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The Politics of the Face-in-the-Crowd

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Recent work indicates that the more conservative one is, the faster one is to fixate on negative stimuli, whereas the less conservative one is, the faster one is to fixate on positive stimuli. The present series of experiments used the face-in-the-crowd paradigm to examine whether variability in the efficiency with which positive and negative stimuli are detected underlies such speed differences. Participants searched for a discrepant facial expression (happy or angry) amid a varying number of neutral distractors (Experiments 1 and 4). A combination of response time and eye movement analyses indicated that variability in search efficiency explained speed differences for happy expressions, whereas variability in post-selectional processes explained speed differences for angry expressions. These results appear to be emotionally mediated as search performance did not vary with political temperament when displays were inverted (Experiment 2) or when controlled processing was required for successful task performance (Experiment 3). Taken together, the present results suggest political temperament is at least partially instantiated by attentional biases for emotional material.

Keywords: anger-superiority, visual search, eye movements, individual differences, politics

In recent years, the conceptualization of political temperament has progressed beyond processes rooted purely in socialization and into one characterized by intrinsic psychological (Jost et al., 2007) and physiological processes (Oxley et al., 2008). Supporting this paradigm shift is mounting evidence that political preferences may be instantiated within broad, nonpolitical constructs, such as personality (Caprara, Schwartz, Capanna, Vecchione, & Barbaranelli, 2006; Carney, Jost, Gosling, & Potter, 2008; McCrae & Costa, 2003; Mondak, Hibbing, Canache, Seligson, & Anderson, 2010), moral foundations (Graham, Haidt, & Nosek, 2009; Haidt & Graham, 2007), core values (Altemeyer, 1996; Jost, Glaser, Kruglanski, & Sulloway, 2003; Schwartz, 2007), neural activation in response to unexpected stimuli (Amodio, Jost, Master, & Yee, 2007), self-reported sensitivity to disgust (Haidt & Hersh, 2001; Inbar, Pizarro, & Bloom, 2009), self-reported sensitivity to threat (Huddy, Feldman, Taber, & Lahav, 2005), physiological response to threat (Dodd et al., 2012; Oxley et al., 2008), and possibly even genetics (Alford, Funk, & Hibbing, 2005; Fowler & Dawes, 2008; Hatemi, Alford, Hibbing, Martin, & Eaves, 2009; Hatemi et al., 2011; Settle, Dawes, Christakis, & Fowler, 2010). Thus, a growing body of work indicates that political preferences are more than just conscious responses to issues-of-the-day and are at least in part biologically motivated. In line with this view, the present study examines whether variation in political temperament is associated with variability in cognitive responses to emotionally laden stimuli. This work will contribute to an understanding of cognitive and emotional factors that promote the development of political preferences, as well as add to an understanding of individual variability in emotional processing more generally.

Psychophysiological work has previously demonstrated that emotional biases correlate with positions on specific policy issues. For example, self-reported support for conservative, socially protective policies has been predicted by physiological responses to startle probes while free-viewing threatening photographs (Oxley et al., 2008). In particular, a correlation between physiological response measures (muscle movement at the obicularis oculi and skin conductance levels) and specific issue preferences related to the protection of social order was observed: those more physiologically responsive supported defense spending, capital punishment, patriotism, and the Iraq War, whereas those less responsive supported foreign aid, liberal immigration policies, pacifism, and gun control. This suggests that high levels of arousal in response to threatening stimuli is associated with support for policies that confront threat (support for war), whereas lower levels of arousal is associated with support for policies that avoid threat (pacifism) or proactively engage threat (gun control).

Recent evidence (Dodd et al., 2012) suggests that pronounced physiological arousal in response to negative stimuli may even characterize conservative political temperament more generally. Dodd et al. (2012; Experiment 1) recorded skin conductance levels as participants free-viewed photographs that were either negative (e.g., snakes, mutilation) or positive (e.g., bunnies, babies, sunsets). Although all individuals were more physiologically responsive to negative versus positive stimuli, those with a more conservative temperament exhibited stronger responses to negative stimuli relative to those with a less conservative temperament.

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Similarly, those with a less conservative temperament exhibited stronger responses to positive stimuli relative to those with a more conservative temperament. In a second experiment, eye movements were recorded as participants free-viewed displays containing both negative and positive photographs (one photograph in each quadrant of the display). Converging with the physiological response data, participants with a more conservative temperament gazed at negative stimuli longer and fixated these images faster than participants with a less conservative temperament. Conversely, those with a less conservative temperament gazed at positive stimuli longer and fixated these images faster than those with a more conservative temperament. Dodd et al. concluded that a more conservative temperament may be associated with an attentional bias toward negative stimuli, whereas a less conservative temperament may be associated with an attentional bias toward positive stimuli.

The eye movement data indicate that variation in political temperament is associated with variability in cognitive responses to positive and negative stimuli, as evidenced by the difference in speed and dwell time with which positive and negative stimuli were fixated, but they are uninformative with regards to the underlying mechanism. It could be that emotional stimuli differ in their capacity to guide attention prior to target selection, as suggested by the emotion-detector hypothesis (Hansen & Hansen, 1988; Öhman & Mineka, 2001). In contrast, it could be that emotional stimuli differ in their capacity to guide the orienting of attention once a target had initially been fixated, as suggested by the sensory-bias hypothesis (D. V. Becker, Anderson, Mortensen, Neufeld, & Neel, 2011; Horstmann & Bauland, 2006). Alternatively, or in addition, it could be that emotional stimuli differentially influence post-selectional factors, i.e., processes commencing after selection of targets and distractors, such as perceptual identification (e.g., Treisman, 1982) or decisional processes (e.g., Theeuwes, 1992; Wolfe, 2001). For instance, Calvo, Nummenmaa, and Avero (2008) used eye movements to measure each of these three components and found preferential effects of emotion on both early attentional orienting and post-selectional processes (but see Reynolds, Eastwood, Partanen, Frischen, & Smilek, 2009, in which post-selectional factors were not found to be influential). Accordingly, the present study uses a visual search paradigm to examine whether components involved in search for happy and angry facial expressions vary with political temperament.

Visual Search for Emotional Faces

Successful social exchange depends in part on the ability to rapidly and accurately interpret the mental states of others. If an individual is seeking assistance from a member of an unknown group for example, success depends on the ability to determine (a) that the group is unlikely to pose a threat and (b) that the group is willing to provide assistance. In this respect, facial expressions of emotion serve an important communicative function (Darwin, 1872) with phylogenic roots (Izard, 1971), signaling to an observer whether group members potentiate harm and should therefore be avoided (e.g., angry facial expressions) or potentiate affiliation and should therefore be approached (e.g., happy facial expressions). Individuals capable of rapidly and accurately detecting signs of threat *and* signs of affiliation would therefore be most suited for survival. Considering the context in which humans evolved, however, which was within the context of a group dependent upon cooperation for survival (Bowles, 2001; Bowles, Choi, & Hopfensitz, 2002; Boyd & Richerson, 2002; Gintis, 2000; Gintis, Bowles, Boyd, & Fehr, 2003), it is plausible that group success may be maximized when traits are well distributed. That is, it may be adaptive for some members of a group to be more sensitive to signs of affiliation and other members more sensitive to signs of threat. Such coevolution might provide a group with the greatest chance of survival.

Visual search tasks are often used to assess the extent to which cognitive processes are sensitive to distinguishing characteristics of target stimuli, which can be achieved by comparing different targets on a measure of search efficiency. Traditionally, search efficiency is assessed by estimating a search function that relates response time (RT) to the total number of items in a display (set size). Set size slopes therefore quantify the effect of additional display items on search performance, with greater slopes indicative of a greater increase in RT per additional item. Efficient search is implied by the result that RT is uninfluenced by set size and is interpreted as evidence that attention could be immediately guided to the location of a target without serialized scanning of nontarget items. In this case, basic features such as orientation or motion are processed in parallel across the visual field and guide attention to likely target locations. Inefficient search, on the other hand, is implied by the result that RT increases with set size and is interpreted as evidence that serialized scanning of display items was required in order to locate the target (Treisman & Gelade, 1980; Treisman & Souther, 1985). Although search performance can rarely be attributed to only parallel or only serial processes (Wolfe, 1998), it is possible to assess the extent to which parallel processes are sensitive to distinguishing characteristics of target stimuli by comparing search efficiency for different targets (Eastwood, Smilek, & Merikle, 2001). Accordingly, search for one target is more efficient than search for another target if one search slope is shallower than the other.

Although the capacity for facial expressions of emotion to influence attention is well accepted, the extent to which a specific type or class of expressions preferentially influences attention is a matter of dispute. For instance, in the *face-in-the-crowd paradigm* (Hansen & Hansen, 1988), in which participants search for a discrepant facial expression (e.g., happy or angry) amid a varying number of distractors, an anger-superiority effect is sometimes reported in which search for angry targets is found to be more efficient than search for happy targets. This effect has been observed with real (e.g., Fox & Damjanovic, 2006; Gilboa-Schechtman, Foa, & Amir, 1999; Hansen & Hansen, 1988; Horstmann & Bauland, 2006; Pinkham, Griffin, Baron, Sasson, & Gur, 2010) and schematic faces (e.g., Eastwood et al., 2001; Esteves, 1999; Fox et al., 2000; Horstmann, 2007; Öhman, Lundqvist, & Esteves, 2001; Tipples, Atkinson, & Young, 2002). However, there are a number of mixed findings, with some studies reporting no difference in search efficiency between angry and happy targets (e.g., Purcell, Stewart, & Skov, 1996) and others reporting a happy-superiority effect (e.g., Byrne & Eysenck, 1995; Juth, Lundqvist, Karlsson, & Öhman, 2005; Krysko & Rutherford, 2009; D. V. Becker et al., 2011; M. A. Williams, Moss, Bradshaw, & Mattingley, 2005).

One reason findings may differ across studies relates to differences in low-level visual confounds associated with different stimulus sets, as well as to design factors (Horstmann, 2007, 2009; see D. V. Becker et al., 2011, for a review and empirical demonstration). For instance, Horstmann (2007, 2009) compared performance on a number of stimulus sets used in previous work and, despite replicating the search advantage for angry targets, was able to demonstrate that low-level confounds associated with both targets and distractors were primarily responsible for these effects. Low-level visual confounds and methodological differences, however, are unlikely to fully account for preferential effects. For example, Bannerman, Milders, de Gelder, and Sahraie (2008) used a forced-choice saccadic and manual localization task in which participants discriminated bilaterally presented threatening and neutral facial expressions and body postures, finding that responses were faster and more accurate to threatening versus neutral stimuli. Two aspects bear mentioning. First, the same pattern of results was observed for body postures as for facial expressions, which rules out the possibility that aspects unique to the face, visual confound or otherwise, produced the results. Second, a threat bias was observed with saccadic responses only when stimuli were presented for a short amount of time (20 ms), whereas a threat bias was observed with manual RTs only when stimuli were presented for a long amount of time (500 ms). Thus, in addition to stimulus set and design factors, mode of response (e.g., saccadic vs. manual) is also likely to contribute to results obtained in studies of attention to emotion.

Another potential explanation for the discrepant findings in the face-in-the-crowd paradigm is that some individuals are more sensitive than others to certain emotional stimuli. In a recent review, Yiend (2010) concluded that differences in attention to threat between the general population and psychopathology populations are quantitative, with attentional biases toward threat more easily activated and more enduring in psychopathology populations. This is an intriguing possibility because it suggests that the extent of capture in paradigms such as the face-in-the-crowd is a matter of degree rather than absolute. Thus, if threat-related attentional biases are more easily activated in some individuals, this also potentially explains differences between studies. Unfortunately, few studies have examined individual differences that may be moderating search for happy and angry expressions, and those that have typically have done so in the context of psychopathology (e.g., *depression* [Phelps, Ling, & Carrasco, 2006]; *anxiety* [Juth et al., 2005]; *social phobia* [Wieser, Pauli, Alpers, & Mühlberger, 2009]), which usually involves comparing clinical or subclinical populations with a low-vulnerability control group. As such, these studies speak to how threat-related attentional biases operate in the tails of particular pathologies rather than articulating if and how these biases operate in general populations. The purpose of the present work is to examine whether individual differences within the general population moderate the search for happy and angry expression. Specifically, as there is evidence for differential behavioral and physiological responsiveness to positive and negative stimuli as a function political temperament, the present work examines whether political temperament moderates search for happy and angry expressions.

Experiment 1

The purpose of Experiment 1 was to determine whether search efficiency for happy and angry expressions varies with political temperament. From an evolutionary perspective, displays of threat should be prioritized for visual selective attention given that they have immediate consequences for survival (Hansen & Hansen, 1988; Öhman & Mineka, 2001). As such, anger-superiority effects ought to be observed irrespective of one's political temperament. If, however, a more conservative temperament is associated with attentional sensitivity to signals of threat, then search for angry targets should be more efficient the more conservative one is. Similarly, if a less conservative temperament is associated with attentional sensitivity to signals of affiliation, then search for happy targets should be more efficient the less conservative one is.

RT set size slopes provide a traditional measure of search efficiency; however, other measures are available (e.g., eye movements, Calvo & Nummenmaa, 2008; Calvo et al., 2008). Saccade path ratio is a measure of eye movement efficiency during search (Henderson, Weeks, & Hollingworth, 1999). Eye movements and attention are closely linked (e.g., Deubel & Schneider, 1996), meaning that analyses of set size slopes and path ratios are likely to converge, but a notable difference between the two is that whereas RT measures require the execution of a manual response following target detection, eye movement measures do not. As such, estimates of search efficiency via RT measures might underestimate effects of expression, particularly if there is disparity in target dwell time. Given that Dodd et al. (2012) found differential dwell time on positive and negative stimuli as a function of political temperament, this suggests that saccade path ratio may provide a more precise measure of search efficiency. Saccade path ratio is defined as the summed amplitude of a set of saccades (i.e., the total distance the eyes travel) divided by the Euclidean distance between two locations. Here, saccade path ratio was applied to the total distance the eyes traveled from the center of the display (i.e., the location of the eyes at the start of a trial, which was the same across trials and participants) to the first fixation on a target expression. Accordingly, the path ratio used here was computed as the sum of all saccades prior to first fixation on the target divided by the Euclidean distance from the center of the display to the location of a target. A path ratio of 1 would indicate that the eyes were oriented on a direct path to the target. Thus, smaller values reflect more efficient search. In addition to RT and saccade path ratio, target dwell time (summed duration of all fixations on a target within trial) and accuracy (proportion of trials with incorrect responses) were also examined.

Method

Participants. A total of 37 undergraduate students from the University of Nebraska—Lincoln volunteered to participate in exchange for course credit. All participants had normal or corrected-to-normal vision and were naïve to the purpose of the experiment. Two participants completed fewer than half of all trials and were eliminated from analysis. The remaining participants ($N = 35$) completed all trials.

Stimuli. Face stimuli consisted of three different expressions (happy, angry, neutral) from the NimStim set of facial expressions

(Tottenham et al., 2009).[1] The same model was selected so that targets were presented against a constant distractor background, in terms of both emotional valence and perceptual similarity (i.e., same facial model for happy and angry targets as for neutral distractors). To create the search array for each of the three set sizes (six, 12, and 18), a 4×6 grid with equally sized and equally spaced rectangles was mapped onto the size of the display screen. The defined space allowed room for 24 faces, each $2° \times 3°$. For target absent trials, neutral faces were removed at random until six, 12, or 18 faces remained, with the restriction that each of the 24 locations would have an equal probability of containing a neutral face for any given trial at each set size. For target present trials, the same procedure was applied but one of the faces was a target. Across all target present trials, either a happy or angry expression had an equal probability of appearing at any of the 24 possible locations.

Measures. Political temperament was determined by combining two measures of political conservatism (Wilson-Patterson Inventory and Society Works Best Scale). The Wilson-Patterson Inventory (Wilson & Patterson, 1968) assesses political attitudes on 24 “bedrock” issues (e.g., abortion, death penalty, foreign aid, pacifism, Iraq war, immigration, welfare spending), with the purpose of providing an overall index of conservatism. For each item, participants indicate whether they “agree,” “disagree,” or are “uncertain.” Responses are assigned a value of +1 if the response is consistent with a conservative temperament and a value of 0 if the response is inconsistent; “uncertain” responses are assigned +.5. The Society Works Best Scale (Smith, Oxley, Hibbing, Alford, & Hibbing, 2011) contains 13 items that ask participants to select from two paired scenarios the one that would make society work the best (e.g., “society works best when: those who break the rules are punished, or when those who break the rules are forgiven”). Responses consistent with a conservative temperament are assigned +1, whereas inconsistent responses are assigned −1. Responses on the two measures were summed to yield a broad measure of political temperament (Dodd et al., 2012), with higher scores representing a more conservative temperament (see Table 1 for descriptive statistics).

Apparatus. Stimuli were displayed on a Pentium 4 PC with VGA monitor (85 Hz) in a dimly lit, sound attenuated testing room. Eye movements were recorded using an SR Research Ltd. EyeLink II system (Mississauga, Ontario, Canada), which has high spatial resolution and a sampling rate of 500 Hz. Thresholds for detecting the onset of saccadic movements were accelerations of $8{,}000°/s^2$, velocities of 30°/s, and distances of 0.5° of visual angle. Movement offset was detected when velocity fell below 30°/s and remained at that level for 10 consecutive samples. Rectangular interest areas were fit to the size of target faces for eye movement analyses. To calibrate the apparatus, a 9-point calibration procedure was performed followed by a 9-point calibration accuracy test. Calibration was repeated if any point was in error by more than 1° or if the average error for all points was greater than 0.5°. Viewing was binocular but only the dominant eye was recorded.

Design and procedure. Participants completed a total of 432 trials presented in a random order. A target was present on half the trials and absent on the other half. As the present study was concerned with whether effects of expression differed by political temperament, only target-present trials were submitted for analysis (we note, however, that target-absent RTs did not vary as a function of political temperament). Thus, analyzed trials differed by target expression (happy, angry) and set size (six, 12, 18). At the beginning of each trial, a fixation point appeared at the center of the display. Participants were instructed to fixate the center point and press the space bar to initiate a trial. Search arrays then appeared without delay. Participants were instructed to indicate as quickly and as accurately as possible whether a discrepant face was present or absent. Arrays were presented until participants entered a response. Participants were seated approximately 44 cm from the monitor and used a button-controller to indicate a response. Questionnaires were completed following the search task. In total, experimental sessions lasted ~60 min.

Results

Trials with incorrect responses (3.9%), as well as trials with RTs less than 250 ms or greater than 2.5 *SD*s above condition means (2.7%) were excluded from RT and eye movement analyses. Mean correct, target-present responses, as well as proportion incorrect, were then calculated for each subject and analyzed with separate 2 (expression: happy, angry) × 3 (set size: six, 12, 18) repeated-measures analyses of variance (ANOVAs), in which political temperament (M = 18.36, SD = 7.36) was entered as a mean centered covariate.

Response time and accuracy. Overall, responses were faster and more accurate to angry (M_{RT} = 1013, SD_{RT} = 139; M_{errors} = .021, SD_{errors} = .024) versus happy targets (M_{RT} = 1136, SD_{RT} = 124; M_{errors} = .097, SD_{errors} = .047), as indicated by significant main effects of expression on RT, $F(1, 33) = 44.66$, MSE = 17850.21, $p < .001$, $\eta_p^2 = .58$, and accuracy, $F(1, 33) = 137.69$, MSE = 0.002, $p < .001$, $\eta_p^2 = .81$. There were also significant main effects of set size on RT, $F(2, 66) = 256.77$, MSE = 5660.36, $p < .001$, $\eta_p^2 = .89$, and accuracy, $F(2, 66) = 5.47$, MSE = 0.002, $p = .006$, $\eta_p^2 = .14$, indicating responses were slower and less accurate at larger set sizes, on average. The interaction of expression and set size was significant for both RT, $F(2, 66) = 7.87$, MSE = 3950.44, $p = .02$, $\eta_p^2 = .19$, and accuracy, $F(2, 66) = 7.28$, MSE = 0.001, $p < .001$, $\eta_p^2 = .18$, indicating that set size slopes were shallower for angry versus happy targets. Thus, overall, an anger-superiority effect was observed, both in terms of RT and accuracy. Moreover, as effects on RT and accuracy were in the same direction, this rules out the possibility that a speed–accuracy trade-off was responsible for the overall pattern of results.

Next, effects of political temperament were examined. In terms of accuracy, all effects of political temperament were nonsignificant (Fs < 1). Thus, the overall pattern of errors described above was not influenced by political temperament. In terms of RT, there was a significant interaction of political temperament and expression, $F(1, 33) = 47.06$, MSE = 17850.21, $p < 001$, $\eta_p^2 = .59$. The pattern of this interaction is shown by Figure 1, in which mean RT is plotted as a function of political temperament for angry and happy targets. Accordingly, *responses to angry targets* were faster the more conservative one was, $t(34) = -3.43$, $p = .002$, $\eta_p^2 = .29$, whereas *responses to happy targets* were faster the less conservative one was, $t(34) = 2.19$, $p = .04$, $\eta_p^2 = .13$. Figure 1 also shows

[1] NimStim Model ID: happy (01F_HA_O), angry (01F_AN_O), neutral (01F_NE_C).

Table 1
Descriptive Statistics for the Political Temperament Measure in All Four Experiments

Experiment	Measure	Range	*M*	*SD*	*N*	*r*	*p*
1	Political temperament	6–34	18.36	7.36	35		
2	Political temperament	8–35	21.43	7.01	29		
	State anxiety	21–60	37.03	9.69	29	−.16	.42
	Trait anxiety	24–62	39.83	10.41	29	−.08	.67
3	Political temperament	5–41	20.57	6.81	37		
4	Political temperament	6.5–37	24.60	6.18	55		
	State anxiety	20–62	34.33	9.14	55	−.08	.52
	Trait anxiety	22–65	39.42	9.79	55	−.19	.15

Note. Correlations between political temperament and anxiety are given for Experiments 2 and 4 (anxiety was not measured in Experiments 1 or 3).

how the effect of expression on RT changed as a function of political temperament. *At higher levels of conservatism*, responses were faster to angry versus happy targets, $t(34) = –9.29$, $p < .001$, $\eta_p^2 = .73$ (as evaluated at political temperament = 31), whereas *at lower levels of conservatism*, responses were faster to happy versus angry targets, $t(34) = 2.38$, $p = .02$, $\eta_p^2 = .15$ (as evaluated for political temperament = 6). No other effects were significant (*F*s < 1). Thus, while the overall anger-superiority effect was descriptive of those with a more conservative temperament, it does not describe those with a less conservative temperament. That is, although less conservative individuals had a shallower slope for angry versus happy targets, the mean function was higher, so an anger-superiority effect cannot be claimed.

Dwell time. There was a significant main effect of expression, $F(1, 33) = 32.35$, $MSE = 1413.67$, $p < .001$, $\eta_p^2 = .50$, indicating that dwell time was longer on happy ($M = 380$, $SD = 66$) versus angry targets ($M = 350$, $SD = 56$), on average. The main effect of set size was also significant, $F(2, 66) = 4.40$, $MSE = 842.58$, $p = .02$, $\eta_p^2 = .12$, indicating that dwell time increased with set size, on average. The interaction of expression and set size was also significant, $F(2, 66) = 4.40$, $MSE = 842.58$, $p = .02$, $\eta_p^2 = .10$, indicating that the effect of set size was larger for happy versus angry targets. No effects of political temperament were significant (*F*s < 1). Thus, dwell time was longer on happy versus angry targets and did not reliably vary with political temperament (see Figure 2). Taken together, these results suggest that effects of political temperament on RTs were not due to disparity in target dwell time. Furthermore, as dwell time was longer on happy versus angry targets, manual RTs may overestimate target detection times asymmetrically, i.e., elapsed time between target detection and response execution may be greater for happy versus angry targets due to disparity in dwell time, suggesting eye movement responses may provide a more reliable index of search efficiency than manual responses.

First fixation path ratio. Overall, there was a significant main effect of expression, $F(1, 33) = 8.45$, $MSE = 0.18$, $p = .006$,

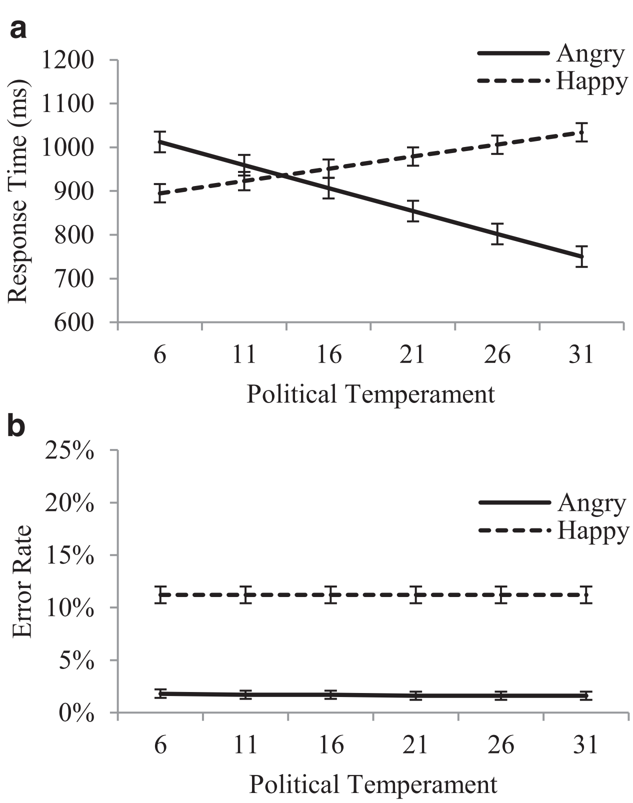

Figure 1. Experiment 1 mean response time (a; smaller values represent speeded detection) and mean error rate (b; smaller values represent more accurate detection) as a function of political temperament (higher values represent a more conservative temperament) for angry and happy targets. Error bars represent ±1 standard error of the mean.

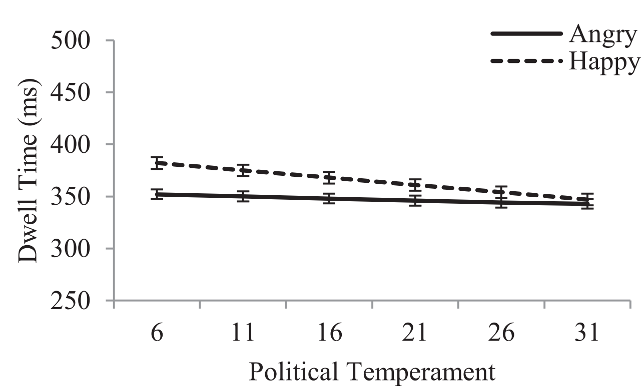

Figure 2. Experiment 1 mean target dwell time as a function of political temperament (higher values represent a more conservative temperament) for angry and happy targets. Error bars represent ±1 standard error of the mean.

$\eta_p^2 = .21$, such that path ratios were smaller for angry ($M = 2.47$, $SD = 0.32$) versus happy targets ($M = 2.64$, $SD = 0.36$). Thus, consistent with the analysis of manual RT set size slopes, eye movements were directed more efficiently toward angry versus happy targets, on average. There was also a significant main effect of set size, $F(2, 66) = 57.96$, $MSE = 0.08$, $p < .001$, $\eta_p^2 = .64$, as well as a significant interaction of expression and set size, $F(2, 66) = 7.67$, $MSE = 0.07$, $p = .001$, $\eta_p^2 = .19$, indicating that path ratios increased with set size, and more so for happy versus angry targets. Finally, there was a significant interaction of expression and political temperament, $F(1, 33) = 20.96$, $MSE = 0.18$, $p < .001$, $\eta_p^2 = .39$. The pattern of this interaction is shown by Figure 3, in which mean path ratio is plotted as a function of political temperament for angry and happy targets. Consistent with the analysis of RT set size slopes, *path ratios to angry targets* did not vary with political temperament, $t(34) = -1.19$, $p = .24$, $\eta_p^2 = .04$, indicating that search efficiency for angry targets was unaffected by political temperament. In contrast, however, *path ratios to happy targets* decreased as conservatism decreased, $t(34) = 3.75$, $p = .001$, $\eta_p^2 = .30$, indicating that search for happy targets was more efficient the less conservative one was. Figure 3 also shows how the effect of expression changed as a function of political temperament. *At higher levels of conservatism*, path ratio was smaller for angry versus happy targets, $t(34) = -5.42$, $p < .001$, $\eta_p^2 = .47$ (as evaluated at political temperament = 31), indicative of an anger-superiority effect. *At lower levels of conservatism*, however, path ratio was smaller for happy versus angry targets, $t(34) = 2.40$, $p = .02$, $\eta_p^2 = .15$ (as evaluated for political temperament = 6), indicative of a happy-superiority effect. No other effects were significant—for the main effect of political temperament, $F(1, 33) = 1.48$, $MSE = 0.51$, $p = .23$, $\eta_p^2 = .04$; for the two-way interaction of set size and political temperament, $F(2, 66) = 0.12$, $MSE = 0.08$, $p = .90$, $\eta_p^2 = .01$; for the three-way interaction, $F(2, 66) = 1.65$, $MSE = 0.07$, $p = .19$, $\eta_p^2 = .05$.

Postfirst fixation path ratio. RTs to angry targets were faster the more conservative one was yet RT set size slopes and first fixation path ratio both indicated that search efficiency for angry targets did not vary with political temperament, suggesting that post-selectional processes were responsible for the speed advantage (e.g., speeded encoding and/or response selection). To investigate this possibility, post-first fixation path ratio was examined—defined as the total distance the eyes traveled after initial target fixation divided by the Euclidean distance between the locations of the target and the fixation preceding response execution. A path ratio of 0 would indicate that no additional eye movements were made once the target had been fixated. Thus, smaller values represent reduced scanning between initial target fixation and manual response, indicative of enhanced post-selectional processing. Accordingly, if this speed advantage for angry targets was due to enhanced post-selectional processing, then post-first fixation path ratio should decrease as conservatism increases (cf. Calvo et al., 2008; Findlay, 1997; D. E. Williams, Reingold, Moscovitch, & Behrmann, 1997).

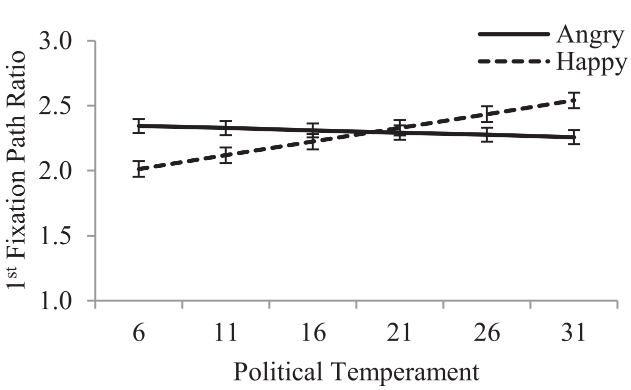

Figure 3. Experiment 1 mean first fixation path ratio (smaller values represent more efficient search) as a function of political temperament (higher values represent a more conservative temperament) for angry and happy targets. Error bars represent ±1 standard error of the mean.

Overall, there was a significant main effect of expression, $F(1, 33) = 143.94$, $MSE = 0.02$, $p < .001$, $\eta_p^2 = .81$, indicating that path ratios were smaller for angry ($M = .39$, $SD = .21$) versus happy targets ($M = .62$, $SD = .16$). There was also a significant main effect of set size, $F(2, 66) = 7.11$, $MSE = 0.03$, $p = .002$, $\eta_p^2 = .18$, indicating that path ratios were smaller at larger set sizes. Importantly, the interaction of expression and political temperament was also significant, $F(1, 33) = 25.47$, $MSE = 0.02$, $p < .001$, $\eta_p^2 = .44$. The pattern of this interaction is shown by Figure 4, in which mean post-first fixation path ratio is plotted as a function of political temperament for angry and happy targets. Accordingly, *for angry targets*, path ratios decreased as conservatism increased, $t(34) = -2.71$, $p = .01$, $\eta_p^2 = .18$, whereas *for happy targets*, path ratios did not vary with political temperament, $t(34) = -0.43$, $p = .67$, $\eta_p^2 = .01$. No other effects were significant—for the interaction of expression and set size, $F(2, 66) = 2.42$, $MSE = 0.02$, $p = .10$, $\eta_p^2 = .07$; for the main effect of political temperament, $F(1, 33) = 3.42$, $MSE = 0.19$, $p = .08$, $\eta_p^2 = .09$; all other Fs < 1.

Discussion

Consistent with previous research (e.g., Dodd et al., 2012), angry targets were detected faster the more conservative one was, whereas happy targets were detected faster the less conservative one was. To determine whether variability in search efficiency explains these speed advantages, two measures of search efficiency (RT set size slope and first fixation saccade path ratio) were examined. For angry targets, both measures indicated that search efficiency did not vary with political temperament, suggesting that speed differences were not due to differential guidance of attention but rather to post-selectional processes. Consistent with this interpretation, analysis of post-first fixation saccade path ratio indicated that the amount of scanning required between first target fixation and response execution decreased the more conservative one was. Accordingly, differences in processing once an angry target had already been selected appear to be responsible for the speed advantage. For happy targets, the two measures of efficiency yielded different results: Analysis of RT set size slopes indicated that search efficiency did not vary with political temperament, whereas analysis of saccade path ratios indicated that search was more efficient the less conservative one was. Given that participants dwelled longer and required more post-first fixation scanning for happy versus angry targets, however, this suggests that saccade path ratio may provide a more sensitive estimate of search efficiency. In line with this logic, saccadic responses are commonly thought to provide a

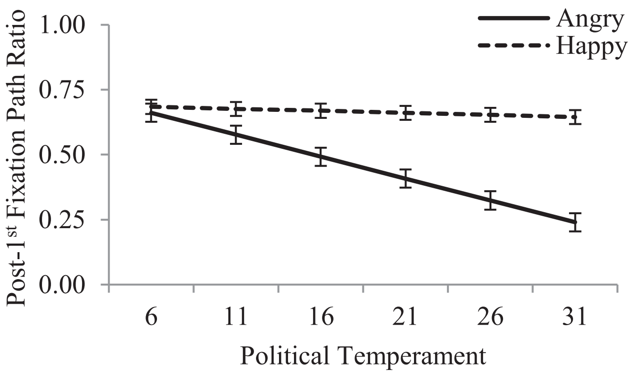

Figure 4. Experiment 1 mean post-first fixation path ratio (smaller values represent enhanced post-selectional processing) as a function of political temperament (higher values represent a more conservative temperament) for angry and happy targets. Error bars represent ±1 standard error of the mean.

more sensitive measure of detection time (Henderson, 2003), and further, effects of emotion are thought to have a greater impact on saccadic responses than manual responses (Bannerman, Milders, & Sahraie, 2009). On the basis of saccade path ratio, then, speed differences for happy targets appear to be due to differential guidance of attention. Consistent with this interpretation, had the speed difference been due to post-selectional processes then analysis of post-first fixation saccade path ratio should have revealed an effect of political temperament, which it did not.

Experiment 2

Experiment 1 found that visual search for emotional expressions was moderated by political temperament. The purpose of Experiment 2 was to examine whether these effects could be attributed to lower level perceptual features of the face as opposed to the emotional content of the face. The processing of emotional expressions has been considered to occur holistically, with inversion eliminating (e.g., Bruce, 1988; Tanaka & Farah, 1993) or reducing the efficiency of holistic processing (e.g., Richler, Mack, Palmeri, & Gauthier, 2011; Sekuler, Gaspar, Gold, & Bennett, 2004). As face inversion adversely influences holistic processing more so than the processing of individual local features, face stimuli are often inverted to ensure that performance differences are not simply due to perceptual features. The rationale is that identical results should be obtained for upright and inverted displays if differences in search efficiency for emotional expressions are due to perceptual properties, whereas preferential effects of emotion should be eliminated if differences in search efficiency are due to emotional content. Experiment 2 also included a measure of anxiety in the postexperiment questionnaire. Given that biases toward threat have been found to be sensitive to individual differences in anxiety (e.g., Gilboa-Schechtman et al., 1999; Juth et al., 2005), it is important to assess whether political temperament and anxiety are related. As can be seen on Table 1, which shows the correlation between political temperament and anxiety, the two were not related.

Method

Participants. Thirty undergraduate students from the University of Nebraska—Lincoln volunteered to participate in the experiment in exchange for course credit. All participants had normal or corrected-to-normal vision and were naïve to the purpose of the experiment. One participant completed fewer than half of all trials and was removed from all analyses. The remaining participants ($N = 29$) completed all trials.

Stimuli and apparatus. Face stimuli were the same as in Experiment 1 except faces were inverted. Stimuli were displayed on a Pentium 4 PC with VGA monitor (85 Hz) in a dimly lit, sound attenuated testing room. Manual responses were made using the key board ("Z" for target-present and "/" for target-absent).

Measures. Political temperament was determined in the same manner as in Experiment 1. In addition, the State and Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) was used to characterize the sample on a relevant measure of psychopathology. The STAI is a common measure of anxiety with good reliability and validity. The alpha coefficient for the STAI-Trait is 0.94, and for the STAI-State 0.81. See Table 1 for descriptive statistics, as well as for bivariate correlations with political temperament.

Design and procedure. These were the same as in Experiment 1 with the exception that participants now completed a total of 864 trials. Again, only target-present trials were submitted for analysis.

Results

Incorrect responses (5.7%), as well as trials with RTs less than 250 ms or greater than 2.5 *SD*s above condition means (7%) were excluded from analysis. Mean target-present RT and proportion incorrect were then calculated for each subject and analyzed with separate 2 (expression: happy, angry) × 3 (set size: 6, 12, 18) repeated-measures ANOVAs in which political temperament ($M = 21.43$, $SD = 7.01$) was entered as a mean centered covariate.

Responses were faster and more accurate to angry ($M_{RT} = 1092$, $SD_{RT} = 191$; $M_{errors} = .05$, $SD_{errors} = .05$) versus happy targets ($M_{RT} = 1347$, $SD_{RT} = 246$; $M_{errors} = .16$, $SD_{errors} = .11$), as indicated by significant main effects of expression on RT, $F(1, 27) = 133.15$, $MSE = 21218.38$, $p < .001$, $\eta_p^2 = .83$, and accuracy, $F(1, 27) = 77.28$, $MSE = 0.007$, $p < .001$, $\eta_p^2 = .74$. There were also significant main effects of set size on RT, $F(2, 54) = 86.15$, $MSE = 15053.49$, $p < .001$, $\eta_p^2 = .76$, and accuracy, $F(2, 54) = 34.52$, $MSE = 0.002$, $p < .001$, $\eta_p^2 = .56$, such that responses were slower and less accurate at larger set sizes. Finally, the interaction of expression and set size was significant for both RT, $F(2, 54) = 11.46$, $MSE = 6719.44$, $p < .001$, $\eta_p^2 = .30$, and accuracy, $F(2, 54) = 10.06$, $MSE = 0.002$, $p < .001$, $\eta_p^2 = .27$, indicating that set size slopes were shallower for angry versus happy targets. No other effects were significant for RT—for the main effect of political temperament, $F(1, 27) = 2.01$, $MSE = 270303.49$, $p = .17$, $\eta_p^2 = .07$; all other Fs < 1—or for accuracy (Fs < 1). Thus, with inverted faces, an anger-superiority effect was again observed, suggesting that the anger-superiority effect in Experiment 1 was due to perceptual features. Importantly, however, inversion eliminated all effects of political temperament, suggesting effects of political temperament in Experiment 1 were due at least in part to the emotional content of the face.

Discussion

With upright faces (Experiment 1), happy targets were detected faster and more efficiently the less conservative one was, whereas with inverted faces search performance did not vary with political temperament. This finding suggests that the emotional content of the happy face, as opposed to perceptual features of the face, was necessary for guiding attention and producing the performance advantages for happy targets in Experiment 1. Similarly, upright angry targets were detected faster the more conservative one was (Experiment 1), whereas search performance for inverted angry targets did not vary with political temperament. As the performance advantage for angry targets in Experiment 1 was attributed to facilitated post-selectional processing (e.g., speeded encoding or response selection), this finding suggests that the emotional content of the angry face was necessary for facilitated post-selectional processing and producing the performance advantage for angry targets in Experiment 1.

Experiment 3

In Experiment 1, angry targets were detected faster the more conservative one was but not more efficiently, suggesting that the speed advantage was due to post-selectional processes. Analysis of post-first fixation path ratio supported this claim by showing that once angry targets were initially fixated, less scanning of the display was required the more conservative one was (reflecting facilitated post-selectional processing). On the one hand, this pattern of results might reflect an emotionally mediated effect such that those with a relatively high sensitivity to threat require little evidence of threat in order to facilitate post-selectional processing. Consistent with this possibility, inverting the face stimuli in Experiment 2 eliminated effects of political temperament, suggesting that the emotional content of the expression was necessary for the speed advantage. On the other hand, differential post-first fixation scanning could be due to variability in controlled processing once a target had been attended. For example, those with a more conservative temperament may have learned a particular feature that led to an easier task solution or discrimination of angry targets might have been easier. The purpose of Experiment 3 was to examine whether differences in search performance could be attributed to variability in controlled processing. A happy or angry target was present on every trial, and participants were required to discriminate the discrepant expression as either "happy" or "angry." Discrimination requires enhanced attentional processing (Bergen & Julesz, 1983; Cheesman & Merikle, 1986; Sagi & Julesz, 1985) relative to simple detection. Accordingly, if differences in search performance were due to controlled processes, then response time patterns should be the same for present/absent responses (Experiment 1) as for discrimination responses. If discrimination eliminates the effect of expression, this would suggest that controlled processing was not solely responsible for the speed advantage.

Method

Participants. Forty-five undergraduate students from the University of Nebraska—Lincoln volunteered to participate in the experiment in exchange for course credit. All participants had normal or corrected-to-normal vision and were naïve to the purpose of the experiment. Eight participants completed fewer than half of all trials or did not complete the political temperament measures and were removed from all analyses. The remaining participants ($N = 37$) completed all trials.

Stimuli, apparatus, and measures. Face stimuli were the same as Experiment 1. Stimuli were displayed on the same apparatus as Experiment 2. Manual responses were made using the key board ("Z" for happy and "/" for angry). Measures were the same as Experiment 1 (see Table 1 for descriptive statistics).

Design and procedure. These were the same as Experiments 1 and 2 except participants now completed a total of 576 trials. Furthermore, instead of responding to the presence/absence of a target, participants now indicated whether the discrepant expression was "happy" or "angry." As each trial contained a target, all trials were submitted to analyses.

Results

Incorrect responses (3.4%), as well as trials with RTs less than 250 ms or greater than 2.5 *SD*s above condition means (<1%) were excluded from analysis. Mean target-present RT and proportion incorrect were then calculated for each subject and analyzed with separate 2 (expression: happy, angry) × 3 (set size: 6, 12, 18) repeated-measures ANOVAs, in which political temperament ($M = 20.57$, $SD = 6.81$) was entered as a mean centered covariate.

RTs were faster to angry ($M = 1488$, $SD = 200$) versus happy targets ($M = 1842$, $SD = 258$), as indicated by the main effect of expression, $F(1, 35) = 211.48$, $MSE = 32919.81$, $p < .001$, $\eta_p^2 = .86$. The main effect of set size on RT was also significant, $F(2, 70) = 304.49$, $MSE = 12429.73$, $p < .001$, $\eta_p^2 = .90$, as was the interaction of expression and set size, $F(2, 70) = 45.22$, $MSE = 7075.43$, $p < .001$, $\eta_p^2 = .56$, indicating that set size slopes were shallower for angry versus happy targets. There were no significant effects of political temperament on RT ($F\text{s} < 1$), and there were no significant effects at all on accuracy ($F\text{s} < 1$). Thus, when a discrimination response was required, search was more efficient for angry versus happy targets independent of political temperament. Importantly, however, discrimination eliminated all effects of political temperament, suggesting that effects of political temperament were due to the emotional content of the face.

Discussion

If speeded detection of angry targets at higher levels of conservatism (Experiment 1) was due to easier discrimination of angry faces, then the speed advantage should have been observed in a discrimination task. Instead, the requirement to discriminate a discrepant face as either a happy or an angry expression eliminated the speed advantage for angry targets, indicating that variability in controlled processing was not solely responsible for the effects of political temperament. As such, this result provides additional support for the conclusion that the speed advantage for angry targets was due to emotionally mediated facilitation of post-selectional processing. It is noteworthy that error rates were lower here than in Experiments 1–2. Moreover, unlike Experiments 1–2 in which error rates were consistently higher for happy versus angry targets, error rates in Experiment 3 were equivalent for happy and angry targets. Thus, when participants were required to attend the discrepant face (which was necessary in order to accurately discriminate the expression as either "happy" or "angry"), error rates were lower and equivalent between expressions relative to when participants were required only to detect a discrepant face (as in Experiments 1–2). This is consistent with the idea that central attention was not the sole means governing search in earlier experiments.

Experiment 4

The purpose of Experiment 4 was to examine the generalizability of Experiment 1. A limitation to the interpretability of the results to this point is that the same face stimulus was used in each experiment, so it could be that the results are specific to this face model. As such, Experiment 4 sought to replicate Experiment 1 using four different face models (two male, two female).

Method

Participants. Fifty-six undergraduate students from the University of Nebraska—Lincoln volunteered to participate in the experiment in exchange for course credit. All participants had normal or corrected-to-normal vision and were naïve to the purpose of the experiment. One participant completed fewer than half of all trials and was removed from all analyses. The remaining participants (N = 55) completed all trials.

Stimuli, apparatus, and measures. Face stimuli consisted of four different facial models from the NimStim set of facial expressions (Tottenham et al., 2009).[2] Two of the models were female and two were male. The same apparatus as Experiment 1 was used to display stimuli and record eye movements. Measures were the same as Experiment 2 (see Table 1 for descriptive statistics).

Design and procedure. These were the same as Experiments 1.

Results

Trials with incorrect responses (3.8%), as well as trials with RTs less than 250 ms or greater than 2.5 *SD*s above condition means (1.7%) were excluded from response time and eye movement analyses. Mean correct, target-present responses, as well as proportion incorrect, were then calculated for each subject and analyzed with separate 2 (expression: happy, angry) × 3 (set size: 6, 12, 18) repeated-measures ANOVAs in which political temperament (M = 24.6, SD = 6.18) was entered as a mean centered covariate.

Response time and accuracy. Overall, responses were faster and more accurate to angry (M_{RT} = 1169, SD_{RT} = 147; M_{errors} = .03, SD_{errors} = .03) versus happy targets (M_{RT} = 1294, SD_{RT} = 146; M_{errors} = .08, SD_{errors} = .05), as indicated by significant main effects of expression on RT, $F(1, 53) = 89.51$, MSE = 14306.33, $p < .001$, $\eta_p^2 = .63$, and accuracy, $F(1, 53) = 107.64$, MSE = 0.002, $p < .001$, $\eta_p^2 = .67$. There were also significant main effects of set size on RT, $F(2, 106) = 316.03$, MSE = 7939.16, $p < .001$, $\eta_p^2 = .86$, and accuracy, $F(2, 106) = 16.61$, MSE = 0.001, $p < .001$, $\eta_p^2 = .24$, indicating that responses were slower and less accurate at larger set sizes, on average. The interaction of expression and set size was significant for both RT, $F(2, 106) = 19.28$, MSE = 4812.61, $p < .001$, $\eta_p^2 = .27$, and accuracy, $F(2, 106) = 40.82$, MSE = 0.001, $p < .001$, $\eta_p^2 = .44$, indicating that set size slopes were shallower for angry versus happy targets. Thus, overall, an anger-superiority effect was observed, both in terms of RT and accuracy.

For RT, the interaction of expression and political temperament was significant, $F(1, 53) = 53.11$, MSE = 14306.33, $p < .001$, $\eta_p^2 = .51$. The pattern of this interaction is shown in Figure 5. Accordingly, *responses to angry targets* were faster the more conservative one was, $t(54) = -2.63$, $p = .01$, $\eta_p^2 = .12$, whereas *responses to happy targets* were faster the less conservative one was, $t(54) = 2.75$, $p = .01$, $\eta_p^2 = .13$. Figure 5 also shows how the effect of expression on RT changed as a function of political temperament. *At higher levels of conservatism,* responses were faster to angry versus happy targets, $t(54) = –11.46$, $p < .001$, $\eta_p^2 = .71$ (as evaluated at political temperament = 33), whereas *at lower levels of conservatism*, responses were faster to happy versus angry targets, $t(54) = 3.77$, $p < .001$, $\eta_p^2 = .21$ (as evaluated for political temperament = 7). No other effects on RT were significant (*F*s < 1). There were no significant effects of political temperament on accuracy (*F*s < 1).

Target dwell time. There was a small but significant main effect of expression, $F(1, 53) = 4.34$, MSE = 1212.89, $p = .04$, $\eta_p^2 = .08$, such that dwell time was longer on angry (M = 436, SD = 76) versus happy targets (M = 428, SD = 75; see Figure 6). No other effects were significant—for the interaction of expression and set size, $F(2, 106) = 2.18$, MSE = 615.79, $p = .12$, $\eta_p^2 = .04$; all other *F*s < 1.

First fixation path ratio. Overall, path ratios were smaller for angry (M = 2.21, SD = 0.25) versus happy targets (M = 2.42, SD = 0.26), as indicated by a significant main effect of expression, $F(1, 53) = 49.37$, MSE = 0.064, $p < .001$, $\eta_p^2 = .48$. There was also a significant main effect of set size, $F(2, 106) = 93.17$, MSE = 0.046, $p < .001$, $\eta_p^2 = .64$, as well as a significant interaction of expression and set size, $F(2, 106) = 6.59$, MSE = 0.031, $p = .002$, $\eta_p^2 = .11$, indicating that path ratios increased with set size, and more so for happy versus angry targets. The main effect of political temperament was significant, $F(1, 53) = 9.74$, MSE = 0.319, $p = .003$, $\eta_p^2 = .16$, but was qualified by a significant interaction with expression, $F(1, 53) = 60.63$, MSE = 0.064, $p < .001$, $\eta_p^2 = .54$. The pattern of this interaction is shown in Figure 7. Whereas *path ratios to angry targets* did not vary with political temperament, $t(54) = -0.69$, $p = .49$, $\eta_p^2 = .01$, indicating that search efficiency for angry targets was unaffected by political temperament, *path ratios to happy targets* decreased as conservatism decreased, $t(54) = 5.69$, $p < .001$, $\eta_p^2 = .38$, indicating that search for happy targets was more efficient the less conservative one was. Figure 7 also shows how the effect of expression changed as a function of political temperament. *At higher levels of conservatism*, path ratios were smaller for angry versus happy targets, $t(54) = –10.43$, $p < .001$, $\eta_p^2 = .67$ (as evaluated at political temperament = 33), indicative of an anger-superiority effect. *At lower levels of conservatism*, however, path ratios were smaller for happy versus angry targets, $t(54) = 5.05$, $p < .001$, $\eta_p^2 = .33$ (as evaluated for political temperament = 7),

[2] NimStim Model ID: happy (07F_HA_O; 18F_HA_O; 34M_HA_O; 36M_HA_O), angry (07F_AN_O; 18F_AN_O; 34M_AN_O; 36M_AN_O), neutral (07F_NE_C; 18F_ NE _C; 34M_ NE _C; 36M_ NE _C).

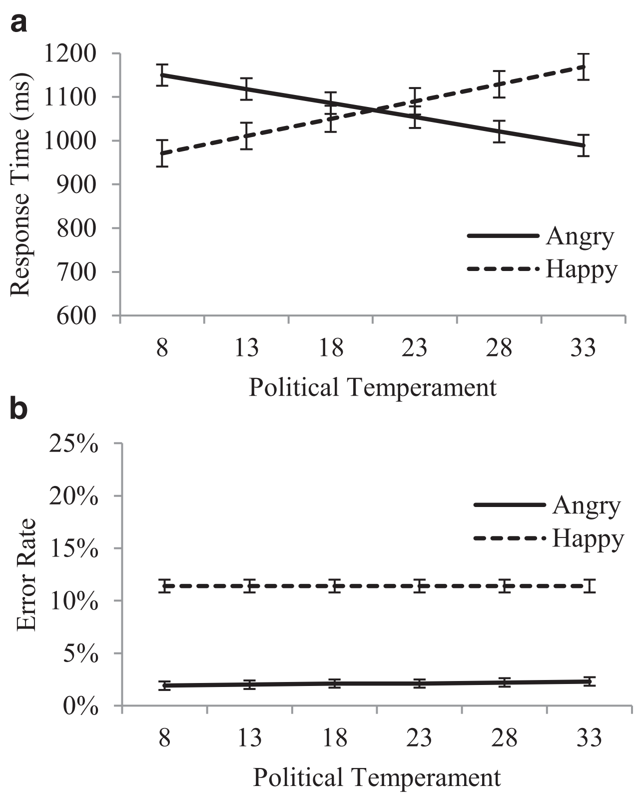

Figure 5. Experiment 4 mean response time (a; smaller values represent speeded detection) and mean error rate (b; smaller values represent more accurate detection) as a function of political temperament (higher values represent a more conservative temperament) for angry and happy targets. Error bars represent ±1 standard error of the mean.

indicative of a happy-superiority effect. No other effects were significant (Fs < 1).

Postfirst fixation path ratio. There were significant main effects of expression, $F(1, 53) = 84.03$, $MSE = 0.02$, $p < .001$, $\eta_p^2 = .61$, set size, $F(2, 106) = 3.62$, $MSE = 0.019$, $p = .03$, $\eta_p^2 = .06$, and political temperament, $F(1, 53) = 12.03$, $MSE = 0.06$,

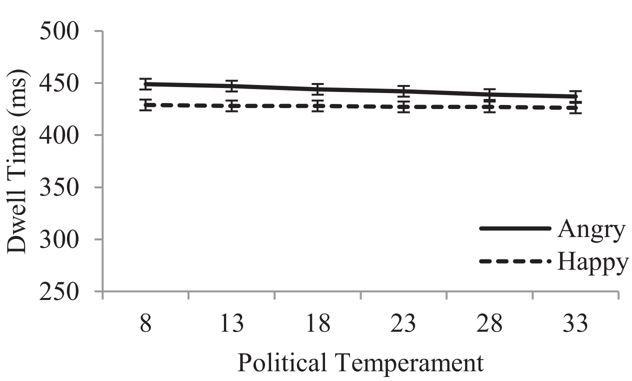

Figure 6. Experiment 4 mean target dwell time as a function of political temperament (higher values represent a more conservative temperament) for angry and happy targets. Error bars represent ±1 standard error of the mean.

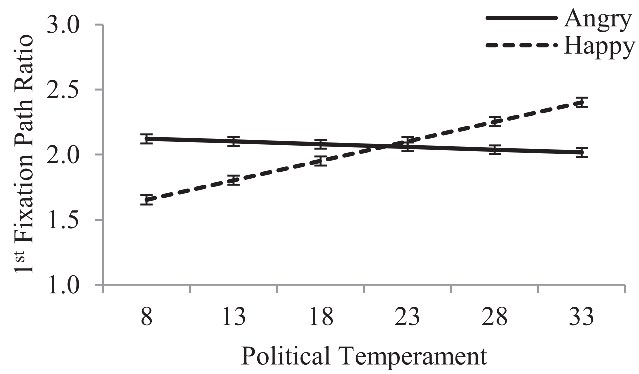

Figure 7. Experiment 4 mean first fixation path ratio (smaller values represent more efficient search) as a function of political temperament (higher values represent a more conservative temperament) for angry and happy targets. Error bars represent ±1 standard error of the mean.

$p = .001$, $\eta_p^2 = .19$, as well as a significant interaction of expression and political temperament, $F(1, 53) = 28.89$, $MSE = 0.02$, $p < .001$, $\eta_p^2 = .35$. The pattern of this interaction is shown in Figure 8. *For angry targets*, path ratios decreased as conservatism increased, $t(54) = -4.30$, $p < .001$, $\eta_p^2 = .26$, whereas *for happy targets*, path ratios did not vary with political temperament, $t(54) = 0.36$, $p = .72$, $\eta_p^2 = .01$. No other effects were significant—for the interaction of expression and set size, $F(2, 106) = 1.21$, $MSE = 0.014$, $p = .31$, $\eta_p^2 = .02$; all other Fs < 1.

Discussion

In general, Experiment 4 replicated the results of Experiment 1 using a broader and more diverse set of face stimuli, which testifies to the generalizability of the political temperament effects. The main difference between the results of Experiments 1 and 4 related to target dwell time. In Experiment 1, dwell time was longer on happy versus angry targets, whereas in Experiment 4 dwell time was longer on angry versus happy targets. It is important to recall that dwell time was defined as the summed duration of all fixations

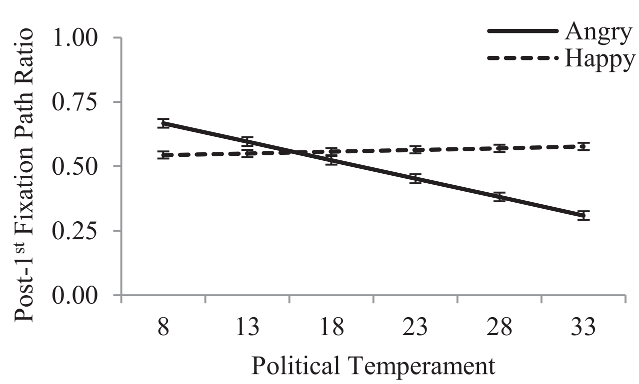

Figure 8. Experiment 4 mean post-first fixation path ratio (smaller values represent enhanced post-selectional processing) as a function of political temperament (higher values represent a more conservative temperament) for angry and happy targets. Error bars represent ±1 standard error of the mean.

on a target face commencing within a given trial, meaning that longer dwell times could reflect an increase in the amount of time needed to process a target, an increase in the amount of time needed to disengage attention from the target and shift it to response selection, and/or an increase in the number of target fixations needed to process a target. Considering how broadly dwell time was defined, it is perhaps imprudent to draw specific conclusions about search performance from specific experimental effects on dwell time. Rather, the more general result of Experiments 1 and 4, i.e., significant difference in dwell time between expressions but no difference in dwell time as a function of political temperament, suggests (a) that differential dwell time on happy and angry targets may have biased indices of search performance in which dwell time was factored into the estimate (i.e., manual RTs) and (b) that effects of political temperament on search performance were not due to disparity in dwell time. Thus, in line with Experiment 1, Experiment 4 suggests that saccade path ratio was a more reliable estimate of search efficiency, the results of which indicated that (a) search for happy targets was more efficient the less conservative one was, whereas search efficiency for angry targets did not vary with political temperament, and (b) at higher levels of conservatism, search was more efficient for angry versus happy targets (anger-superiority effect), whereas at lower levels of conservatism, search was more efficient for happy versus angry targets (happy-superiority effect).

General Discussion

Recent work using a free-viewing paradigm has found that, compared with a less conservative temperament, individuals with a more conservative temperament are faster to fixate negative stimuli and slower to fixate positive stimuli (Dodd et al., 2012). When considered in light of related research demonstrating that conservatives are more physiologically responsive to negative stimuli (Oxley et al., 2008), it has been suggested that conservatism may be positively associated with an attentional sensitivity to threat stimuli and negatively associated with an attentional sensitivity to positive stimuli. The present series of experiments used the face-in-the-crowd paradigm to examine whether variability in the efficiency with which happy and angry expressions are detected underlies such speed differences or whether post-selectional processes are responsible. The main finding was that variability in efficiency underlies the speed advantage for happy expressions, whereas variability in post-selectional processing underlies the speed advantage for angry expressions.

In Experiments 1 and 4 (which differed only in the number of facial models included in the stimulus set so as to ensure that the critical results were not driven by idiosyncratic features of a specific facial model), participants searched for a discrepant facial expression (happy or angry) amid a varying number of neutral distractors. Consistent with previous research, those with a more conservative temperament responded to angry targets faster than those with a less conservative temperament, whereas those with a less conservative temperament responded to happy targets faster than those with a more conservative temperament (as indexed by manual RTs). Having observed this processing difference within the confines of a visual search task, we then sought to determine whether it can be attributed to variability in search efficiency (as indexed by RT set size slopes and first fixation saccade path ratio). Whereas search efficiency for happy targets was negatively associated with conservatism (expressed in saccade path ratio), search efficiency for angry targets did not vary with conservatism (expressed in both RT set size slopes and saccade path ratio). As such, the speed advantage for happy targets shown by those with a less conservative temperament was driven by more efficient detection of happy expressions, whereas the speed advantage for angry targets shown by those with a more conservative temperament appears to have been driven by post-selectional processing.

To further investigate the involvement of post-selectional processing, post-first fixation path ratio was examined. For angry targets, post-selectional processing was more efficient the more conservative one was (there was no difference for happy targets). Facilitated processing after initially fixating an angry target explains how those with a more conservative temperament searched for angry targets faster yet no more efficiently than those with a less conservative temperament, i.e., while attentional guidance was equivalent, more efficient post-selectional processing such as speeded encoding and/or response selection led to faster responses. Moreover, as the slowed response times to angry targets were not attributable to disparity in dwell time or error rates (Experiments 1 and 4), or to difficulty discriminating angry faces (Experiment 3), this may suggest that political temperament moderates post-selectional processing at the level of response selection. An additional, nonmutually exclusive possibility is that those with a less conservative temperament avoided angry faces, which requires that attention first be allocated to the location of the angry face so that the location of the face may be avoided (M. W. Becker & Detweiler-Bedell, 2009). Early detection followed by later avoidance could also explain how search for angry targets differed in speed (later avoidance) but not efficiency (early detection). Further research is needed to delineate between these possibilities. It is worth noting, however, that when viewing collages consisting of a single negative image, conservatives not only fixated the negative image more quickly but were also more likely to return to the image for additional processing (Dodd et al., 2012), which is inconsistent with these stimuli being avoided.

An important issue concerns whether the effects observed in Experiments 1 and 4 were due to emotional or perceptual factors. One method for investigating this issue is to recruit participants with known biases to threatening stimuli and to compare their performance with a control sample. The logic is that if differences exist, this would suggest emotionally mediated effects given that perceptual salience is controlled for (both types of people view the same stimuli). Self-report, behavioral, and psychophysiological evidence suggests that conservatism is positively associated with sensitivity to threat stimuli and negatively associated with sensitivity to positive stimuli (Dodd et al., 2012; Huddy et al., 2005; Oxley et al., 2008). Accordingly, as political temperament was found to influence search for angry and happy faces, this suggests that performance differences were emotionally mediated. A more traditional method is to invert face stimuli and compare the pattern of results with upright stimuli (Experiment 2). As inversion eliminated all effects of political temperament, this suggests that holistic processing of emotional content was necessary for attentional guidance by happy expressions at lower levels of conservatism, as well as for facilitated response selection by angry expressions at higher levels of conservatism.

It is also worth considering that the present results could be influenced by processes involved in learning. It could be, for instance, that those with a more conservative temperament learned or had knowledge of a particular feature that influenced target detection differentially over the course of the experiment. This would make it difficult to conclude that that those with a more conservative temperament would be faster at detecting a novel angry face or that those with a less conservative temperament would be more efficient at detecting a novel happy face. Given that the shallow slopes are obtained with naïve subjects and minimal practice (e.g., 20 trials; see Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977), however, learning is an unlikely explanation for the present results.

Although our primary purpose in using the face-in-the-crowd paradigm was to further examine the influence of political temperament on cognitive processing, the present results also provide insight into discrepancies in the visual search literature. For example, although anger-superiority effects tend to be upheld as the normative finding in tasks of this type (see Frischen, Eastwood, & Smilek, 2008), there has also been evidence for happy-superiority effects (D. V. Becker et al., 2011; Byrne & Eysenck, 1995; Juth et al., 2005; Krysko & Rutherford, 2009; M. A. Williams et al., 2005), in addition to null findings (e.g., Purcell et al., 1996). It is conceivable that these discrepancies are attributable to sample characteristics and individual differences that are rarely examined in these studies. A sample that skews more conservative might be more likely to elicit an anger superiority effect, whereas a less conservative sample may be more likely to elicit a happy superiority effect. As the study of individual differences becomes more prominent it will become increasingly important to take subject characteristics into account when interpreting experimental results.

The present work adds to a rapidly growing literature examining the degree to which liberals and conservatives differ with respect to low-level cognitive processes, for example, attentional bias. It has long been established that those with opposing political ideologies differ considerably in terms of how they think about issues and prioritize information. Political scientists have traditionally accounted for these differences in terms of purely environmental factors (e.g., Lewis-Beck, Jacoby, Norpoth, & Weisberg, 2008), the thinking being that political temperament is directly attributable to one's own experiences and rational consideration of issues. With recent evidence that political orientations may also have a partial basis in biology (Alford et al., 2005; Fowler & Dawes, 2008; Hatemi et al., 2009, 2011; Settle et al., 2010), it has become crucial to examine the degree to which cognitive and attentional biases might influence the manner in which an individual views their environment and acts on it.

Liberals and conservatives clearly have different visions of the world in which they prefer to live (e.g., Carmines, Gerrity, & Wagner, 2009; Jacobs & Carmichael, 2002). Differing policy visions raise at least two interesting issues. The first is whether liberals and conservatives literally *see* the world differently, detecting threat or affiliation where none exists, or whether they see the world the same but attend to different aspects of that world. The present results suggest the latter. Angry expressions were detected faster the more conservative one was and happy expressions were detected faster and more efficiently the less conservative one was; however, errors did not differ as a function of political temperament. Thus, political temperament influenced *when* and *where* attention was directed, but it did not affect *what* was ultimately perceived. To this end, the present study is unique in that it provides insight into how cognitive differences between liberals and conservatives are manifested in terms detecting and responding to stimuli in the environment. To date, much of the literature on political temperament has focused primarily on the mere fact that differences exist, with little to say as to why such differences exist or how task performance is affected. This issue is critical moving forward in advancing the present line of study.

The second issue concerns the reason such differences in attentiveness to emotional material persists in the population. We conclude by considering an explanation that invokes the controversial concept of group selection. It is well established that emotional material tends to influence attention preferentially compared with nonemotional material. Evolutionarily, this is quite useful, as those who are better able to detect and respond to sources of threat or affiliation should have greater chances of survival. Social, economic, and political benefits also exist. Institutions that identify sources of threat early on, for example, are in a position to proactively eliminate potential problems. As with all good things, however, there are associated costs, such as the failure to detect potential mates and useful trading partners. Considering that tradeoffs accompany various levels attentiveness, it seems as though it could be advantageous to a society for its population to include substantial individual level variation in sensitivity to different types of emotional material. Such organization could provide a system of checks and balances in which costs at one end of the continuum are counterbalanced by benefits generated at the other end, resulting in a stronger and more able system of governance. Indeed, cognitive models of biased attention and emotion processing generally acknowledge that attentional responses to emotional information are widely distributed across normal and psychopathological functioning (Mathews & Mackintosh, 1998; Mogg & Bradley, 1998). Support for this claim, however, is derived primarily from either anxious or phobic populations (see Rosen & Schulkin, 1998, for a biological account of the continuity of psychopathology). Given such marked variation in personality reviewed in the introduction and given the empirical results just presented, it may be the case that liberals and conservatives are positioned at different points on the continuum of how emotional information interacts with attentional processes (see Yiend, 2010, for comparative conclusions regarding attention to emotion in psychopathological and general populations). These differing positions may afford a group the best chance of survival.

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