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Research report

Political conservatism predicts asymmetries in emotional scene memory

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HIGHLIGHTS

- Old/new memory task for positive, negative, and neutral scenes.
- Positive correlation between memory negativity bias and conservatism.
- Conservatism explained 45% of subject variation in negativity bias.
- Associations between ideology and emotional bias extend to memory.

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ABSTRACT

Variation in political ideology has been linked to differences in attention to and processing of emotional stimuli, with stronger responses to negative versus positive stimuli (negativity bias) the more politically conservative one is. As memory is enhanced by attention, such findings predict that memory for negative versus positive stimuli should similarly be enhanced the more conservative one is. The present study tests this prediction by having participants study 120 positive, negative, and neutral scenes in preparation for a subsequent memory test. On the memory test, the same 120 scenes were presented along with 120 new scenes and participants were to respond whether a scene was old or new. Results on the memory test showed that negative scenes were more likely to be remembered than positive scenes, though, this was true only for political conservatives. That is, a larger negativity bias was found the more conservative one was. The effect was sizeable, explaining 45% of the variance across subjects in the effect of emotion. These findings demonstrate that the relationship between political ideology and asymmetries in emotion processing extend to memory and, furthermore, suggest that exploring the extent to which subject variation in interactions among emotion, attention, and memory is predicted by conservatism may provide new insights into theories of political ideology.

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Emotion modulates several cognitive processes, including perception, attention, decision making, and memory (see Ref. [19], for review). For example, relative to neutral stimuli, emotional stimuli are associated with enhanced contrast sensitivity in early vision [27], are detected faster and more accurately in a field of distractors [11], and are more likely to be attended [6] and remembered [16]. Not all emotional stimuli are equivalent in their effects on cognition, however. Often, large asymmetries can be observed in the effects of different emotions. In particular, a well-established finding is *negativity bias*—on average, individuals are attuned more to generally negative versus generally positive stimuli [1]. The present study is concerned with the variation around this "average". Some individuals respond strongly to negative stimuli (e.g., those with high anxiety); others less so (e.g., those with less anxiety). Likewise, some negative stimuli strongly affect cognitive processes (e.g., snakes and spiders); others less so (e.g., road kill). Here, we use crossed random effect modeling to investigate simultaneously the extent to which subject variation in the effect of emotional scene content on declarative memory is explained by political ideology, as well as the extent to which scene variation in the effect of political ideology on memory is explained by emotion-related variables.

Previous work has shown that political ideology is associated with attentional asymmetries in the processing of emotionally

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valenced stimuli [4,22,31]. Carraro et al. [4] (Experiment 1) used an emotional Stroop task and found that, relative to liberals, conservatives responded more slowly to negative words, suggesting that negative information automatically captured the attention of conservatives. In a second experiment using a dot-probe task, conservatives were more likely to direct their attention toward spatial locations at which negative information was presented [4]; (Experiment 2), suggesting that the likelihood of attending negative scene content also correlates positively with conservatism. Similar findings have been reported across different tasks, stimuli, and measures. Dodd et al. [8] recorded eye movements during a free-view task in which participants viewed collages of positive and negative scenes and found that speeded fixation of and prolonged dwell time on negative versus positive scenes each correlated positively with conservatism, suggesting that eye movements were selectively biased toward negative stimuli as a function of political ideology. Mills et al. [22] recorded both behavioral and eye movement responses during a visual search task for happy and angry faces and found a positive correlation between anger-superiority (speeded detection of angry versus happy faces, as measured by behavioral response times) and conservatism. In contrast to Carraro et al. [4] (Experiment 1), however, this speed advantage was not due to attention capture but rather to post-selectional processes. Specifically, Mills et al. showed that all individuals were equally quick to fixate angry faces but whereas liberals tended to make additional eye movements before manually responding to the presence of an angry face, conservatives did not, suggesting their response time advantage was due to speeded response selection rather than attention capture.

Taken together, these studies demonstrate that political ideology is associated with attentional asymmetries in the processing of emotionally valenced stimuli, with conservatives being more vigilant toward negative stimuli. As attention is known to enhance memory [21], these findings lead to the prediction that the effect of emotional valence on memory should vary with political ideology in a similar manner. Some evidence for this comes from Shook and Fazio [31], in which an asymmetry in reward-based learning of novel objects was found to vary with political ideology such that superior learning of negatively valenced information (objects paired with a monetary loss) correlated positively with conservatism. This might suggest that conservatives remembered negative objects better than positive objects, though, it should be noted that they were also more likely to misremember positive objects (objects paired with a monetary gain) as being negative. In other words, this finding may reflect a simple bias to respond that an object is "negative", as opposed to being solely driven by memory. Therefore, to test whether memory for emotionally valenced stimuli varies with political ideology, the present study had participants study 120 positive, negative, and neutral scenes in preparation for a memory test. On the memory test, participants viewed 240 scenes, half of which were the studied scenes and half of which were novel. For each scene, participants indicated whether or not it had been studied. Given the pattern of attentional asymmetry and the general enhancing effect of attention on memory, we expect superior memory for negative versus positive scenes (negativity bias) to be enhanced the more conservative one is. Moreover, political ideology should explain a substantial portion of the variability in negativity bias across subjects.

1. Method

1.1. Participants

Sixty-four undergraduates from the University of Nebraska-Lincoln participated in exchange for course credit. All participants had normal or corrected-to-normal vision, were naïve to the purpose of the study, and were informed of their rights of participation according to the University of Nebraska-Lincoln institutional review board.

1.2. Measures

Political ideology was measured using the Wilson-Patterson Inventory [35], which asked participants to indicate the degree to which they agreed or disagreed with 20 "hot-button" issues (e.g., abortion). On the basis of these responses, participants received a score indicating the extent to which they held liberal or conservative positions (see Appendix A for items and scoring). Scores ranged from −29 to +28 ($M = 0.58$, $SD = 11.87$), where more positive scores reflect a more conservative ideology. In addition to the Wilson-Patterson Inventory, participants also indicated their self-reported political identification (5-point Likert scale, where 1 = liberal, 2 = moderate, leaning liberal, 3 = moderate, 4 = moderate, leaning conservative, and 5 = conservative) and their self-reported party identification (7-point Likert scale, where 1 = strong Democrat, 2 = weak Democrat, 3 = Independent, leaning Democrat, 4 = Independent, 5 = Independent, leaning Republican, 6 = weak Republican, and 7 = strong Republican). Wilson-Patterson scores correlated significantly with self-reported political identification, $r = 0.61$, $p < 0.001$, and self-reported party identification, $r = 0.58$, $p < 0.001$.

1.3. Stimuli

Stimuli were 240 full-color scenes (640 × 480 pixels) sampled from the Geneva Affective Picture Database (GAPED; [7]. GAPED contains 730 real-world scenes nested within three general scene content categories (positive, negative, and neutral) and pre-rated on dimensions of valence and arousal. Of these, we randomly selected 80 positive and 80 neutral scenes. Positive scenes depicted mostly baby humans, baby animals, and landscapes. Neutral scenes depicted mostly interior scenes and furniture, as well some less-common objects such as an extension cord and analog antenna. GAPED additionally distinguishes between four subcategories of negative scenes: snakes, spiders, human concerns (scenes depicting human rights violations), and animal concerns (scenes depicting animal mistreatment). We randomly selected 10 snakes, 10 spiders, 30 human concerns, and 30 animal concerns, for a total of 80 negative scenes. Descriptive statistics for the selected sample of scenes are presented on Table 1. Example scene stimuli are shown in Fig. 1. Scenes were displayed on a Pentium IV computer with a 17" monitor (60 Hz) within individual testing suites equipped with soft lighting and sound attenuation.

1.4. Procedure

Participants first completed a study phase and then a test phase. In the *study phase*, participants viewed 144 scenes in preparation for a memory test. Each trial began with a central fixation cross, which was replaced after 1000 ms by a to-be-studied scene. Scenes were presented for 2000 ms and were followed immediately by the next trial. To control for serial position effects (primacy and recency), the first and last 12 scenes served as buffers and were excluded from the testing phase. Buffer stimuli were neutral scenes selected from the International Affective Picture Database [18]. The study phase lasted ∼7 min and was followed immediately by instructions for the test phase. As these instructions were quite simple, the interval between study and test was no more than 1–2 min.

In the *test phase*, participants viewed 240 scenes, half of which were presented during the study phase and half of which were novel. Each trial began with a central fixation cross for 1000 ms,

Table 1
Descriptive statistics for the present sample of scenes.

Category	*N*	Valence			Arousal		
		M	*SD*	*Range*	*M*	*SD*	*Range*
Negative	80	10.0	5.6	1–25	74.3	6.1	65–92
Animal (legal norm violations)	30	7.9	3.9	1–13	74.8	5.5	67–89
Human (moral norm violations)	30	8.0	4.8	1–16	76.2	7.0	65–92
Snake	10	19.6	2.7	16–25	68.0	1.5	66–70
Spider	10	13.0	2.7	10–19	73.5	2.9	70–79
Neutral	80	55.0	5.3	41–66	24.1	6.8	10–42
Positive	80	92.9	3.0	87–99	19.1	8.1	6–43

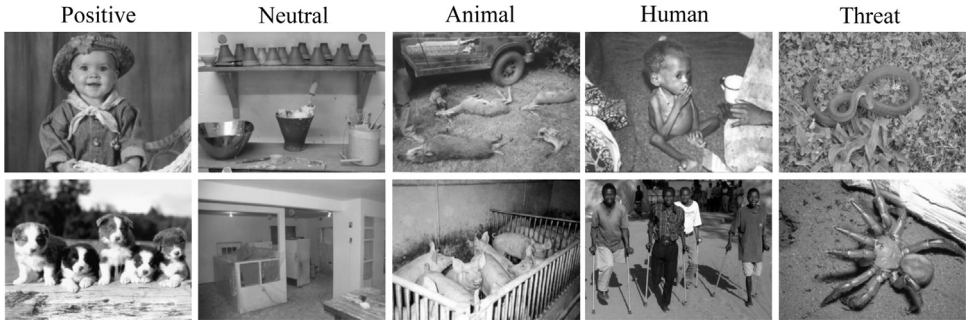

Fig. 1. Example scene stimuli for the positive and neutral scene categories, as well as for the animal, human, and threat subtypes within the negative scene category. Note that scenes were presented in full color during the experiment.

followed by a test scene, which was present until a response was entered. Participants were to press the 'f' key if a scene had been studied or the 'j' key if a scene had not been studied. To ensure that participants were not responding indiscriminately, 8 catch trials were included. Catch stimuli were "fake" scenes depicting animal caricatures (e.g., buck-toothed shark, squirrel holding a gun) downloaded from the internet. Participants were instructed to withhold their response to these scenes. Catch stimuli were displayed for 5000 ms or until an erroneous response was entered. Questionnaires were completed following the test phase. In total, sessions lasted ~45 min.

2. Results and discussion

Four participants were excluded from analysis for responding erroneously on all or all but one of the catch trials. Of the remaining subjects, 7 responded on 1–2 catch trials and 3 responded on 3 catch trials; all others successfully withheld their response on all 8 catch trials. Trials with response times <250 ms (0.003%) or >5000 ms (0.012%) were also excluded from analysis. The left panel of Fig. 2 shows the mean proportion of correct responses for positive, negative, and neutral scene categories as a function of ideology. As can be seen, memory appears to be enhanced for the negative versus positive category. Moreover, this bias appears to be larger at higher levels of conservatism (Fig. 2, middle panel).

2.1. Effect of scene category

To confirm these observations statistically, as in previous studies, we computed subject mean proportion of correct responses for each scene category and submitted them to a mixed analysis of variance with category (positive, negative, neutral) as a within-subject factor and political ideology (centered at 0, reflecting a political moderate) as a between-subject covariate. There was a significant main effect of category, $F(2, 116) = 22.55$, $p < 0.001$, such that the proportion of correct responses was higher for negative ($M = 0.84$) than for positive ($M = 0.78$), $t(116) = -6.65$, $p < 0.001$, and neutral categories ($M = 0.80$), $t(116) = -4.10$, $p < 0.001$. Thus, on average, memory was superior for the negative category. The main effect of ideology was not significant, $F < 1$, indicating that, on average, memory did not differ between liberals and conservatives. Critically, there was a significant category by ideology interaction, $F(2, 116) = 3.72$, $p = 0.03$, such that superior memory for negative versus positive categories was positively associated with conservatism, $t(116) = -3.04$, $p = 0.003$. Thus, the anticipated negativity bias (enhanced processing of negative versus positive stimuli) was larger the more conservative one was.[1] Although this result provides evidence that the relationship between political ideology and negativity bias extends to memory, it is uninformative in one key way: it does not quantify the extent to which political ideology explained differences in negativity bias across subjects. This is because the critical interaction was tested against a within-subject error term. If negativity bias differs between subjects as a function of ideology, then the critical interaction needs be tested against a between-subject error term, specifically, a residual for subject variation in negativity bias. Otherwise, the between-subject variation

[1] We also analyzed the data in terms of d'. The results were identical, with the exception that superior memory for negative versus neutral scenes also correlated positively with conservatism. There was a significant main effect of category, $F(2, 116) = 10.75$, $p < 0.001$. Sensitivity was significantly greater for the negative category than the positive, $t(116) = 4.64$, $p < 0.001$, and neutral, $t(116) = 2.31$, $p = 0.02$, categories. Sensitivity was also significantly greater for the neutral versus positive category, $t(116) = -2.33$, $p = 0.02$. The main effect of ideology was not significant, $F(1, 58) = .55$, $p = 0.46$. Importantly, there was a significant category by ideology interaction, $F(2, 116) = 5.46$, $p = 0.01$, such that greater sensitivity for the negative versus positive category was enhanced for more conservative individuals, $t(116) = 4.87$, $p < 0.001$. Greater sensitivity for the negative versus neutral category was also enhanced for more conservative individuals, $t(116) = 2.20$, $p = 0.03$. Greater sensitivity for the neutral versus positive category did not vary significantly with ideology, $t(116) = -1.04$, $p = 0.30$.

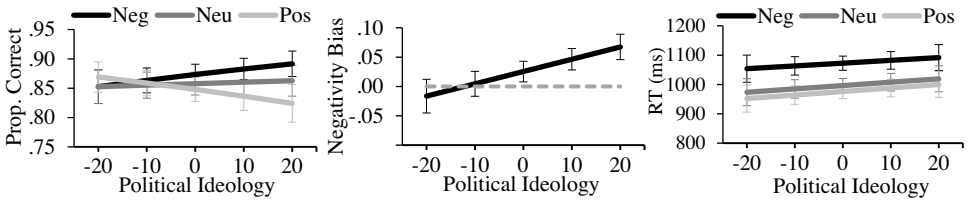

Fig. 2. *Left panel:* mean proportion of correct responses as a function of political ideology (higher values reflect a more conservative ideology) for positive (Pos), negative (Neg), and neutral (Neu) scene categories. *Middle panel*: mean negativity bias (negative minus positive) as a function of political ideology (black line). A reference line for the 0 location (i.e., no difference in proportion correct between negative and positive scene categories) is also included (dashed gray line). *Right panel*: mean response time (RT) in milliseconds as a function of political ideology for positive, negative, and neutral scene categories. Error bars represent +/− 1 standard error.

in negativity bias that political ideology is hypothesized to predict is confounded with within-subject variation.

In order for political ideology to predict subject variation in negativity bias, the ideal analysis would need to model all relevant sources of variation simultaneously. Moreover, given that accuracy is a binary outcome (correct/incorrect), the ideal analysis would need to transform the outcome onto a scale that it is not bounded by 0 and 1. Finally, given that the valence of a scene varies not only between categories but also within a category (Table 1), the ideal analysis would need to analyze the effect of scene valence continuously (as opposed to categorically) in order to capture this variability. To that end, a generalized linear mixed model was used to predict variability across subjects and scenes in logit-transformed probability of correct recognition, p(correct), for 240 scenes and 60 subjects as a function of scene valence (centered at 0, reflecting a negatively valenced scene), subject ideology (centered at 0, reflecting a politically moderate individual), and their interaction. To account for this sampling structure, crossed random effects modeling was used to explicitly represent each source of variation simultaneously [13]. In the present design, this included variation across subjects, scenes, and their interaction. Critically, crossed models allow subjects to differ in their effects of scene predictors (valence) via random slope variances, which affords the ability to evaluate the extent to which subject characteristics (political ideology) explain this source of subject variation (i.e., differences between subjects in the effect of valence).

2.2. Effect of scene valence

To examine the extent to which political ideology predicts subject variation in the effect of scene valence, we began by estimating a series of empty means models (i.e., models without predictors) in order to decompose the total variation in the outcome, p(correct). Relative to a model specifying a single residual variance, there was significant variability in mean p(correct) across subjects, $-2\Delta LL(\sim 1) = 1142$, $p < 0.001$, and across scenes, $-2\Delta LL(\sim 1) = 4329$, $p < 0.001$, such that 15% of the total variation was due to mean differences across subjects, 48% to mean differences across scenes, and the remaining 37% to the subject by scene interaction. Sequential models were then tested to examine the main effects of scene valence and subject ideology (described below). To quantify how much of the total between-scene and between-subject variation in mean p(correct) was explained by scene valence and subject ideology, respectively, we calculated pseudo-R^2 statistics, which express the proportion of variance reduced in a given variance component after inclusion of a relevant fixed effect. Accordingly, the main effect of scene valence explained 1.48% of the total between-scene variation and the main effect of subject ideology explained 0.95% of the total between-subject variation.

Subject differences in the effect of scene valence on p(correct) were then examined. The effect of scene valence varied significantly over subjects, $-2\Delta LL(\sim 1) = 10.6$, $p = 0.001$. An interaction term to assess moderation of the effect of scene valence by subject ideology was then added to the model. Model 1 on Table 2 provides the estimates obtained from the final model, which can be interpreted as follows. The intercept of 1.9960 is the expected mean p(correct) specifically for a subject with ideology = 0 (politically moderate) to a scene with valence = 0 (negative valence). The effect of scene valence indicates that, for a subject with ideology = 0, p(correct) is expected to be non-significantly lower by −0.0035 for every one-unit more positively valenced a scene is. The effect of subject ideology indicates that, for a scene with valence = 0, p(correct) is expected to be non-significantly higher by 0.0101 for every one-unit more conservative one is. Critically, the significant scene valence by subject ideology interaction indicates that the effect of valence was enhanced by −0.0002 for every one-unit more conservative one is. In other words, superior memory for negatively valenced scenes (negativity bias) correlated positively with political conservatism. The effect was sizeable, explaining 45.16% of subject variation.

For comparison, we estimated the same model but used arousal ratings to predict memory performance rather than valence ratings (see Model 2 on Table 2 for parameter estimates). Given that valence and arousal ratings were strongly correlated ($r = -0.89$, $p < 0.001$; variance inflation index = 4.81), the critical finding was the same (i.e., superior memory for more arousing scenes correlated positively with conservatism). However, whereas political ideology explained 45.16% of subject variation in the effect valence, it explained 35.48% of subject variation in the effect of arousal, indicating that the valence model has greater explanatory power. Consistent with this finding, inspection of the valence and arousal rating distributions for neutral and positive scenes (Table 1) shows that positive scenes were rated as more positively valenced but not more arousing (in fact, on average, neutral scenes were slightly more arousing). As memory was significantly better for neutral versus positive scenes (evident by significant effects of valence at higher levels of conservatism; Model 1 on Table 2), the arousal model thus incorrectly predicts that memory should be equivalent for these scenes. Taken together, these findings suggest that negativity bias offers a more complete account of the data.

Speed-accuracy tradeoff? To assess whether the larger negativity bias in conservatives was attributable to a speed-accuracy tradeoff, response time to correct recognition was examined as a function of scene valence and subject ideology (Fig. 2, right panel). There was a significant main effect of valence (*Estimate* = 96.66, *SE* = 9.17, $p < 0.001$) such that responses were faster for more positively valenced scenes. However, neither the main effect of ideology nor its interaction with valence were significant ($ps > 0.66$), indicating that effects of ideology were not due to a speed-accuracy tradeoff.

Table 2
Parameter estimates (*Est*), standard errors (*SE*), *p*-values, and pseudo R^2 values for the valence (model 1) and arousal models (model 2).

Model	Parameter	*Est*	*SE*	*p*	R^2
1	Intercept	1.99602	.17151	<0.01	
	Valence (0 = negative)	−0.00347	.00233	.14	1.48%
	Ideology (0 = moderate)	.01005	.00800	.21	0.95%
	Valence × Ideology	−0.00019	.00007	.01	45.16%
2	Intercept	1.61316	.15616	<0.01	
	Arousal (0 = low)	.00621	.00310	.05	2.05%
	Ideology (0 = moderate)	−0.00704	.00745	.35	0.95%
	Arousal × Ideology	.00024	.00009	.01	35.48%

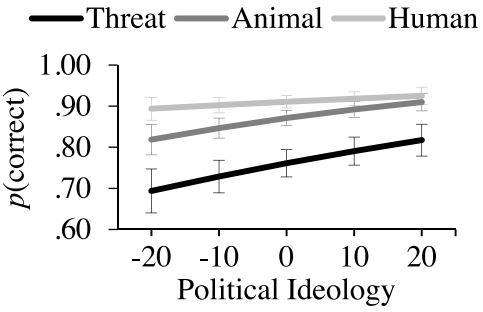

Fig. 3. Mean probability of correct recognition, *p*(correct), as a function of political ideology (higher values reflect a more conservative ideology) for threat, animal, and human subtypes within the negative scene category. Error bars represent +/−1 standard error.

2.3. Effects of negativity subtypes

So far, we have shown that emotional memory varies with political ideology such that superior memory for negatively valenced scenes is enhanced in more conservative individuals. The notion here is that scene valence accounts for this asymmetry. There are alternative possibilities, however. One is intensity bias (i.e., the tendency to respond more strongly to highly arousing scenes, regardless of scene valence; [32,33]. As described above, we cannot definitively rule out this account, though, we have reported evidence that it provides a less complete account of the present data. Another possibility is that rather than reflecting an attunement to generally negative or generally arousing stimuli, the relationship between political ideology and responses to emotional scenes reflects a more narrowly tuned bias to a particular subtype of negative or arousing stimuli, specifically, biological threat [20,22].

To investigate this issue, we examined memory for three subtypes of scenes within the negative scene category. The first subtype (threat) consisted of snakes and spiders, stimuli which have been used extensively in previous work and which are commonly assumed to be of high relevance on account of their biological and evolutionary threat-related content. The second subtype (animal) contained scenes depicting animal mistreatment. The third subtype (human) contained scenes depicting human rights violations. If political conservatism is characterized by stronger responses to broadly negative [4,8,12,31] or broadly arousing [33] stimuli, then memory for different kinds of negative and arousing stimuli (threat, animal, or human) should not vary in their relationship with political ideology. On the other hand, if conservatism is characterized by a more specific biological threat bias [20,22], then the relationship between ideology and memory for biologically threatening scenes should differ from the relationship between ideology and memory for animal or human scenes.

Fig. 3 shows the mean proportion of correct responses as a function of political ideology (centered at 0, reflecting a political moderate) for the threat, animal, and human subtypes (effect coded) within the negative scene category. There was a significant main effect of subtype, $F(2, 78.4) = 11.55$, $p < 0.001$. Relative to threat, memory was significantly better for animal, $t(74.6) = 3.58$, $p < 0.001$, and human subtypes, $t(78.4) = 4.97$, $p < 0.001$. The difference between animal and human subtypes was not significant, $t(83.5) = -1.02$, $p = 0.31$. The main effect of ideology was marginally significant, $F(1, 69.5) = 3.61$, $p = 0.06$. Importantly, the subtype by ideology interaction was not significant, $F < 1$, indicating that there were no significant differences among subtypes of the negative scene category in their relationship with political ideology. Thus, the positive relations between conservatism and memory for negative stimuli extended beyond overtly threatening images (snakes and spiders) and into those that are more broadly negative (animal and human subtypes of negativity, which depict legal and moral norm violations, respectively).[2] This suggests that negativity bias, not specifically threat bias, underlies differences in political temperament.

3. General discussion

We have shown that political ideology significantly affects emotional memory, providing evidence that emotional scene content biases memory asymmetrically as function of political ideology. Specifically, we found that political conservatism correlated positively with superior memory for negative versus positive scenes. Thus, associations between ideology and emotional processing biases extend to memory. Importantly, this relationship was sizeable, accounting for 45% of the total subject variation. Taken together, these findings provide compelling evidence that individual differences in emotional processing underlie higher-level processes involved in political preference formation.

A currently debated issue relates to the affective component of political ideology responsible for emotional bias. One possibility is that scene valence underlies emotion processing biases [4,8,12,31]. Liberals and conservatives differ on several broad personality traits and social orientations such as openness to new experiences and conscientiousness [3,14], tolerance of social equality and change [15], moral foundations [9], internal values [29], and perceptions of human nature [26]. Recent proposals suggest that a major factor underlying these differences is one's orientation to negatively valenced stimuli [12]. According to this account, negativity bias (tendency to respond more strongly to negatively valenced stimuli) varies widely across individuals. These variations, in turn, encourage particular social tendencies and political beliefs. Negativity bias is known to vary greatly across individuals [24] and has been found to manifest itself in broad social orientations such as risk

[2] These data were also analyzed in terms of d'. The results were the same except that the overall difference in sensitivity between animal and human subtypes was now significant. There was a main effect of subtype, $F(2, 116) = 59.95$, $p < 0.001$. Sensitivity was significantly greater for the human subtype relative to the animal, $t(116) = 2.50$, $p = 0.02$, and threat subtypes, $t(116) = 10.52$, $p < 0.001$. Sensitivity was also significantly greater for the animal versus threat subtype, $t(116) = 8.02$, $p < 0.001$. The main effect of political ideology was marginally significant, $F(1, 58) = 2.83$, $p = 0.09$. The interaction was not significant, $F < 1$.

tolerance [1]. Thus, the negativity bias account proposes that variations in negativity bias shape not only broad social orientations but also the nature of political beliefs. Consistent with this proposal, the present study found that political ideology explained 45% of subject variation in the effect of scene valence on memory.

From an evolutionary perspective, negativity bias may be adaptive in at least two respects. First, enhanced memory for negative stimuli and events may facilitate memory for the source, location, and consequence of items and events that should be engaged and resolved (e.g., violations of normative standards) or avoided (e.g., threats to health such as disease). Second, to the extent that negativity bias facilitates engagement and resolution of negative content, negativity bias may indirectly foster more positive views of life. This could explain the finding that conservatives report greater happiness than liberals [23]; but see Ref. [36]. In this regard, it may be more precise to characterize the present and previous findings as a deficit in negativity bias the more liberal one is, as opposed to an enhanced negativity bias the more conservative one is.

Another possibility is that variation in arousal underlies emotion processing biases [33]. It is well-known that emotional arousal has an enhancing effect on memory [10,17]; see Ref. [30], for a review). Given that the present stimulus set was strongly correlated on dimensional ratings of valence and arousal, this account may also explain the present results. Tritt et al. [32] offer two possibilities for why arousal may promote conservative orientations. One is that arousal interferes with cognitive ability, which causes a preference for intuitive "gut-level" ideas (an umbrella under which conservative ideas presumably fall). Since the claim that interference with cognition causes a preference for ideas that do not rely on cognition is merely a restatement of an empirical phenomenon in theoretical terms, it must be true by definition. Staying within this level of theorization is economical but not instructive. A natural next step is to weigh the relative plausibility of alternative sources of emotion processing asymmetries.

The second possibility they suggest is that arousal might motivate individuals to endorse value systems that promote social structures geared toward minimizing the potential for intense arousal. There are two problems with this proposal. First, it presupposes that (a) individuals are aware of the items and events instigating intense arousal (otherwise they could not endorse values aimed at removing them) and, (b) endorsement of value systems minimize the potential for such events. Both of these are questionable assumptions given that individuals routinely misattribute sources of arousal [28] and that endorsement of a value system (e.g., anti-immigration) cannot reliably minimize the arousal induced by immigration-related cues (e.g., endorsing anti-immigration policies cannot minimize the arousal induced by seeing someone who looks like an immigrant), rendering the utility of such a mechanism dubious. Second, as mentioned above, arousal tends to benefit cognition, so why would it be desirable to minimize it? Although Tritt et al. recognized that activation of arousal systems is frequently beneficial, they cite two studies showing that intense arousal can be experienced as aversive, as well as a study showing that intense arousal is associated with mania and impulsivity. Thus, according to this account, conservatives respond so intensely to emotional events that their cognitions become pathological and debilitating, thereby motivating the endorsement of values that minimize those events. Associating conservatism with psychopathology notwithstanding, the problem with this is that the level of arousal leading to liberal-conservative differences in cognition has yet to be shown to be debilitating. In fact, the present study, as well as all others showing correlations between political ideology and emotion processing asymmetries, have uniformly showed that emotion benefits cognition more for conservatives than liberals. Biased processing of and memory for negative stimuli is adaptive—it prevents organisms from harm. True, it may be maladaptive in cases of psychopathology, but only through convoluted argument can conservatism be related to psychopathology.

In sum, our results show that negatively valenced emotional stimuli appear to have a more privileged status in memory the more conservative one is. Although the present study cannot distinguish between valence and arousal accounts, the relevant contribution it makes to theories of political ideology is that emotional memory plays role in the development of political ideology. This, in turn, provides new avenues for investigating how variation in emotion processing shape broad social orientations in general and political ideology in particular. An important issue for future work to address is the locus of the ideology by emotion interaction effect on memory in the course of information processing. One possibility is that individual variation in encoding processes (attention and elaboration) give rise to individual differences in emotional memory. As noted in the introduction, several studies have demonstrated that attentional biases to emotional stimuli differ between individuals. Although the exact components of attention (engagement, shifting, disengagement) on which individuals differ await systematic investigation, there is some evidence implicating attentional engagement [22]. In a present/absent search task for happy and angry faces, Mills et al. [22] reported eye tracking data showing that once an angry face had been fixated, conservatives responded to its presence immediately, prior to making even a single additional eye movement. Liberals, in contrast, tended to make at least one additional eye movement. These data suggest that conservatives engaged and responded to threat. Another possibility is that individual variation in post-encoding processes (consolidation and cortisol release) give rise to individual differences in emotional memory. As consolidation is a process that unfolds over time, investigation of this possibility will require future studies to manipulate the amount of time allowed for consolidation. If individual variation in consolidation gives rise to individual differences in emotional memory, then observed effects of emotion on memory should increase with time.

As emotion modulates several cognitive processes, including perception, attention, decision making, and memory, it plays an important role in how individuals perceive and construe their environment, how they make judgments, and what they will remember. Individual differences in the effect of emotion on cognition, in turn, likely underlie higher-level processes such as attitude formation [5,31] and the development of political ideology [12]. The present finding that political conservatism is positively correlated with negativity bias in memory, along with previous findings showing the same correlation in attention, suggest that these two fundamental processes of intellectual function are intimately involved in shaping higher-level processes.

Appendix A.

Wilson-Patterson items and scoring procedure

The Wilson-Patterson Inventory is a twenty-item battery containing 10 conservative (C) items and 10 liberal (L) items. Positive responses to conservative items were assigned a positive value; negative responses a negative value (strongly disagree = −2, disagree = −1, uncertain = 0, agree = 1, strongly agree = 2). Conversely, positive responses to liberal items were assigned a negative value; negative responses a positive value (strongly disagree = 2, disagree = 1, uncertain = 0, agree = −1, strongly agree = −2). Responses to all items were then summed. In this scheme, more positive values reflect a more conservative ideology.

Item	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree
School prayer (C)	m	m	m	m	m
Pacifism (L)	m	m	m	m	m
Stop illegal immigration (C)	m	m	m	m	m
Death penalty (C)	m	m	m	m	m
Government-arranged healthcare (L)	m	m	m	m	m
Premarital sex (L)	m	m	m	m	m
Gay marriage (L)	m	m	m	m	m
Abortion rights (L)	m	m	m	m	m
Evolution (L)	m	m	m	m	m
Biblical truth (C)	m	m	m	m	m
Increase welfare spending (L)	m	m	m	m	m
Protect gun rights (C)	m	m	m	m	m
Increase military spending (C)	m	m	m	m	m
Government regulation of business (L)	m	m	m	m	m
Small government (C)	m	m	m	m	m
Foreign aid (L)	m	m	m	m	m
Lower taxes (C)	m	m	m	m	m
Stem cell research (L)	m	m	m	m	m
Abstinence-only sex education (C)	m	m	m	m	m
Allow torture of terrorism suspects (C)	m	m	m	m	m

References

[1] R.F. Baumeister, E. Bratslavsky, C. Finkenauer, K.D. Vohs, Bad is stronger than good, Rev. Gen. Psychol. 5 (2001) 323–370.
[3] D.R. Carney, J.T. Jost, S.D. Gosling, J. Potter, The secret lives of liberals and conservatives: personality profiles, interaction styles: and the things they leave behind, Polit. Psychol. 29 (2008) 807–840.
[4] L. Carraro, L. Castelli, C. Macchiella, The automatic conservative: ideology-based attentional asymmetries in the processing of valenced information, PLoS One 6 (2011) e26456.
[5] L. Castelli, L. Carraro, Ideology is related to basic cognitive processes involved in attitude formation, J. Exp. Soc. Psychol. 47 (2011) 1013–1016.
[6] M.M. Chun, M.C. Potter, A two-stage model for multiple target detection in rapid serial visual presentation, J. Exp. Psychol. Hum. Percept. Perform. 21 (1995) 109–127.
[7] E.S. Dan-Glauser, K.R. Scherer, The Geneva affective picture database (GAPED): a new 730-picture database focusing on valence and normative significance, Behav. Res. Methods 43 (2011) 468–477.
[8] M.D. Dodd, A. Balzer, C.M. Jacobs, M.W. Gruszczynski, K.B. Smith, J.R. Hibbing, The political left rolls with the good; the political right confronts the bad, Philos. Trans. R. Soc. Lond. B: Biol. Sci. 367 (2012) 640–649.
[9] J. Graham, J. Haidt, B.A. Nosek, Liberals and conservatives rely on different sets of moral foundations, J. Pers. Soc. Psychol. 96 (2009) 1029–1046.
[10] S. Hamann, Cognitive and neural mechanisms of emotional memory, Trends Cogn. Sci. 5 (2001) 394–400.
[11] C.H. Hansen, R.D. Hansen, Finding the face in the crowd: an anger superiority effect, J. Pers. Soc. Psychol. 54 (1988) 917–924.
[12] J.R. Hibbing, K.B. Smith, J.R. Alford, Differences in negativity bias underlie variations in political ideology, Behav. Brain Sci. 37 (2014) 297–350.
[13] L. Hoffman, Longitudinal Analysis: Modeling Within-person Fluctuation and Change, Routledge Academic, New York. New York, 2014.
[14] J.T. Jost, The end of ideology, Am. Psychol. 61 (2006) 651–670.
[15] J.T. Jost, J. Glaser, A.W. Kruglanski, F.J. Sulloway, Political conservatism as motivated social cognition, Psychol. Bull. 129 (2003) 339–375.
[16] E.A. Kensinger, Remembering emotional experiences: the contribution of valence and arousal, Rev. Neurosci. 15 (2004) 241–252.
[17] K.S. LaBar, E.A. Phelps, Arousal mediated memory consolidation: role of the medial temporal lobe in humans, Psychol. Sci. 9 (1998) 490–493.
[18] P.J. Lang, M.M. Bradley, B.N. Cuthbert, International Affective Picture System (IAPS): Instruction Manual and Affective Ratings (Tech. Rep. No. A-4), University of Florida, Center for Research in Psychophysiology, Gainsville, FL, 1999.
[19] V.R. LeBlanc, M.M. McConnell, S.D. Monteiro, Predictable chaos: a review of the effects of emotions on attention, memory: and decision making, Adv. Health Sci. Educ. 20 (2015) 265–282.
[20] S.O. Lilienfeld, R.D. Latzman, Threat bias, not negativity bias: underpins differences in political ideology, Behav. Brain Sci. 37 (2014) 318–319.
[21] G.D. Logan, An instance theory of attention and memory, Psychol. Rev. 109 (2002) 376–400.
[22] M. Mills, K.B. Smith, J.R. Hibbing, M.D. Dodd, The politics of the face-in-the-crowd, J. Exp. Psychol. Gen. 143 (2014) 1199–1213.
[23] J.L. Napier, J.T. Jost, Why are conservatives happier than liberals? Psychol. Sci. 19 (2008) 565–572.
[24] C.J. Norris, J.T. Larsen, L.E. Crawford, J.T. Cacioppo, Better (or worse) for some than others: individual differences in the positivity offset and negativity bias, J. Res. Pers. 45 (2011) 100–111.
[26] S. Pinker, The Blank Slate: The Modern Denial of Human Nature, Viking Penguin, New York, 2002, ISBN 0-6700-3151-8.
[27] E.A. Phelps, S. Ling, M. Carrasco, Emotion facilitates perception and potentiates the perceptual benefits of attention, Psychol. Sci. 17 (2006) 292–299.
[28] S. Schachter, J.E. Singer, Cognitive, social: and physiological determinants of emotional state, Psychol. Rev. 69 (1967) 379–399.
[29] S.H. Schwartz, G.V. Caprara, M. Vecchione, Basic and personal values, core political values: and voting: a longitudinal analysis, Polit. Psychol. 31 (2010) 421–452.
[30] J.W. Schooler, E. Eich, Memory for emotional events, in: E. Tulving, F.I.M. Craik (Eds.), The Oxford Handbook of Memory, Oxford University Press, New York, 2000.
[31] N.J. Shook, R.H. Fazio, Political ideology, exploration of novel stimuli: and attitude formation, J. Exp. Soc. Psychol. 45 (2009) 995–998.
[32] S.M. Tritt, M. Inzlicht, J.B. Peterson, Preliminary support for a generalized arousal model of political conservatism, PLoS One 8 (2013) e83333.
[33] S.M. Tritt, J.B. Peterson, E. Page-Gould, M. Inzlicht, System justification and electrophysiological responses to feedback: support for a positivity bias, J. Exp. Psychol.: Gen. 143 (2014) 1004–1010.
[35] G.D. Wilson, J.R. Patterson, A new measure of conservatism, Br. J. Soc. Clin. Psychol. 7 (1968) 264–269.
[36] S.P. Wojcik, A. Hovasapian, J. Graham, M. Motyl, P.H. Ditto, Conservatives report, but liberals display greater happiness, Science 347 (2015) 1243–1246.