 2010; Glanzer & Cunitz, 1966; Murdock, 1962; Schwarz, 1999). More recently, research on framing has demonstrated the importance of considering sequence in this domain as well: A frame, once encountered, can stick in the mind and continue to influence judgment, even in the face of an opposing frame (Ledgerwood & Boydstun, 2014). In other words, people do not always just respond based on the current frame in the current context, as the existing framing literature has tended to assume; sometimes, their judgments are also influenced by the frames they have seen before. What's more, this recent work on frame sequencing has shown that the stickiness of an initial frame depends crucially on its valence. An initial negative frame seems to have a more lasting impact than

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an initial positive frame, in that people's attitudes change less in response to reframing when a negatively framed object is reframed in positive terms, compared to when a positively framed object is reframed in negative terms.

Although this initial research on sequentially encountered frames provided an important first glimpse into biases in reframing effects, it focused quite narrowly on one particular type of negative and positive framing: namely, loss and nonloss frames. This type of loss domain framing is very common in framing research (e.g., Block & Keller, 1995; Meyerowitz & Chaiken, 1987; see Kühberger, 1998, for a review). However, studying only these two frames (i.e., loss and nonloss) overlooks the crucial fact that outcomes can vary not just in their valence (negative vs. positive) but also in whether they concern a punishment or a reward (i.e., a loss vs. a gain). This distinction—prominently highlighted by regulatory focus theory (Higgins, 1997)—clarifies that the presence of a punishment (i.e., a loss) is not psychologically the same as the absence of a reward (i.e., a nongain), although they both share a negative valence. Similarly, the presence of a reward (i.e., a gain) is psychologically distinct from the absence of a punishment (i.e., a nonloss), despite both having a positive valence (Cacioppo & Berntson, 1994; Cacioppo, Gardner, & Berntson, 1997; Cesario, Corker, & Jelinek, 2013; Idson, Liberman, & Higgins, 2000; see also Tritt, Inzlicht, & Peterson, 2014). Thus, although we know that negative (vs. positive) frames have a more lasting impact in the *loss* domain, we cannot assume that the same pattern would characterize the gain domain. If we are to fully understand the sequential effects of frames on judgments—and more broadly, the way that humans learn and think about positive and negative information in their environment—we must therefore move beyond the loss domain to explore sequential framing effects when people consider potential gains.

Single-Shot Framing Effects

In everyday life, positive and negative frames are ubiquitous. Different pundits might describe the same economic stimulus program in terms of its success rate or its failure rate; different doctors might frame the same surgical procedure in terms of the chances of survival or mortality. Research across many different areas has demonstrated the power of such frames to influence current judgments and decisions: Attitudes toward the same outcome depend on whether that outcome is currently described in positive or negative terms (e.g., Kahneman & Tversky, 1979; Levin, Schnittjer, & Thee, 1988; Levin & Gaeth, 1988; Marteau, 1989; Wilson et al., 1987). For example, studies have found that participants evaluate a medical procedure more favorably when it is described in terms of its survival rate as opposed to its (objectively equivalent) mortality rate (e.g., Marteau, 1989; Wilson et al., 1987). Likewise, people rate the quality of ground beef more positively when it is labeled as "75% lean" rather than "25% fat" (Levin & Gaeth, 1988), and they rate a job placement program more positively when it is described in terms of its success rate rather than its failure rate (Davis & Bobko, 1986). Taken together, this vast and multidisciplinary literature converges on the key finding that the current frame powerfully influences people's current attitudes and decisions.[1]

In the real world, of course, people encounter information over time, rather than only once in a single-shot context. Thus, people may often come across the same information framed one way at first, and subsequently reframed in a different way: One pundit's description of an issue might be quickly countered by another's; a patient might seek a second medical opinion and encounter a different frame. These situations are not unique to our modern, information-rich world: In our ancestral past, six group members might safely cross a river (highlighting the chances of a successful crossing), and then a seventh might be injured (highlighting the chances of failure). However, despite the fact that in the real world, people rarely encounter a single frame in isolation as they do in the lab, the existing framing literature can be largely characterized as emphasizing the power of a single, current frame to shape current judgments (e.g., Kahneman & Tversky, 1979; Kühberger, 1998; Levin et al., 1998). Very little work has examined what happens when people encounter an object framed in different ways from one time point to the next.

We do know, from a small handful of studies on multiple frames, that the combined effect of two frames encountered simultaneously seems to be different than the sum of each frame's effect when encountered alone (De Dreu, Carnevale, Emans, & Van De Vliert, 1994; Wu and Markle, 2008). In other words, frames can and do operate differently in combination than they do in isolation. It is therefore critical to move beyond the existing literature's predominant focus on single-shot framing contexts to consider what happens when different frames are encountered in sequence, if we are to fully capture the psychological processes that underlie framing effects (Gärling & Romanus, 1997; Ledgerwood & Boydstun, 2014; Thaler & Johnson, 1990). With this aim, recent research has begun to explore *sequential framing effects*, or what happens when an object that is initially framed in one way is subsequently reframed in a different way (Ledgerwood & Boydstun, 2014).

Sticky Frames

In the first research to explore sequential framing effects, Ledgerwood and Boydstun (2014) examined whether responses may sometimes be influenced by previously encountered frames. This program of work drew from research on functional fixedness (Adamson, 1952; Duncker, 1945), which suggests that once a person labels an object one way, the label can stick in their mind and limit their ability to categorize the object in a new way. For example, mentally categorizing an object as a box for thumbtacks makes it difficult to see its potential as a shelf for a candle (Duncker, 1945). Ledgerwood and Boydstun hypothesized that frames may operate in a similar manner: Once an object has been conceptualized in positive or negative terms, it may be difficult for people to reconceptualize it in a different way.

Moreover, these authors posited that the general and presumably adaptive human tendency to prioritize safety and potential negatives (Baumeister et al., 2001; Rozin & Royzman, 2001)

[1] Our focus in this article concerns valence framing effects. Note that although the bulk of the framing literature shares this focus on valence framing, several other types of framing have been studied as well. For discussions of other kinds of framing and different accounts of framing effects, see Chong & Druckman, 2007; Keren, 2011; Reyna & Brainerd, 1991; Sher & McKenzie, 2006). Our framework and concepts apply to valence framing and are not meant to extend to all types of framing.

may not only lead negative frames to loom larger than positive frames (Kahneman, & Tversky, 1979), but also may cause negative frames to last longer or have stronger carryover effects. In other words, if frames can be cognitively sticky in the manner suggested by functional fixedness, then negative frames might be particularly difficult to shift away from.

In line with these predictions, Ledgerwood and Boydstun (2014) demonstrated in a series of studies that people's attitudes change less in response to reframing when frames switch from negative to positive, relative to when frames switch from positive to negative. In other words, not only do frames have carryover effects, but negative and positive frames seem to have distinct carryover effects: In these studies, negative frames tended to stick in the mind more strongly than positive frames. Supporting the notion that this asymmetry in carryover effects reflected an asymmetry in the stickiness of an initial positive versus negative frame, participants took longer to mentally convert negatively framed concepts into positively framed concepts than to convert from positives to negatives, and reframing changed positive construals but not negative ones. Together, these studies (along with multiple replications; Boydstun, Ledgerwood, & Sparks, 2016) suggested that it was more difficult for participants to reconceptualize a negative as a positive than vice versa.

Thus, initial work on sequential framing has suggested that negative frames, in particular, seem to lodge in the mind and continue to influence judgment even in the face of a different frame. But importantly, this research overlooked half of the sequential framing story because it used an incomplete set of frames.

Distinguishing Gain and Loss Domains

Many topic areas in psychology have been dominated (perhaps unintentionally) by a focus on loss domain phenomena, in that negatives are often conceptualized as creating tension and positives are conceptualized as eliminating tension (Higgins, 1997). For example, historically, clinical psychology was concerned with treating abnormal disorders (a perspective that defines negatives as psychological abnormalities and positives as the lack of abnormalities), to the omission of a positive psychological focus on promoting mental thriving; judgment and decision-making research focused on the biased ways in which people make decisions (a perspective that defines negatives as errors in judgment and positives as the absence of errors), rather than thinking about how biases may facilitate functional or adaptive behavior (Gigerenzer, 1991; Maslow, 1954; Seligman, 2008). This predominant focus on the loss domain may have constrained both the questions that researchers tend to ask as well as the results they tend to find.

Consistent with this tendency to focus on losses in the broader psychological literature, the vast majority of the framing literature has used paradigms that involve loss domain scenarios such as disease outbreaks, surgical procedures, job layoffs, incurring fines, and the presence or absence of undesirable qualities (like fat in ground beef; see Levin et al., 1998, for a review). As a whole, the literature on valence framing tends to study positive and negative framing without considering the distinction between loss and gain domains—a conflation facilitated by the fact that this literature often refers to positive and negative frames as *gain* and *loss* frames. Following these conventions, Ledgerwood and Boydstun's initial investigation of sequential framing effects adapted classic framing paradigms in which participants learn about a potential loss, like the outbreak of an unusual disease expected to kill 600 people (Tversky & Kahneman, 1981) and then see the outcomes framed in positive or negative terms. For instance, in one of their studies, participants learned that 600 lives were at stake (a potential loss). Those in the negative-to-positive reframing condition first saw a set of program options framed in terms of the number of lives that would be lost (a negative frame), and then saw the same program options reframed in terms of the number of lives that would be saved (a positive frame). In the positive-to-negative framing condition, the program options were framed first in terms of lives saved and then reframed in terms of lives lost.

Ledgerwood and Boydstun's other study scenarios all focused similarly on potential losses, leaving unanswered the question of how sequential frames operate in the gain domain (see Figure 1).[2] Indeed, in general, the framing literature (like other literatures) has not carefully distinguished between the gain and loss domains—positive frames capturing the presence of gains and the absence of losses are often assumed to be interchangeable, as are negative frames capturing the presence of losses and the absence of gains (e.g., Block & Keller, 1995; Meyerowitz & Chaiken, 1987; Uskul, Sherman, & Fitzgibbon, 2009; see Higgins, 1997; Idson et al., 2000, for more on this point). Thus, research focusing on sequential framing effects in the loss domain has established that negatives are stickier than positives, but as this section makes clear, the loss domain is only half of the picture.

Sequential Framing in the Gain Domain

The present research set out to investigate the missing half of the sequential framing picture by exploring sequential framing effects when people consider potential gains. There are three logical possibilities for what we might find in the gain domain, and theoretical reasons to predict each one, further underscoring the importance of empirically investigating this question.

The first possibility is that the gain and loss domains may look similar, such that negatives are always stickier than positives. After all, work on negativity bias demonstrates a potent and pervasive human tendency to give greater weight to negative than positive entities (Kahneman & Tversky, 1979, 1984; see Baumeister et al., 2001; Rozin & Royzman, 2001, for reviews). People attend more readily to negative than positive information, process it more deeply, and remember it better; likewise, negative information tends to have greater clout in influencing impression formation and emotional reactions (Fiske, 1980; Hansen & Hansen, 1988; Öhman, Lundqvist, & Esteves, 2001; Peeters & Czapinski, 1990; Pratto & John, 1991; Rothbart & Park, 1986; Skowronski &

[2] Like most of the framing literature, Ledgerwood and Boydstun (2014) mistakenly labeled their positive and negative frames "gain" and "loss." If we consider a broader framework that considers both domain (gain vs. loss) and valence (positive vs. negative) of frames, the correct term for the manipulation in those studies was valence (positive vs. negative), which corresponds to the terms we use here.

		Domain	
		Loss	*Gain*
Valence	*Negative*	loss (e.g., food stolen; paying a fine)	non-gain (e.g., food missed; not getting a discount)
	Positive	non-loss (e.g., food protected; avoiding a fine)	gain (e.g., food gathered; getting a discount)

Figure 1. Past research (e.g., Ledgerwood & Boydstun, 2014) has focused on the two shaded cells in loss domain, reflecting loss and nonloss frames. But this misses two cells in the gain domain. For example, a shopper might go to a grocery store that charges a $.10 fine when shoppers forget their own bag (a potential loss) or a store that offers a $.10 discount when shoppers bring their own bag (a potential gain). Either prospective outcome could be framed in negative terms (e.g., the chances of paying the fine or not getting the discount) or positive terms (the chances of avoiding the fine or getting the discount). The present work looks at all four types of frames, with an emphasis on understanding new patterns that may emerge in the understudied gain domain, reflecting gain and nongain frames.

Carlston, 1992). Some scholars have made an evolutionary argument for why negativity dominance might be strong and pervasive, suggesting that it is adaptive for humans to be generally more sensitive to negatives than positives (Baumeister et al., 2001; Rozin & Royzman, 2001). According to these perspectives, organisms who are more attuned to negatives should be more likely to survive potential threats and pass on their genes. Drawing on this body of theoretical and empirical work, one might reasonably infer that a general negativity bias should permeate both loss and gain domains.

A second possibility, however, is that the gain domain may behave in the opposite way than the loss domain, with positives stickier than negatives. This prediction follows from theory and research on positivity offset, which implies that people may tend to expect or be particularly sensitive to the possibility of positives, especially when entering novel environments in which information about rewards and punishments is not yet known (Cacioppo & Berntson, 1994; Cacioppo et al., 1997). Such a bias toward positive information could promote exploratory behavior and enable the discovery of rewards. According to scholars who advance this perspective, positivity offset is assumed to be an evolutionarily adaptive complement to negativity bias: If people were always more attuned to the possibility of negatives than the possibility of positives, they would not be motivated to explore new environments, which is essential for learning and growth (see also Ainsworth & Bell, 1970). Thus, organisms that are especially attuned to rewards in novel environments might have an evolutionary advantage. Consistent with such theorizing, research on reward processing in the brain has identified a distinctive dopamine response elicited by novel rewards (but not punishments) that is thought to constitute a particularly effective teaching signal for learning to approach potential gains in new environments (Schultz, 2000; Schultz, Dayan, & Montague, 1997).

This second possibility (for positives to be stickier than negatives in the gain domain) also follows from research on regulatory fit (Higgins, 2000, 2005). In the context of framing, fit would describe a situation where the frame presented to participants (positive vs. negative) matches their current goal orientation (promotion vs. prevention, which theoretically would be induced by focusing people on potential gains vs. potential losses; see also Idson et al., 2000). In light of past research suggesting that regulatory fit improves the efficiency of encoding processes (Lee & Aaker, 2004; Wänke, Bohner, & Jurkowitsch, 1997), one might expect fit to enhance frame stickiness. Building on regulatory fit theory and research, one could predict that when there is "fit" (i.e., a positive frame in the gain domain or a negative frame in the loss domain), people will process a frame more fluently and then find it especially difficult to reconceptualize the object using a different frame. Such a process would lead negatives to be stickier than positives in the loss domain (consistent with past research), whereas positives would be stickier than negatives in the gain domain.

The final possibility for what could occur in the gain domain is that there may be no difference in the stickiness of positive and negative frames. Although existing perspectives do not make this prediction directly, one might reasonably infer it by carefully scrutinizing theoretical claims for why negativity bias should exist at all. When scholars have built a case for a general negativity bias, they have tended to ignore the distinction that regulatory focus theory makes between domain (gain vs. loss) and valence (positive vs. negative), and their arguments for why negatives should be more important than positives tend to be made within the domain of losses (e.g., imminent danger requires urgent attention to ensure survival; Baumeister et al., 2001; Rozin & Royzman, 2001). One could draw on this reasoning to predict that negativity dominance will be circumscribed to the loss domain: Negatives will be stickier than positives in the loss domain, but this negativity bias will disappear in the gain domain.

Given these three plausible predictions, the present research set out to test how sequential framing effects operate in the gain domain. Of course, we know that in social psychology, the answer to any question that begins with "which is it?" tends to be a ringing "it depends." Thus, whether positive or negative frames are stickier in the gain domain might also vary depending on context—and indeed, this is what ultimately proved to be the case in the studies that follow.

Before moving on to describe our studies, we note that the central goal of this line of research is to shed light on asymmetries in reframing effects across both loss and gain domains. Our work therefore has important implications for understanding valence and framing—but crucially, it does not require a starting assumption about the process by which a framing effect occurs in the first place. Indeed, researchers have proposed multiple accounts for why single-shot framing effects occur (e.g., Cesario et al., 2013; Reyna & Brainerd, 1991; Sher & McKenzie, 2006). However, regardless of whether valenced frames initially influence people's preferences by leaking information about a speaker's "implicit recommendations" (Sher & McKenzie, 2006), by influencing the way people summarize or simplify a particular option (Reyna & Brainerd, 1991), or by another process altogether, the questions we ask in this manuscript remain relevant and important: Are there asymmetries in reframing effects? And can we outline the specific conditions under which positivity and negativity biases in reframing effects occur?

Overview of Studies

In Studies 1 and 2, participants read about a potential gain (a cognitive training regimen designed to enhance memory or a fruit extract designed to enhance energy) framed in positive terms (the success rate of the regimen or extract) or negative terms (the failure rate) and then saw the same potential gain reframed in the opposing way. In Study 1, we also examined the loss domain to ensure that we could replicate the results of prior research in this domain. To capture attitude change in response to reframing, we asked participants in each study to rate their attitudes toward the regimen or extract at two time points: Once after the initial frame, and again after the reframe. Both studies were well-powered to detect the effect of interest and, on the surface at least, the two study scenarios seemed quite similar. Intriguingly, however, the different scenarios produced strikingly different results—prompting a search for a moderator in our next studies. In particular, drawing on theorizing about positivity offset, we wondered whether sequential framing effects might differ depending on whether a scenario feels novel (like a cognitive training regimen) or more familiar (like a fruit extract).

In Study 3, we tested whether the novelty or familiarity of a given scenario might moderate the sequential effects of positive and negative frames in the gain domain. Building on the cognitive training regimen scenario used in Study 1, which presumably seemed quite novel and unfamiliar to our participants, we led half of the participants in Study 3 to feel like the scenario was more familiar by suggesting that the regimen was similar to other activities that they had experienced before. Moreover, we examined the role of novelty/familiarity in not only the gain domain, but also the loss domain, in order to help narrow down potential theoretical explanations for our results.

In Studies 4 and 5, we sought to conceptually replicate the moderating role of familiarity in the gain domain to provide converging evidence for our results across different operationalizations, allowing us to better triangulate on our construct of interest. In Study 4, we again built on the cognitive training regimen scenario used in Study 1, but this time, we manipulated familiarity by giving half of our participants direct experience with a task like the regimen. In Study 5, we built instead on the fruit extract scenario used in Study 2, and simply described it to participants as a familiar-sounding "strawberry extract" versus a novel-sounding "polyphenolic compound." By varying whether the operationalization of familiarity provided participants with additional text describing how the scenario was similar to tasks that participants had previously experienced (Study 3), actual experience with the scenario itself (Study 4), or simply a more familiar-sounding label (Study 5), we can provide converging evidence for the central role of familiarity in modulating sequential framing effects in the gain domain.

In every study, we report how we determined our sample size, any and all data exclusions, all manipulations, and all key dependent measures of interest (where "key" was defined and recorded a priori).[3] All power calculations were conducted using G*Power (Faul et al., 2007). Our stopping rule for data collection was always to collect data until we reached our a priori target sample size; the ultimate sample size of a study sometimes varies slightly from our target because our data collection platform counts the number of people who proceed to the very last page of a survey rather than the number completing all survey questions. All study materials are available at https://ucdavis.box.com/s/0oc241ssk56xocxx3b5xxf2nqt9cingi.

Study 1

In Study 1, we adapted a typical framing paradigm used in past research (e.g., Wilson et al., 1987) to provide a first test of whether sequential framing effects might differ depending on whether people are contemplating a potential gain versus a potential loss. Participants read about a cognitive training regimen designed to either enhance memory capacity (a potential gain) or prevent memory loss (a potential loss). Half the participants saw the regimen framed in positive terms (its success rate), and the other half saw it framed in negative terms (its failure rate). After reporting their initial attitudes toward the regimen, participants then saw it reframed in the opposing way (i.e., positive-to-negative or negative-to-positive) and reported their attitudes again. This design thereby allowed us to assess how participants' attitudes changed from one time point to the next as they encountered different frames presented in sequence. We predicted that the findings in the loss domain would replicate the results from Ledgerwood and Boydstun (2014): If negative frames are stickier than positive frames in the loss domain, then changing the framing of the regimen from negative to positive (vs. positive to negative) will have a muted effect on participants' attitudes. In the gain domain, each of the three possibilities outlined earlier seemed equally plausible, so we had no a priori prediction.

Method

Participants and power. Two hundred and four participants (68 women, 136 men; 99.5% from the United States) between the ages of 18 and 73 years (M = 31.98, SD = 11.30) completed the study online in exchange for payment through Amazon's Mechanical Turk (MTurk) platform. They were randomly assigned to condition in a 2 (domain: gain vs. loss) by 2 (frame valence order: positive-to-negative vs. negative-to-positive) between-subjects design. We chose to set a target of 50 participants per cell following previous research on sequential framing effects (Ledgerwood & Boydstun, 2014). Our final cell size (between 50 and 52 in each of the four cells of our design) provided about 78% power to detect the sequential framing effect found by Ledgerwood and Boydstun (2014) in the loss domain (d = .54, roughly a medium size effect).[4] Without prior knowledge about the effect size to expect in the gain domain, we decided to adequately power our study to at least detect the same effect size as observed in the loss domain.

In this and all subsequent studies, participants could only complete the study if they had never participated in another sequential framing study conducted by our lab. MTurk workers were paid

[3] Many studies included additional exploratory measures designed to provide ideas for future studies that we do not report here. We do report all measures that were designated a priori as the primary, focal measures for a given study. Note that the N used in manipulation checks versus main analyses sometimes differs slightly within a study because not all participants responded to all items.

[4] Computed as the meta-analytic average of the three relevant effect sizes from past research (Ledgerwood & Boydstun, 2014, Studies 1, 2, and the study reported in Footnote 4).

$.25 to complete the 5-min study (which aligns with recent reports of average MTurk compensation rates; Bohannon, 2016). To ensure that participants were paying attention, we asked them to close background windows and minimize distractions, and we included open-ended questions at the end of each study where participants could report any confusion about the instructions (none did). Note that our previous research on reframing has always shown similar patterns of effects in MTurk and laboratory samples (Ledgerwood & Boydstun, 2014), which increases our confidence in the generalizability of findings obtained using either type of sample.

Materials and procedure. Participants were asked to imagine that "a national panel is evaluating a recently-developed cognitive training regimen." To manipulate domain, participants read that the regimen was either "designed to enhance memory capacity" (a potential gain) or "designed to prevent memory loss" (a potential loss).

The rest of the procedure closely followed the one developed by Ledgerwood and Boydstun (2014). Participants learned about the ostensible results of a study on the regimen, which were initially framed in either positive terms (a success rate of 60%) or negative terms (a failure rate of 40%). After reading this initial frame, participants rated their attitudes toward the regimen by moving sliders along three unmarked scales anchored at the endpoints (*very negative* to *very positive*, *harmful* to *beneficial*, and *completely oppose* to *completely favor*). These scales were averaged to form an index of attitudes toward the regimen at Time 1 ($\alpha = .91$).

Next, participants read "additional information" about the training regimen that simply reframed the prior information using the opposite frame valence. For example, in the gain domain, participants in the positive-to-negative condition had first read that a regimen designed to enhance memory capacity had a 60% success rate, and now read "additional information" that simply described the same regimen as having a 40% failure rate. Thus, the information presented at the two time points was mathematically equivalent, but the language used to describe the regimen switched either from positive to negative or from negative to positive.

Finally, participants were asked to rerate their attitudes toward the regimen using the same three slider scales from Time 1. These scales were averaged to form an index of attitudes toward the regimen at Time 2 ($\alpha = .95$).

Results and Discussion

Following Ledgerwood and Boydstun (2014), we set a priori exclusion criteria to exclude participants who reported knowing about framing effects (since including non-naïve participants could bias our results) as well as anyone who failed to move any of the sliders for the dependent variable items (see Van Boven, Judd, & Sherman, 2012). In this sample, four participants reported prior knowledge about framing effects, and no participants failed to move the sliders. We conducted analyses using the remaining 200 participants in the sample.

To test whether attitude change in response to reframing depends on domain as well as frame valence order, we conducted a 2 (domain: gain vs. loss) by 2 (frame valence order: positive-to-negative vs. negative-to-positive) between-subjects analysis of variance (ANOVA) on the extent of attitude change that participants displayed in the direction of the Time 2 frame (i.e., the amount each participant shifted away from the Time 1 frame and toward the Time 2 frame).[5]

There was no main effect of frame valence order ($p = .51$), and there was a main effect of domain, $F(1, 196) = 8.95$, $p = .003$, $\eta_p^2 = .04$, indicating an overall tendency for attitudes to change more in the loss domain than the gain domain, regardless of framing order.[6] More importantly, the analysis revealed a significant two-way interaction between frame valence order and domain, $F(1, 196) = 19.59$, $p < .001$, $\eta_p^2 = .09$, suggesting that the effect of frame valence order differed between loss and gain domains.

Replicating past work, in the loss domain, attitudes changed significantly less when the framing switched from negative to positive, relative to when the framing switched from positive to negative, $F(1, 196) = 12.94$, $p < .001$, $\eta_p^2 = .06$. In contrast, this pattern significantly reversed in the gain domain: Here, attitudes changed less in response to reframing when the initial frame was positive (vs. negative), $F(1, 196) = 7.09$, $p = .008$, $\eta_p^2 = .04$. In other words, as can be seen in Figure 2, the results of Ledgerwood and Boydstun (2014) replicated in the loss domain but not the gain domain. Thus, whereas negative frames are stickier than positive frames in the loss domain, this first study seemed to indicate that positive frames may be stickier than negative frames in the gain domain.

Study 2

Study 2 was designed to test whether this new finding in the gain domain would replicate across different kinds of scenario content. In other words, we sought to conduct a *systematic replication*, varying aspects of the materials that we thought at the time should not matter for producing the results (Ledgerwood, Soderberg, & Sparks, 2017; Roediger, 2012). Participants read about a fruit extract designed to enhance energy levels. Mirroring Study 1, half the participants saw the extract initially framed in positive terms (its success rate), and the other half saw it initially framed in negative terms (its failure rate). After reporting their initial attitudes toward the extract, participants then saw it reframed in the opposing way and reported their attitudes again. We reasoned that if positive frames are generally stickier than negative frames in the gain domain, then changing the framing of the extract from positive to negative (vs. negative to positive) would have a muted effect on participants' attitudes, as in Study 1. (We omitted the loss domain in this study because that effect has already been repeatedly replicated across a variety of different scenarios; see Boydstun et al., 2016; Ledgerwood & Boydstun, 2014, and we wanted to

[5] The dependent variable was thus calculated as (Time 2 attitude–Time 1 attitude) for the negative-to-positive condition, and as -1^*(Time 2 attitude–Time 1 attitude) for the positive-to-negative condition, such that higher numbers in both conditions indicated greater attitude change in the direction of the Time 2 frame. Of course, we can also test our prediction treating attitudes at Time 1 and Time 2 as repeated measures, rather than calculating a change score, which yields statistically identical results. We focus here on attitude change in response to reframing because it is the simplest and clearest way to capture our dependent variable of interest, but interested readers may consult the online supplemental materials to see Time 1 and Time 2 scores graphed separately.

[6] Note that this main effect of domain also occurs in Study 3; because it is not central to our main research question, we will wait to discuss it in more detail until then.

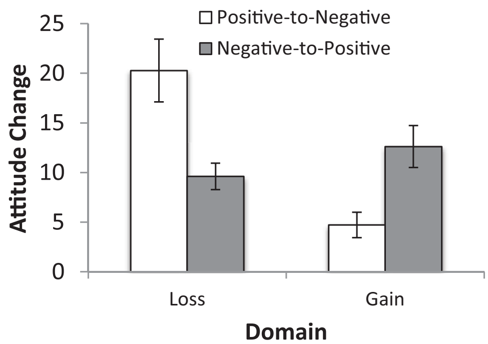

Figure 2. Attitude change in response to reframing as a function of domain (loss vs. gain) and frame valence order (positive-to-negative vs. negative-to-positive) in Study 1. Error bars indicate one standard error above and below the mean.

funnel our resources toward maximizing power to detect effects in the understudied gain domain).

Method

Participants and power. Participants (N = 108; 38 women, 67 men, and 3 unidentified; 100% from the United States) between the ages of 18 and 58 years (M = 29.41, SD = 7.57) completed the study online through MTurk. They were randomly assigned to one of two frame valence order conditions (positive-to-negative vs. negative-to-positive). A power analysis indicated we would need a cell size of n = 41 to achieve 80% power. Given that we had the resources to collect a larger sample, that classic power analyses can be overly optimistic (McShane & Bockenholt, 2014; Perugini, Gallucci, & Costantini, 2014), and that we expected we would have to drop a few participants to follow our a priori exclusion criteria, we decided to recruit at least 50 participants per cell.

Materials and procedure. Participants were asked to imagine that "a national panel is evaluating a recently-developed fruit extract designed to enhance energy levels." They then learned about the ostensible results of a study on the extract, which were initially framed in either positive terms (a success rate of 60%) or negative terms (a failure rate of 40%). After reading this initial frame, participants rated their attitudes toward the extract 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 to form an index of attitudes toward the extract at Time 1 (α = .91).

As in Study 1, participants then read "additional information" about the fruit extract that reframed the prior information using the opposite frame valence. Finally, participants were asked to rerate their attitudes toward the extract using the same three slider scales used at Time 1. These scales were averaged to form an index of attitudes toward the extract at Time 2 (α = .91).

Results

We followed the same a priori exclusion criteria set in Study 1. In this sample, 2 participants reported prior knowledge about framing effects, and 3 participants failed to move the sliders or the slider values failed to record. We conducted analyses using the remaining 103 participants in the sample.

To test the effect of frame valence order on attitude change, we conducted an independent samples t test to compare attitude change in the positive-to-negative versus negative-to-positive conditions. Interestingly—despite the fact that we had intended to change only irrelevant aspects of the scenario from Study 1 to Study 2 and that our Study 2 sample size provided 88% power to detect effects like those observed in previous studies—the effect of framing order (positive-to-negative vs. negative-to-positive) on attitude change did not replicate in this study, $t(101) = 1.57$, p = .119, d = .31. In fact, if anything, the nonsignificant pattern of results was in the *opposite* direction than the one observed in Study 1: Negative-to-positive reframing produced somewhat smaller changes in attitude (M = 8.45, SD = 15.02) than positive-to-negative reframing (M = 13.86, SD = 19.56; see Figure 3).[7]

Discussion

Taken together, then, Studies 1 and 2 represented two well-powered studies that produced strikingly different results. To us, this inconsistency suggested the potential presence of an undiscovered and important moderating variable. After comparing our scenarios side by side and delving into the literature on positivity offset (Cacioppo & Berntson, 1994; Cacioppo et al., 1997, 2002), we began to wonder whether unintended variations in the novelty of the two scenarios we used in Studies 1 and 2 might be turning on or off the stickiness of positive frames in the gain domain.

Our reasoning was as follows. The scenario in Study 1 focused on a cognitive training regimen, which we suspected sounded unfamiliar to most of our MTurk participants—in fact, we deliberately chose this wording to avoid any preexisting, valenced associations participants might have with a more familiar activity to try to keep our manipulations as clean as possible. However, in Study 2, the scenario involved a fruit extract, which might have seemed much more familiar to our participants—after all, various extracts are routinely advertised and consumed in sports drinks, fruit smoothies, and nutritional supplements. Could this unintentional difference in the apparent novelty or familiarity of the scenarios explain the different pattern of results in our first two studies? We decided to directly manipulate familiarity to find out.

Study 3

We began by conducting an initial, exploratory study to probe whether novelty might help provide a unifying account for the inconsistent results in Studies 1 and 2. Here, we define the dimension of novelty versus familiarity as the extent to which people feel like they have information or knowledge about a given scenario (which could come from direct experience or from social learning). We reasoned that if the relative stickiness of positive and negative frames in the gain domain depends on how novel (vs. familiar) the scenario feels to participants, as proposed above, then if we ma-

[7] We conducted a second version of Study 2 using a similar fruit extract scenario to see if it mattered whether the positive or negative frame constituted the larger percentage. The pattern of results was similar to Figure 3, regardless of counterbalance condition (60% success rate/40% failure rate vs. 40% success rate/60% failure rate).

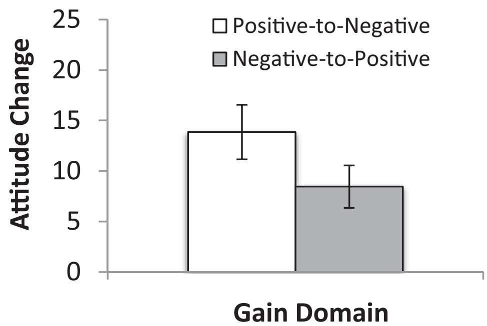

Figure 3. Attitude change in response to reframing in the gain domain as a function of frame valence order (positive-to-negative vs. negative-to-positive) in Study 2. Error bars indicate one standard error above and below the mean.

nipulate novelty versus familiarity, we should see a pattern of results that looks like Study 1 in the novel condition and a pattern that looks like Study 2 in the familiar condition. The full methods and results of this initial, exploratory study ($N = 249$) are reported in the online supplemental materials as Study 3s (to conserve page space here, we will move directly to describing our more cleanly designed replication of this preliminary study). As can be seen at a glance in Figure 4, the exploratory findings of Study 3s suggested that the novelty or familiarity of a scenario may indeed play a key role in moderating the effect of frame order on attitude change: Positive-to-negative reframing produced less attitude change than negative-to-positive reframing when the scenario was novel, but not when it was more familiar.

In Study 3, we sought to replicate and extend the results from our exploratory Study 3s to (a) lend confidence to the preliminary conclusion that novelty moderates sequential framing effects in the gain domain and (b) distinguish between alternative theoretical accounts for why novelty might play a key moderating role.

The first plausible theoretical account we considered derived from a closer inspection of the literature on positivity offset that we described in the introduction. In fact, multiple literatures have suggested that in novel environments in particular, humans have an exploratory bias or positivity offset for potential gains (e.g., Cacioppo & Berntson, 1994; Cacioppo et al., 1997, 2002; Schultz, 2000; see also Bowlby, 1969). For instance, work on reward processing in the brain suggests that a phasic dopamine response in certain brain areas may be especially sensitive to the presence of novel rewarding stimuli, providing a particularly effective teaching signal for learning about the presence of gains in unfamiliar situations (Schultz, 2000; Schultz et al., 1997; Suri & Schultz, 1999). Meanwhile, theoretical work on positivity offset (e.g., Cacioppo et al., 1997) has proposed an adaptive argument for why humans would have evolved a tendency to orient toward positives in novel situations: People need something that propels them to explore so that they can learn about new rewards, to offset the generalized human tendency to prioritize safety and potential negatives. Without such a push toward exploration, people would always cower in the corner, afraid of potential negatives, and never learn about new environments. Thus, whereas negative features of losses are assumed always to instigate avoidance, regardless of novelty, this perspective highlights the importance of novelty in the gain domain by suggesting that people may initially overattend to the positive features of potential rewards.

Once a situation grows more familiar—either through direct exploration of one's environment or, for humans, through social mechanisms such as talking and observational learning (Bandura, 1977; Burkart, Hrdy, & Van Schaik, 2009)—the necessity for this extra motivational push toward exploration dissipates. Instead, it may be more useful to assess the possibility of gains and nongains in an evenhanded way. Such an account would also suggest that in the loss domain, negatives should always be stickier than positives, regardless of novelty—it is always adaptively valuable to avoid potential losses, regardless of whether the environment is familiar or unfamiliar (see also Baumeister et al., 2001). Thus, when integrated and applied to the topic of reframing, the logic developed in the literatures described above (Bowlby, 1969; Cacioppo et al., 1997; Schultz, 2000) suggests that the effect of familiarity on bias should be asymmetrical across gain versus loss domains: Familiarity should moderate reframing effects in the gain domain but not in the loss domain.

The second theoretical account that we thought could plausibly explain novelty as a moderator is regulatory fit, which suggests that a person's experience of pursuing a goal depends on whether their orientation toward that goal matches the means they are using to pursue it (Higgins, 2000). In the context of framing effects, regulatory fit would occur when a person encounters a frame (negative vs. positive) that matches their current regulatory orientation (prevention vs. promotion, respectively). Because experiencing regulatory fit can increase processing fluency (Lee & Aaker, 2004), a fit perspective might predict stickiness in the "high fit" cells of our design—that is, the initial positive frame in the gain domain and the initial negative frame in the loss domain, as observed in Study 1. At first glance, it might appear that fit cannot explain why novelty would moderate sequential framing effects. However, it is possible that novelty could itself influence a person's regulatory orientation (see Cesario et al., 2013). In that case, high fit would occur when the initial frame is positive and when the scenario is novel in the gain domain, and when the initial frame is negative and when the scenario is familiar in the loss domain. Thus, if in fact our manipulation of novelty versus familiarity affects regulatory orientation, then we would expect to see more stickiness in those two high-fit cells of the design (positive-first/novel/gain domain and negative-first/familiar/loss domain).

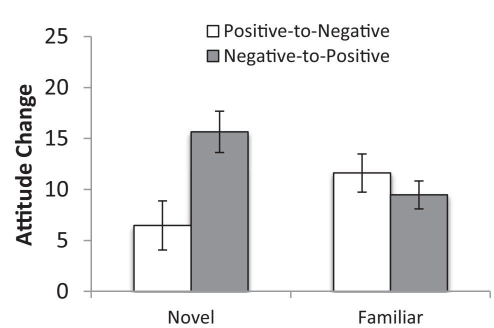

Figure 4. Attitude change in response to reframing in the gain domain as a function of familiarity (novel vs. familiar) and frame valence order (positive-to-negative vs. negative-to-positive) in Study 3s. Error bars indicate one standard error above and below the mean.

Notably, these two theoretical accounts predict a similar pattern of results in the gain domain (the pattern already observed in our exploratory Study 3s; see Figure 4), but they predict different patterns of results in the loss domain: A domain asymmetry account predicts no moderating impact of novelty in the loss domain, whereas a regulatory fit or matching account predicts that novelty will moderate symmetrically in the loss (vs. gain) domain (see Figure 5). To help distinguish between these accounts in Study 3, we extended our design to include the loss domain once again. We also tested whether novelty actually affects goal orientation, as the fit account constructed above would require.

Method

Participants and power. A power analysis based on Study 3s indicated that a cell size of 113 would provide 80% power. Balancing power considerations and resource constraints, we decided to run at least 100 participants per cell in our 8-cell design, which would provide 76% power to detect an interaction with novelty in the gain domain, as well as similarly high power to detect an interaction with novelty in the loss domain (assuming that a true effect of novelty in the loss domain would be similar in size to the effect we observed in the gain domain). Note, however, that our design is underpowered to detect a three-way interaction among domain, novelty, and frame order (one rule of thumb would suggest doubling the sample size to adequately power this test, which was simply not feasible in this case; Simonsohn, 2014); we therefore treat comparisons of our findings in the loss and gain domains as exploratory. Thus, for our 2 (domain: gain vs. loss) × 2 (familiarity: novel vs. familiar) by 2 (frame valence order: positive-to-negative vs. negative-to-positive) design, a total of 833 participants (387 women, 426 men, 7 who did not identify with either label, and 13 unreported; 100% from the United States) between the ages of 18 and 73 years (M = 33.3, SD = 11.7) completed the study online through MTurk.

Familiarity. As in Study 1, participants were asked to imagine that "a national panel is evaluating a recently-developed cognitive training regimen" for enhancing memory capacity (in the gain domain) or preventing memory loss (in the loss domain). Recall that this scenario was the one we suspected had felt novel to participants in Study 1. Thus, participants in the novel condition saw only this information, whereas those in the familiar condition saw the following paragraph designed to make the training regimen feel like something they knew more about:

The training regimen consists of a series of computer games that provide a cognitive workout for short-term and long-term memory, concentration, and spatial awareness. For instance, one part of the task involves unscrambling letters to form words; another part involves a Tetris-like game with shapes that the player can fit together by shifting and rotating them. The training takes 5–10 min per day for three weeks and can be completed on any computer or hand-held device.

Framing order and attitude change. The remaining materials were identical to those used in Study 1: Participants rated their attitudes toward the regimen after seeing an initial positive or negative frame at Time 1 (α = .91) and then again after seeing the reframe at Time 2 (α = .95).

Manipulation check. In order to assess how familiar versus novel participants perceived the cognitive training regimen to be, we asked them to indicate to what extent the regimen felt familiar to them (1 = very unfamiliar, 9 = very familiar) and how much they felt like they knew about the regimen (1 = very little, 9 = very much). These items were averaged to form an index of perceived familiarity, r = .18, $p < .001$.[8]

Goal orientation measures. In order to examine whether the novelty manipulation affected participants' regulatory orientation, we also measured the extent to which participants experienced promotion- versus prevention-related concerns when thinking about the regimen succeeding or failing. Following previous research on promotion and prevention orientations (e.g., Cesario et al., 2013), participants were asked to imagine that they "went through the cognitive training regimen and it worked. How relieved versus happy would you be at this result?" They indicated their responses on a nine-point scale (1 = extremely relieved, 9 = extremely happy). Next, participants were instructed to imagine that the training regimen did not work and asked: "How worried versus sad would you be at this result?" Participants again rated their responses on a nine-point scale (1 = extremely worried, 9 = extremely sad). Promotion- versus prevention-related affect was computed by averaging the two items together, such that higher numbers indicate experiencing greater promotion-related emotions (elation and sadness) and lower numbers indicate experiencing greater prevention-related emotions (quiescence and anxiety; see Cesario et al., 2013; Shah & Higgins, 2001).

Also following Cesario et al. (2013), a second set of goal orientation measures assessed interference with promotion- and prevention-related goals. Participants were asked to imagine the negative outcome for the regimen (i.e., no memory enhancement in the gain domain; memory loss in the loss domain). To assess interference with promotion-related goals, we asked: "To what degree do you think this would interfere with your ability to meet your hopes and aspirations in life?" To assess interference with prevention-related goals, we asked: "To what degree do you think this would interfere with your ability to meet your duties and obligations in life?" Participants rated their responses on nine-point scales (1 = not at all, 9 = very much).

Results and Discussion

We followed the same a priori exclusion criteria used in our previous studies. In the current study's large sample, 15 participants reported prior knowledge about framing effects, and four participants failed to move the sliders or the slider values failed to record. We conducted analyses using the remaining 814 participants.

Manipulation check. Confirming the effectiveness of our manipulation, participants in the familiar (vs. novel) condition reported higher levels of perceived familiarity (M = 4.89, SD = 1.41 vs. M = 3.85, SD = 1.74), $t(811)$ = 9.37, $p < .001$, d = .66.

Main analyses. Recall that our key confirmatory hypothesis was that familiarity would moderate the effect of frame valence order on

[8] The size of this correlation was substantially higher in Study 3s (r = .50), and so the smaller estimate here surprised us. Importantly, analyzing the two items separately rather than averaging them into a single index yielded identical conclusions to those we report subsequently. Because the two items correlated strongly again in Studies 4 and 5 (r = .52 and r = .46, respectively), we reasoned that the estimate here was probably too low because of sampling fluctuation and that averaging the items together would provide the best measure of our construct.

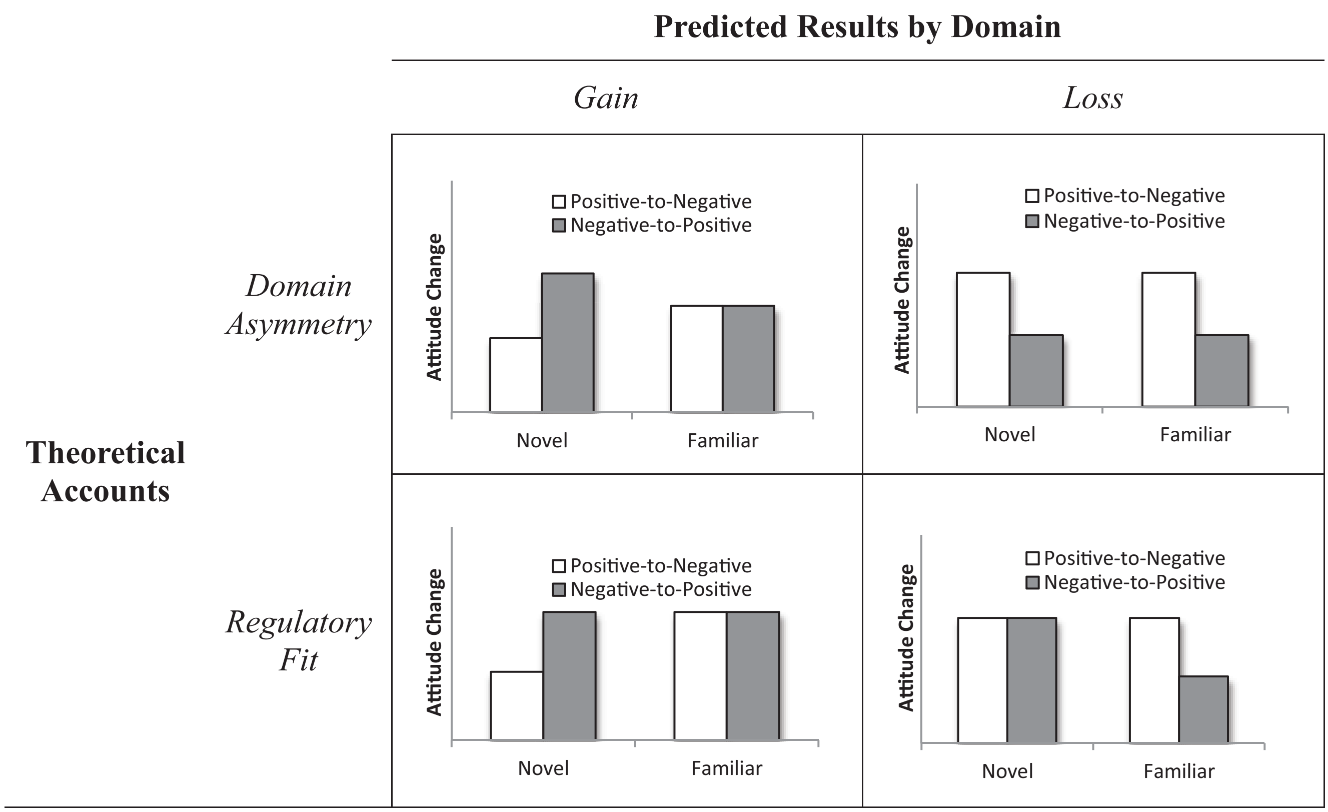

Figure 5. Our two plausible theoretical accounts of familiarity effects (domain asymmetry vs. regulatory fit) predict similar patterns of results in the gain domain, but different patterns of results in the loss domain, as illustrated by this figure.

attitude change in the gain domain. To test this hypothesis, we conducted a 2 (familiarity: novel vs. familiar) by 2 (frame valence order: positive-to-negative vs. negative-to-positive) between-subjects ANOVA on the extent of attitude change that participants displayed in the direction of the Time 2 frame in the gain domain (see Figure 6, Panel A).

There was a main effect of frame valence order, $F(1, 401) = 4.51$, $p = .034$, $\eta_p^2 = .01$, suggesting an overall tendency for attitudes to change more in the negative-to-positive (vs. positive-to-negative) condition, and no main effect of familiarity ($p = .950$). More importantly, the main effect of frame order was qualified by the predicted two-way interaction with familiarity, $F(1, 401) = 4.61$, $p = .032$, $\eta_p^2 = .01$, replicating our exploratory results from Study 3s. Once again, in the novel condition, attitudes changed significantly less when the framing switched from positive to negative (vs. negative to positive), $F(1, 401) = 9.01$, $p = .003$, $\eta_p^2 = .02$. In contrast, when the scenario was familiar, there was no effect of frame order on attitude change ($F < 1$). In other words, the results of this study suggest that novelty does indeed play a key role in moderating the effect of frame order on attitude change in the gain domain.

The secondary goal of this study was to distinguish between alternative theoretical accounts for why novelty moderates sequential framing effects. To help narrow down potential explanations, we first explored whether novelty would play a similar moderating role in the loss domain. Within the loss domain, there was a main effect of frame order, $F(1, 405) = 21.55$, $p < .001$, $\eta_p^2 = .05$, replicating past results showing that attitudes change less when frames switch from negative to positive (vs. positive to negative) in this domain. There was also a main effect of novelty, $F(1, 405) = 7.88$, $p = .005$, $\eta_p^2 = .02$, suggesting that attitudes tended to change more in the novel (vs. familiar) condition. However, there was no evidence for an interaction between novelty and frame order, $F(1, 405) = .112$, $p = .738$, $\eta_p^2 = .00$ (see Figure 6, Panel B).

Thus, this analysis suggests that novelty may not moderate sequential framing effects in the loss domain—a pattern of results that is consistent with the domain asymmetry account described earlier, but inconsistent with a regulatory fit account that would have predicted greater stickiness in the high fit cell of the loss domain (i.e., negative-first/familiar/loss domain; see Figure 5).[9]

Goal orientation measures. The lack of an interaction between novelty and frame valence order in the loss domain is one

[9] Of course, the best way to test whether novelty has different effects in the gain versus loss domain would be to conduct a well-powered test of the three-way interaction between domain, novelty, and frame valence order. To have adequate power for detecting this effect (using Simonsohn's, 2014 rule of thumb for detecting interactions), we would have needed about 226 participants per cell—more than twice the number we were able to include in this study, which is why we decided a priori to distinguish between our confirmatory analysis in the gain domain and our more exploratory analysis in the loss domain. Unsurprisingly, given the low power to detect it, the three-way interaction did not reach significance ($p = .312$).

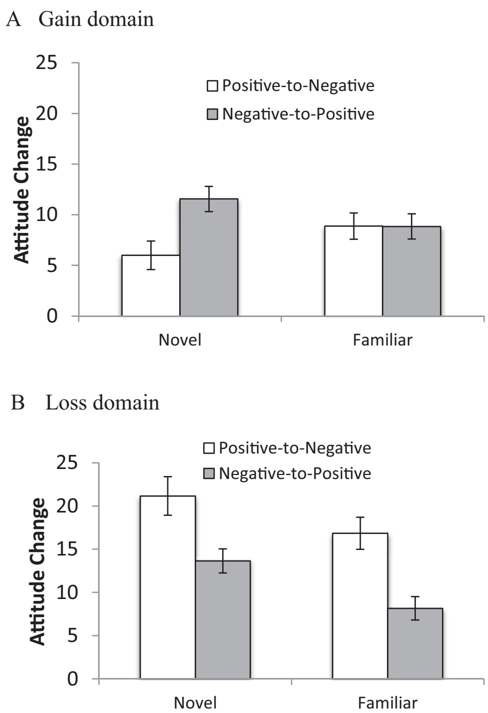

Figure 6. Attitude change in response to reframing as a function of familiarity (novel vs. familiar) and frame valence order (positive-to-negative vs. negative-to-positive), in the gain domain (Panel A) and the loss domain (Panel B) in Study 3. Error bars indicate one standard error above and below the mean.

clue that regulatory fit may not explain the moderating role of novelty in the gain domain (because, as illustrated in Figure 5, if fit were key to producing this effect, we would expect to see a symmetrical pattern of results indicating muted attitude change in both high-fit cells of the design). A second way to test whether regulatory fit can explain the moderating role of novelty is to examine whether novelty affects goal orientation, as the fit account constructed above assumes. Hence, we tested whether participants in the novel (vs. familiar) condition experienced more promotion- (vs. prevention-) related affect and interference with promotion-related versus prevention-related goals. Inconsistent with a fit account, novelty did not influence affect ($p = .541$), interference with prevention-related goals ($p = .322$), or interference with promotion-related goals ($p = .125$). Taken together, then, the results of Study 3 seem to support a domain asymmetry account over a regulatory fit account for explaining the role of novelty in moderating sequential framing effects.

Additional analyses. One additional feature of our results deserves mention. Although not central to our main research question, a quick glance at Figure 6 suggests that in general, participants simply displayed more attitude change in the loss domain than in the gain domain, regardless of framing order or novelty. Indeed, in both studies that included both loss and gain domains (i.e., Studies 1 and 3), the overall extent of attitude change was significantly higher in the loss (vs. gain) domain. An inspection of mean attitudes at each time point separately (see the online supplemental materials) confirms that it is in fact attitude chang*e* from Time 1 to Time 2 (rather than differences in attitude extremity at Time 1) that is driving this result, suggesting that it is not attributable to regression toward the mean or to a floor or ceiling effect. Instead, we can see that the Time 1 means start in similar places in the loss and gain domains, but the Time 2 means in the loss domain are simply more extreme.

Thus, participants seem to be generally more sensitive to reframing in the loss (vs. gain) domain. Although not relevant to our predictions about sequencing—which were all focused on comparing positive-to-negative versus negative-to-positive reframing—future research might fruitfully explore this main effect of domain on attitude change. For instance, one might posit that reframing effects will generally be larger in the loss domain than in the gain domain because potential losses heighten people's sensitivity to contextual information (perhaps akin to the effect of negative mood on information processing; Chartrand, van Baaren, & Bargh, 2006; Mackie & Worth, 1989). More broadly, the emergence of this unexpected but potentially generative pattern in our results underscores the potential of the current approach to help uncover new directions in framing research, by revealing differences in responses to *re*framing that would not emerge in single-shot framing contexts.

Study 4

Thus far, the results of our studies suggest that novelty plays a key role in moderating sequential framing effects in the gain (but not loss) domain. Moreover, the fact that Study 3 provided a highly powered direct replication of Study 3s gives us considerable confidence in the reliability of our findings. However, we would have greater confidence that our conceptual variable of familiarity (vs. novelty)—rather than some other variable unintentionally confounded with the particular manipulation we used in Studies 3s and 3—was causing our results if we observed the same pattern of effects using a different manipulation of familiarity. In our next study, we therefore sought to conceptually replicate our central gain domain findings with an alternative manipulation.

To that end, we presented participants in Study 4 with the novel cognitive training regimen scenario from Study 1. Rather than asking participants in the familiar condition to read the paragraph of additional information used in Study 3, we instead gave them actual experience with a cognitive training task that involved matching a series of patterns. We reasoned that if the relative stickiness of positive and negative frames in the gain domain depends on familiarity with a given setting, then experience (vs. no experience) with the pattern matching task should moderate sequential framing effects in the gain domain.

Method

Participants and power. A meta-analysis of the relevant interaction effect in Study 3s ($d = .38$) and Study 3 ($d = .21$) yielded a meta-analytic effect size estimate of Cohen's $d = .25$ for the interaction between novelty and frame valence order in the gain domain (Lipsey & Wilson, 2001; Wilson, 2001). We used this estimate as a best guess of the interaction effect size to expect in the current study. A power analysis using the meta-analytic effect size estimate indicated that a total sample size of 505 would provide 80% power to detect the critical two-way interaction of interest in the gain domain. Balancing power considerations and resource constraints, we decided that although we were willing to collect a maximum of 505 observations if necessary, we would prefer to stop earlier if the available data provided clear support for our hypothesis. We planned a sequential analysis that would allow us to do this while holding our Type I error rate at 5% (Lakens & Evers, 2014; Ledgerwood et al., 2017).[10]

We planned to conduct three equally spaced analyses after collecting 169, 308, and 507 participants to reach the desired final sample size of at least 505. Using a linear spending function (in R's GroupSeq package, this is indicated by the alpha*t^phi function), we calculated alpha boundaries for the 3 analyses (two interim, and one final) of .017, .022, and .028, following the detailed step-by-step guide for the GroupSeq package in R provided by Lakens (2014). Because the observed *p* value in the first interim analysis fell below the first alpha boundary of .017, we terminated data collection at this point.

Thus, the participants in our final sample were 192 adults (75 women, 115 men, and 2 unreported; 100% from the United States), between the ages of 18 and 70 years ($M = 33.9$, $SD = 10.28$), who completed the study online through MTurk. They were randomly assigned to condition in a 2 (familiarity: novel vs. familiar) × 2 (frame valence order: positive-to-negative vs. negative-to-positive) between-subjects design.

Materials and procedure. The procedure and materials were identical to those used in the gain domain condition of Study 3, except for the following changes:

Familiarity. To manipulate familiarity with the cognitive training regimen, participants in the familiar condition were first asked to click on a link to gain experience with a pattern matching task, which we created for the purposes of this study.[11] The link opened up a new browser tab with the following instructions: "A grid of blocks will be highlighted on the screen for a moment. Your task is to reproduce the pattern by clicking on the appropriate blocks." The pattern matching task stopped after one minute and participants proceeded to the rest of the survey, where the cognitive training regimen was described as similar to the task they had just experienced. Participants in the novel condition proceeded straight to the description of the cognitive training regimen, without first gaining experience with the pattern matching task.[12]

Measures. We included the same manipulation check ($r = .52$) and dependent measure ($\alpha = .93$ and $\alpha = .94$ for the attitude scales at Time 1 and Time 2, respectively) used in Study 3.

Results and Discussion

We followed the same a priori exclusion criteria used in our previous studies, with the addition of one new a priori criterion—we asked participants to report any glitches encountered while completing the pattern matching task and excluded those who indicated that the task failed to load, because pilot testing had alerted us to this possibility and these participants would not actually gain experience with the task. In this sample, no participants reported prior knowledge about framing effects, the dependent variable failed to record for two participants, and three participants reported an error loading the pattern matching task. We conducted analyses using the remaining 187 participants in the sample.[13]

Manipulation check. Our new manipulation of familiarity was successful: Participants in the familiar (vs. novel) condition reported higher levels of perceived familiarity with the cognitive training regimen ($M = 5.09$, $SD = 1.66$ vs. $M = 3.95$, $SD = 1.88$), $t(184) = 4.36$, $p < .001$, $d = .64$.

Main analyses. A 2 (familiarity: novel vs. familiar) × 2 (frame valence order: positive-to-negative vs. negative-to-positive) between-subjects ANOVA on the extent of attitude change that participants displayed in the direction of the Time 2 frame revealed a marginal main effect of familiarity ($p = .073$), such that attitudes change somewhat more in the novel (vs. familiar) condition, and no main effect of frame valence order ($p = .139$). More importantly, consistent with the idea that familiarity plays a key role in shaping sequential framing effects in the gain domain, we again observed the predicted two-way interaction between familiarity and frame valence order, $F(1, 181) = 6.930$, $p = .009$, $\eta_p^2 = .037$ (see Figure 7).

As in Studies 3s and 3, in the novel condition, attitudes changed significantly less when the framing switched from positive to negative (vs. negative to positive), $F(1, 181) = 8.812$, $p = .003$, $\eta_p^2 = .046$. In contrast, in the familiar condition, there was no effect of frame valence order on attitude change, $F(1, 181) = .634$, $p = .427$, $\eta_p^2 = .003$.

Thus, Study 4 provided a first conceptual replication of the moderating role of familiarity in the gain domain by giving participants actual experience (in the familiar condition) versus no experience (in the novel condition) with a cognitive training task. This new familiarity manipulation produced the same pattern of results as observed in Studies 3s and 3, increasing our confidence in our theoretical construct.

[10] Note that although sequential designs provide a valuable tool to balance the goals of boosting power and conserving resources, the effect sizes obtained from sequential analyses will tend to be inflated (Ledgerwood et al., 2017). For this reason, sequential analyses are particularly well suited for determining whether an effect exists or not—which was our main interest in this study—rather than determining a stable estimate of the effect size itself.

[11] Available at https://ucdavis.box.com/s/0oc241ssk56xocxx3b5xxf2nqt9cingi.

[12] In an ideal world, all participants would complete the pattern matching task, and it would be possible to manipulate familiarity merely by leading some participants to believe that the experienced task was related to the cognitive training regimen and others to believe that it was unrelated. Indeed, we tried this subtler manipulation first, but even though we did not explicitly link the task to the cognitive training regimen in the "novel" condition, participants seemed to spontaneously infer a link (they reported feeling more familiar with the regimen than did participants in the novel condition of previous studies, and they showed a pattern of sequential framing results that looked like the familiar condition rather than the novel condition in previous studies). In Study 4, we therefore opted simply to manipulate whether participants had actual experience with the task or not.

[13] Although our target total sample size for the first interim analysis was 169, the rate at which the pattern matching task failed to load was lower than expected and the number of participants who completed all the key measures was higher than the number recorded by MTurk as officially completing the survey. These two factors meant that although we stopped data collection when we believed we had reached our target sample size of 169, our actual usable sample turned out to be slightly larger ($N = 187$).

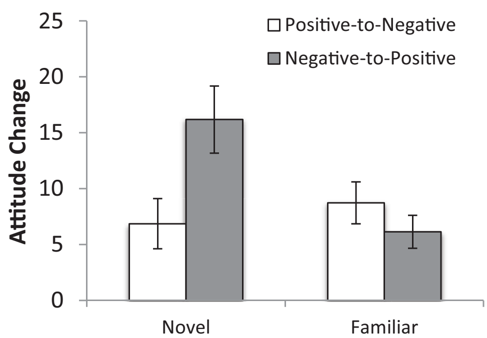

Figure 7. Attitude change in response to reframing as a function of familiarity (novel vs. familiar) and frame valence order (positive-to-negative vs. negative-to-positive) in Study 4. Error bars indicate one standard error above and below the mean.

Study 5

Our fifth and final study was designed to provide an additional conceptual replication of our key results and to rule out one lingering alternative explanation for the moderating role of familiarity. In Studies 3 and 4, we manipulated familiarity by building on the cognitive training paradigm from Study 1, using this novel-sounding scenario as a starting point and adding something to make it feel more familiar (a paragraph of text in Study 3 and actual experience with a cognitive training task in Study 4). So far, then, participants in our familiar conditions had always received more of something (more text, an additional experience) than those in our novel conditions, which means that our familiarity manipulations may have been confounded with variables like how much time or effort participants spent on the first part of the study. To remove this confound and test the generalizability of our results across different scenarios, we returned to our Study 2 paradigm about a familiar-sounding fruit extract. We reasoned that if the results observed in Studies 3s, 3, and 4 truly reflect something about novelty/familiarity, then we should observe the same moderation of sequential framing effects if we simply describe the fruit extract using a label that sounds more novel versus more familiar to participants.

Method

Participants and power. As in Study 4, we set our target sample size to 505 to provide 80% power to detect the critical two-way interaction of interest in the gain domain. We again planned a sequential analysis that would allow us to optionally stop at a specific interim analysis point without inflating our Type I error rate. We planned the sequential analysis to test our key interaction prediction after collecting 253 and 506 participants to reach the desired final sample size of at least 505. Using the same linear spending function as before, we calculated alpha boundaries for the two analyses (one interim, and one final) of .025 and .034, respectively (see Lakens, 2014). Because the observed p value in the first analysis fell below the first alpha boundary of .025, we terminated data collection at this point.

Thus, the participants in our final sample were 267 adults (142 women, 114 men, 4 who did not identify with either label, and 7 unreported; 100% from the United States), between the ages of 19 and 69 years ($M = 34.5$, $SD = 11.74$) who completed the study online through MTurk. They were randomly assigned to one cell of a 2 (familiarity: novel vs. familiar) × 2 (frame valence order: positive-to-negative vs. negative-to-positive) between-subjects design.

Materials and procedure. The procedure and materials were identical to those used in Study 2 ($\alpha = .94$ and $\alpha = .93$ for the attitude scales at Time 1 and Time 2, respectively), except for the following changes.

Familiarity. To manipulate familiarity, we created two versions of the fruit extract scenario used in Study 2—one that we thought would sound familiar to participants and one that we thought would sound novel. Participants in the familiar condition were asked to imagine that "a national panel is evaluating a recently developed strawberry extract designed to enhance energy levels," whereas participants in the novel condition were asked to imagine that "a national panel is evaluating a recently developed polyphenolic compound designed to enhance energy levels." Although polyphenols are found in many fruits, we reasoned that the first (vs. second) description of a fruit extract would sound far more familiar to participants.

Manipulation check. To confirm that our manipulation was successful, we again asked participants to indicate how familiar the object felt to them (1 = *very unfamiliar*, 9 = *very familiar*) and how much they felt like they knew about the object (1 = *very little*, 9 = *very much*). We also included two new items in this study that we thought could help more fully capture our underlying construct of familiarity: We asked participants how much experience they had with things like the object (1 = *no experience*, 9 = *a lot of experience*), and (reverse-coded) how unfamiliar the object seemed to them (1 = *not at all unfamiliar*, 9 = *very unfamiliar*). These four items were averaged to form an index of familiarity toward the object ($\alpha = .72$).

Results and Discussion

We followed the same exclusion criteria used in our previous studies. In this sample, no participants reported prior knowledge about framing effects, and the dependent variable failed to record for five participants. We conducted analyses using the remaining 262 participants in the sample.[14]

Manipulation check. A t test comparing perceived familiarity of the object in the novel versus familiar conditions confirmed that our new manipulation of familiarity was successful: Participants in the familiar (vs. novel) condition reported higher levels of perceived familiarity ($M = 3.95$, $SD = 1.60$ vs. $M = 3.33$, $SD = 1.56$), $t(260) = 3.17$, $p = .002$, $d = .39$.

Main analyses. A 2 (familiarity: novel vs. familiar) × 2 (frame valence order: positive-to-negative vs. negative-to-positive) between-subjects ANOVA on the extent of attitude change that participants displayed in the direction of the Time 2 frame revealed a marginal main effect of frame valence order ($p = .092$), such that

[14] Although our target total sample size for the first interim analysis was 253, the number of participants who completed all the key measures was higher than the number recorded by MTurk as officially completing the survey. Thus, although we stopped data collection when we believed we had reached our target sample size of 253, our actual usable sample turned out to be slightly larger ($N = 262$).

attitudes change somewhat more in the negative-to-positive (vs. positive-to-negative) condition, and no main effect of familiarity ($p = .638$). More importantly, consistent with the idea that familiarity plays a key role in shaping sequential framing effects in the gain domain, this conceptual replication produced the same two-way interaction between familiarity and frame valence order that we observed in our previous studies, $F(1, 252) = 5.251$, $p = .023$, $\eta_p^2 = .020$ (see Figure 8).

As in our previous studies, in the novel condition, attitudes changed significantly less when the framing switched from positive to negative (vs. negative to positive), $F(1, 252) = 7.746$, $p = .006$, $\eta_p^2 = .030$. In contrast, in the familiar condition, there was no effect of frame valence order on attitude change, $F(1, 252) = .185$, $p = .668$, $\eta_p^2 = .001$. Thus, across multiple operationalizations and multiple scenarios, familiarity appears to systematically modulate the stickiness of positive frames in the gain domain.

Meta-analysis

Given recent calls to move from evaluating single studies in isolation to considering the information provided by a cumulative body of research evidence (e.g., Braver, Thoemmes, & Rosenthal, 2014; Ledgerwood, 2014; Maner, 2014), we conducted a meta-analysis to quantitatively synthesize the results from the studies that tested familiarity as a moderator of reframing effects in the gain domain (Studies 3s, 3, 4, and 5). Table 1 reports the size of the reframing effect in the novel and familiar conditions of each study.

We used Comprehensive Meta-Analysis software (Borenstein, Hedges, Higgins, & Rothstein, 2005) to meta-analyze the effect sizes estimating the influence of frame valence order on attitude change by aggregating the four effect sizes involving a total of 542 participants in the novel condition and the four effect sizes involving a total of 546 participants in the familiar condition. Following common practice, we employed a random-effects model with study as the unit of analysis.[15] Consistent with the notion that familiarity plays a key role in moderating sequential framing effects, a comparison of the meta-analytic effect sizes for sequential framing effects in the novel and familiar conditions revealed a significant difference $Q(1) = 21.72$, $p < .001$. In the novel conditions, the meta-analysis revealed that attitude change was substantially smaller when frames switched from positive to negative (vs. negative to positive; Hedges' $g = .51$, 95% CI [.34, .68], $z = 5.92$, $p < .001$). In contrast, in the familiar conditions, attitude change was essentially equivalent when frames switched from positive to negative (vs. negative to positive; Hedges' $g = -.05$, 95% CI [–.22, .11], $z = -.62$, $p = .53$).

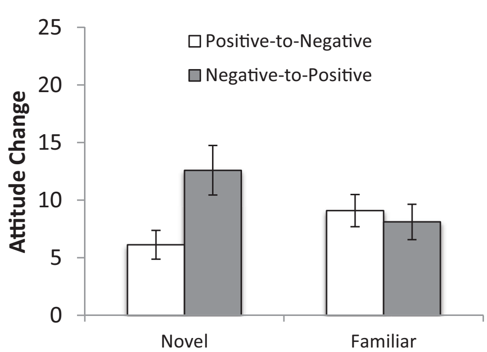

Figure 8. Attitude change in response to reframing as a function of familiarity (novel vs. familiar) and frame valence order (positive-to-negative vs. negative-to-positive) in Study 5. Error bars indicate one standard error above and below the mean.

Table 1
Reframing Effect Sizes in the Gain Domain for Meta-Analysis

	Novel condition		Familiar condition	
Study	*n*	Hedges' *g*	*n*	Hedges' *g*
3s	121	.603	121	−.141
3	200	.425	205	−.002
4	96	.608	89	−.017
5	125	.499	131	−.075
Meta-analysis	542	.510	546	−.050
		[.34, .68]		[−.22, .11]

Note. To obtain these values for the size of the reframing effect within each familiarity condition, we calculated effect size *d* for the effect of framing order on attitude change in response to reframing, such that positive values indicate greater change in response to reframing in the negative-to-positive (vs. positive-to-negative) condition. We then converted *d* to Hedges' *g*, which better accounts for bias from small samples. Numbers in brackets refer to 95% CIs. Cell sizes differ slightly from individual studies due to treatment of missing data in our software program.

General Discussion

The present research sought to build a comprehensive account of reframing by investigating sequential framing effects in both the loss and the gain domains. In addition to replicating past reframing work in the loss domain showing that negatives are stickier than positives, the studies reported here provide the first evidence that reframing effects are different—and more complex—in the gain domain. In Studies 1 and 2, participants read about a potential gain (a cognitive training regimen for memory enhancement or a fruit extract for energy enhancement) framed in positive or negative terms and then saw the same potential gain reframed in the opposing way. Despite their surface similarity, the two study scenarios produced strikingly different patterns of attitude change, prompting a search for a moderator. In Study 3, we drew on past work on positivity offset and dopamine signaling (Cacioppo & Berntson, 1994; Schultz, 2000) to predict that novelty (vs. familiarity) with a scenario might moderate reframing effects in the gain domain. In this study, we also examined the loss domain to help narrow down potential theoretical explanations for our results. Consistent with a domain asymmetry account (and inconsistent with a regulatory fit account), novelty moderated reframing effects in the gain domain but not in the loss domain. Finally, Studies 4 and 5 employed alternative manipulations of familiarity to help triangulate on our conceptual variable of interest and provide converging evidence for the moderating role of novelty in the gain domain.

[15] Note that fixed- and random-effects models produced identical results, which is common with a small number of studies and does not rule out the possibility of effect size heterogeneity (Braver et al., 2014; Lipsey & Wilson, 2001).

Taken together, the results of these studies suggest that in the gain domain, positives are stickier than negatives, but only when a scenario feels new and unfamiliar. When the scenario is more familiar, positive-to-negative and negative-to-positive reframing are equally effective. In the loss domain, on the other hand, negativity bias persists: Negatives are stickier than positives regardless of how novel or familiar a scenario is.

Importantly, these results lay the groundwork for a new, comprehensive account of sequential framing effects across the gain and loss domains. By moving beyond the extant literature's predominant focus on single-shot frames to consider what happens when frames are encountered in sequence, our findings have broad implications for a number of different literatures, which we discuss below. First, however, let us consider some possible—but ultimately unsupported—accounts for our results.

Unsupported Explanations

The programmatic nature of our studies helps rule out several possible alternative explanations for our results. As discussed earlier, one theoretical account that initially appeared to be a promising candidate was regulatory fit (Higgins, 2005). In the context of framing, fit describes a situation where the frame presented to participants (positive vs. negative) matches their current goal orientation (promotion vs. prevention, which theoretically would be induced by focusing people on potential gains vs. potential losses). Moreover, those familiar with regulatory fit theory might further argue that novelty could plausibly also influence goal orientation, such that novelty prompts a promotion focus whereas familiarity prompts a prevention focus. High fit would then occur in the gain domain when the initial frame is positive and the scenario is novel, as well as in the loss domain when the initial frame is negative and the scenario is familiar. According to this logic, we should expect to see more stickiness in these two high fit cells of the design (gain domain/positive-first/novel and loss domain/negative-first/familiar—the symmetrical pattern illustrated in the bottom row of Figure 5).

To test this account, we expanded our design in Study 3 to investigate whether novelty moderates sequential framing effects in the loss domain, mirroring the pattern we saw in the gain domain. It does not. This lack of moderation by novelty in the loss domain led us to doubt that regulatory fit (or indeed, any matching account predicting a symmetrical pattern of bias in the gain vs. loss domains) could provide a good explanation for our results. Moreover, Study 3 also examined whether novelty affects goal orientation, as our fit account would have to assume. Inconsistent with the possibility that fit might provide a good explanation for sequential framing effects, novelty had no effect on goal orientation. Taken together, these findings therefore led us to doubt regulatory fit as a likely candidate to explain the observed results.

A second alternative explanation that we considered seriously was that our findings might reflect a tendency for the *presence* of an outcome (i.e., a loss or a gain) to stick more strongly than the *absence* of an outcome (i.e., a nonloss or a nongain). Indeed, research on linguistic marking might suggest that because people must process the meaning of an outcome's presence in order to understand its absence, it should be relatively easy to switch from thinking of absence (e.g., nongain) to thinking of presence (e.g., gain). In contrast, switching from thinking of presence (e.g., gain) to absence (e.g., nongain) should be more difficult because thinking about the former concept does not already require processing the latter one (see, e.g., Clark, 1969; Clark & Card, 1969). Considered in isolation, the results of Study 1 are consistent with this account: In this study, losses stuck more than nonlosses and gains stuck more than nongains. Crucially, however, a presence versus absence account cannot explain why, in Studies 2 through 5, gains were only stickier than nongains in the novel (but not familiar) condition. If it were generally more difficult for people to switch from thinking about presence to thinking about absence than vice versa, then gain-to-nongain reframing should always produce less attitude change than nongain-to-gain reframing. Ultimately, then, our results seemed inconsistent with this account as well.

Finally, we wondered about a third possible alternative explanation for our results: Could the observed moderating role of familiarity in the gain but not loss domains reflect the fact that gain domain frames are somehow fundamentally more fragile than loss domain frames, and therefore more susceptible to moderation? This notion that loss frames are robust whereas gain frames are fragile might at first seem to square well with the well-known take-home from Kahneman and Tversky's work suggesting that losses loom larger than gains (e.g., the possibility of people dying looms larger than the possibility of people being saved; Tversky & Kahneman, 1981)—but of course, this work in fact suggested that *negative* frames loom larger than *positive* frames, which is conceptually orthogonal to the gain/loss dimension as we have defined it here. Furthermore, supplementary analyses testing the idea that gain frames were simply weaker than loss frames in our studies revealed no evidence for this hypothesis (see the online supplemental materials).

Toward a Model of Domain Asymmetries in Bias

Given that none of these three accounts—fit, presence versus absence, or fragile gain domain frames—seem able to explain the pattern of results that consistently emerged across our five studies, what account can explain our results? We believe that the evidence favors a domain asymmetry account of sequential framing effects that applies regulatory focus theory's crucial distinction between valence and domain (Higgins, 1997) to the extant literature on negativity bias and positivity offset (Baumeister et al., 2001; Cacioppo & Berntson, 1994; Cacioppo et al., 1997, 2002; Rozin & Royzman, 2001; see also Fazio, Eiser, & Shook, 2004; Schultz, 2000). Integrating and building on these literatures allows us to distinguish between the gain versus loss domain when considering how positivity and negativity biases might operate. Meanwhile, it allows us to infer when positive or negative conceptualizations are likely to be sticky by drawing on past theorizing about when positivity versus negativity biases would be useful or adaptive.

Consider first the extensive literature documenting a general human tendency to attend to and weigh negative information more than positive information in many contexts. Building on this research, theories of negativity dominance have argued that organisms who are especially attuned to potential losses should be more likely to avoid threats and survive to reproduce successfully (Baumeister et al., 2001; Rozin & Royzman, 2001). When applied to reframing, this logic suggests that in the loss domain, once a person conceptualizes an outcome in terms of potential negatives (e.g., encountering a predator, falling from a narrow mountain path), it should be harder to reconceptualize it in terms of potential positives (e.g., avoiding the predator, safely crossing the mountain path) than to switch from positive to negative. Once the possibility of a loss is recognized, it should stick in the mind, rather than giving way to a conceptualization that focuses on the possibility of nonloss.

Yet, as the literature on positivity offset reminds us, negativity dominance cannot be the whole story (Cacioppo et al., 1997). If protecting against the possibility of negatives always took priority over seeking out potential positives, then humans would never venture out to explore new environments. From this perspective, motivation toward exploration is critical for survival and reproduction: Humans must not just avoid potential negatives (e.g., predators), they must also pursue positives (e.g., finding new food, approaching potential mates) to survive and reproduce successfully. A positivity bias can offset negativity dominance and push humans to explore and learn about potential rewards when they do not yet have much information about their environment (Bowlby, 1969; Cacioppo & Berntson, 1994).

Integrating these literatures suggests that humans may have evolved a cognitive architecture that not only helps them avoid potential negatives (i.e., losses) but also pushes them to explore novel or foreign environments in search of potential rewards (i.e., gains; Cacioppo et al., 1997; Fazio et al., 2004). Applying this logic to the context of reframing suggests that in the gain domain, the possibility of a positive should tend to stick more strongly than the possibility of a negative when in an unfamiliar context. Once a person conceptualizes an outcome in terms of potential positives (e.g., finding a new source of food, attracting a new mate), it should be harder to reconceptualize it in terms of potential negatives (e.g., missing the new food source, failing to attract the mate) than to switch from negative to positive. In novel environments, once the possibility of a gain is recognized, it should stick in the mind, rather than giving way to a conceptualization that focuses on the possibility of nongain.

We can reason further that as humans approach and learn about new environments (through direct experience and/or social learning; Burkart et al., 2009), those novel environments become more familiar and rewards are identified. At this point, the adaptive need for a positivity bias dissipates—humans no longer require a push to explore once they have learned about their current environment. Consistent with this notion, research on reward processing in the brain suggests that novel rewards elicit a distinctive dopamine response that helps an organism learn to approach potential gains in a new environment (Schultz, 2000; Schultz et al., 1997). However, this response disappears as familiarity increases (i.e., once a reward is learned or expected). When the environment is familiar, then, a positivity bias is no longer necessary, and humans can be evenhanded in their sensitivity toward gains versus nongains.

In contrast, in the loss domain, familiarity should not mitigate negativity dominance because a negativity bias always has critical adaptive value. The importance of avoiding a potential predator does not dissipate when a context grows more familiar. Thus, the possibility of a loss should always stick more strongly in the mind than the possibility of a nonloss, regardless of novelty.

Overall, then, this perspective on domain asymmetries in bias helps to tease out an evolutionarily adaptive coupling of tendencies (i.e., a negativity bias in the loss domain, and a positivity bias for novel contexts in the gain domain). We can use this model not only to retroactively describe the results of our initial studies and generate predictions like the asymmetrical prediction for Study 4 (see Figure 5), but also to make new predictions for future research. For example, studies on valence biases in memory typically have not distinguished between gain and loss domains (see Baumeister et al., 2001, for a review). The present model would predict that participants will show memory biases for positively framed information when considering novel (but not familiar) gains, whereas they will show memory biases for negatively framed information when considering both novel and familiar losses.

Implications for Understanding Negativity and Positivity Biases More Broadly

As noted earlier, much of the framing literature has conflated positive and negative frames with gain and loss frames. In reality, most frames used in past research reside in the loss domain and reflect the presence of a negative outcome and the absence of a negative outcome, completely overlooking framing in the gain domain. Our findings highlight the fact that research conducted solely in the loss domain risks painting an incomplete and oversimplified picture of human bias. Whereas negativity bias may generally dominate in the domain of losses, positivity bias may emerge under specific conditions in the gain domain.

The literature's overriding focus on the loss domain may have hindered theory development by leading researchers to overlook key patterns and factors that only emerge in the domain of gains. In a related vein, Higgins (1997) noted that many psychological theories have been dominated by a prevention focus, in that they conceptualized negatives in terms of tension and positives in terms of tension reduction (e.g., Festinger, 1957; Freud, 1920/1952). More broadly, we suspect that because many psychological theories have been developed within an implicit context that focuses on potential losses, the literature may be missing important complexities that arise only in the gain domain.

For example, much of the research on perceptual and cognitive biases has focused implicitly on the loss domain (e.g., examining how people overperceive or exaggerate potential threats or losses; Kurzban & Leary, 2001; Öhman, Flykt, & Esteves, 2001; Tversky & Kahneman, 1981). This literature documents negativity biases in topic areas as diverse as perception, disease, and conflict and cooperation (see Haselton et al., 2009, for a review). For instance, people often develop food aversions after a single instance of illness following consumption of a particular food. A bias toward avoiding food associated with the illness, even if the illness was caused by another factor, would seem to enhance survival more than erring on the side of adventurous food choices (Rozin & Kalat, 1971). Research on such biases in reasoning tends to converge on findings of negativity bias, and scholars often interpret this pattern as consistent with the idea that ignoring negatives was costlier in ancestral environments than ignoring positives (Haselton et al., 2009). The tendency for much of this work to focus implicitly on the loss domain may have resulted in a (potentially oversimplified) consensus on the power and prevalence of negativity biases (e.g., Baumeister et al., 2001; Rozin & Royzman, 2001).

Expanding the consideration of biases to the gain domain might produce a very different picture. In fact, our model of domain asymmetries in bias would predict two key differences in the gain domain: We should see positivity bias instead of negativity bias, and this bias should be specific to novel (vs. familiar) contexts. Indeed, one of the few examples of an error management bias that has been studied in the gain domain is men's sexual overperception bias (Haselton, 2003). This bias presumably reflects the fact that, for men, the more reproductively costly error is ignoring potential positives (vs. negatives): It is costlier to fail to recognize women's sexual interest when it exists (vs. failing to recognize a lack of interest and therefore pursuing disinterested mates). To minimize this relatively costly error, Haselton et al. (2009) suggested that men have evolved a bias to err in the opposite direction, toward overperceiving positives (i.e., perceiving sexual interest even when it may not exist). Consistent with this notion, men seem to overestimate sexual interest from women (a potential gain) even when it may not exist (Abbey, 1982; Haselton, 2003; Maner et al., 2005). In other words, a positivity bias emerges when considering the evolutionarily advantageous potential gain of a reproductive opportunity.

Intriguingly, from our theoretical perspective, the extensive literature documenting this positivity bias of sexual overperception (Haselton et al., 2009) has focused on the initial (novel) stage of attraction: These studies examine men's perceptions of sexual interest from strangers or in the context of new relationships (e.g., Abbey, 1982; Harnish, Abbey, & DeBono, 1990; Haselton & Buss, 2000). Our model suggests a new prediction for this literature: The positivity bias should disappear in the context of men's perceptions of familiar (vs. novel) women. In other words, while men may tend to overperceive sexual interest from new women (e.g., strangers or new acquaintances), we predict that this bias would decrease as they get to know a woman better (i.e., as a relationship progresses over time; see also Muise, Stanton, Kim, & Impett, 2016).

Connections to the Literature on Attitude Strength

The present research may also pave the way for future links between the literature on attitude strength and the literature on framing, which have thus far remained oddly disconnected. Research on attitude strength suggests that strong (vs. weak) attitudes are more stable, more resistant to counterattitudinal persuasive appeals, and exert a stronger influence on information processing and behavior (Petty & Krosnick, 2014; Pomerantz, Chaiken, & Tordesillas, 1995). It is interesting to consider whether resistance to reframing may be another marker of attitude strength. If so, then the conditions under which we observe greater frame stickiness may also be conditions that tend to produce greater attitude strength more generally. This idea suggests that scholars studying attitude strength might fruitfully consider domain (gain vs. loss) and familiarity as important variables that could act in conjunction to predict attitude strength, over and above the precursors of attitudes strength already identified in that literature (e.g., Chaiken, Pomerantz, & Giner-Sorolla, 1995; Petrocelli et al., 2007; Petty & Krosnick, 2014). Meanwhile, research on the predictors of attitude strength may suggest some promising candidates for future research on the mechanisms underlying frame stickiness, including greater rehearsal, increased elaboration, and/or greater attitude clarity.

Connections to Behavioral Economics

Our results also add to a growing body of psychological research that refines and qualifies classic economic approaches to human behavior. One classic economic assumption is that people only consider marginal outcomes that relate to the current context, such as the additional cost associated with waiting an extra 10 minutes in line, not prior outcomes from past contexts, such as the sunk costs of already waiting an hour (Kahneman & Tversky, 1979; Thaler & Johnson, 1990; Tversky & Kahneman, 1983; also see Slovic, 1972). In framing research, the notion that only the current frame is relevant is analogous to the assumption that only marginal outcomes in the current context matter. However, the results of our studies provide one demonstration that this assumption is unjustified—the sequencing of frames (or prior information) is critical. Moreover, our findings demonstrate an asymmetric influence of reframing depending on the domain of the outcome. This insight suggests substantial revisions to the way framing effects are studied and understood—from incorporating order effects into prospect theory, to accounting for domain asymmetries when developing theoretical accounts of how framing effects operate (e.g., Reyna & Brainerd, 1991; Sher & McKenzie, 2006).

Conclusion

The research presented here suggests that both domain (gain vs. loss) and novelty play crucial roles in modulating negativity and positivity biases in sequential framing effects. By integrating these findings with the broader literatures on negativity dominance, positivity offset, and regulatory focus theory, we sought to develop a comprehensive theoretical framework that may help organize disparate findings on negativity biases, point to understudied areas of research, and generate new hypotheses regarding the role of novelty versus familiarity. Future research might fruitfully build on this framework to expand our understanding of when, why, and how valence biases operate across time and across different contexts.

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