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Karl Evan Giuseffi

University of Nebraska-Lincoln

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Processing Facial Emotions: An EEG Study of the Differences between Conservatives
and Liberals and Across Political Participation

By

Karl E. Giuseffi

A THESIS

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Processing Facial Emotions: An EEG Study of the Differences between Conservatives
and Liberals and Across Political Participation

Karl E. Giuseffi, M.A.

University of Nebraska, 2012

Adviser: John H. Hibbing

Behavioral differences have been reported between conservatives and liberals when categorizing facial expressions, yet no study explores potential differences in the manner in which the two groups *process* facial expressions, let alone how partisanship contributes or how political engagement may vary with brain processing of facial expressions. In this context, processing refers to brain patterns following exposure to a facial expression and participants' subsequent attention to the presented facial expressions. This thesis addresses the question of whether political temperament is associated with differences in neural processing. Research subjects participated in an emotion discrimination task while event-related potentials (ERP) were captured in order to explore the neurological processing similarities and differences between conservatives and liberals (also by accounting for partisanship), and those with varying levels of participation, in response to the facial expressions of fear, happiness, anger, disgust, and no emotion (neutral). The findings suggest that, for the P2 component, compared to liberals, conservatives process facial emotions more rapidly but only for particular categories of emotion. When including partisanship in a model, more pronounced differences emerge, with ideology emerging as a factor that captures facial processing differences irrespective of emotion. In terms of participation, those who tend to

participate less have higher P1 amplitudes, indicating large cognitive resources spent to process facial information, and also tend to have higher cortisol levels.

Introduction

The brain is an important frontier for political science research. Although it is often not understood as such, the brain is central to the dispute over whether, where, when, and how genes and the environment interact or, at times, impinge one another when it comes to people's political attitudes and behaviors. To put it bluntly, the brain is the powerhouse for all individual political attitudes and behaviors—the brain is responsible for all behaviors, many of which occur outside the realm of consciousness (Gazzaniga, 2009; Gazzaniga, 2011). The brain bears the imprints of many forces and it is incontrovertible that the brain and its activity is an outgrowth of genes, the environment, the interaction between genes, and the interaction between genes and the environment (Alford, Funk, & Hibbing, 2005; Charney, 2008; Charney & English, 2012; Gazzaniga, 2009; Gazzaniga, 2011; Luck, 2005; Schreiber, 2011). The brain is a complex entity composed of intricate functions, structures, and mechanisms and is influenced by the interactions of genes and the environment.

The brain is increasingly becoming a focus for research. Some previous work in political science has focused on brain chemicals or neurotransmitters to observe correlations with political attitudes and behavior (Fowler & Dawes, 2008; Fowler, Baker, & Dawes, 2008; Charney & English, 2012), while other work has focused on structural differences (Kanai et al., 2012; Westen et al 2006; Schreiber et al., 2009). Few studies (Amodio et al., 2007; Inzlicht et al., 2009; Weissflog et al., 2010) have utilized tools to better understand overall brain processing, especially at the speed which the brain functions—milliseconds—and how it relates to politically related attitudes and behaviors. Accordingly, much work remains to explore the neural correlates of political attitudes

and behaviors and it is appropriate to step back and study brain activity with a different technique that can capture brain activity at the speed it unfolds (Luck, 2005). This thesis helps fill that void by exploring changes in brain activity (EEG) in response to an emotion discrimination task, dissecting potential differences in terms of ideology, partisanship, and political participation.

The project is divided into three parts. The first section evaluates how brain activity varies across liberals and conservatives in response to an emotion discrimination task. Extending the first portion, the second portion engages in both a theoretical and methodological debate over how ideology manifests itself in brain activity, resulting in the use of a model that incorporates partisanship. The third section explores how facial processing is relevant to political participation. In short, ideological differences manifest themselves in the processing of faces, and there is a relationship between political participation and processing of faces. The takeaway point is that when it comes to the brain, its processing is related to participation and ideology. The processing differences in the brain are not merely associated with ideology or participation, however. This research makes room for more complexity and shows that partisanship is an important contributor to brain processing differences.

Perhaps one of the most provoking findings of this body of work is how costly, both in terms of attention and cognitive resources, it is to process faces for those who tend to participate less in politics. For a long time, rational choice evaluations of voting and other iterations of it have suggested that those who do not participate find the costs too high and, if not forthrightly, imply there is an emotional detachment from politics amongst low participators. Processing facial expressions—perhaps one of the most

fundamental pieces of human interaction— requires much brain activity for low
participators. This finding then potentially provides a great deal of insight, suggesting
low participators spend more cognitive resources to process basic social information,
which might explain why they avoid politics, an innately social process.

Faces—A Valuable Source of Information

Evaluating facial expressions is pivotal for guiding individuals through their dynamic and complicated interactions with each other. Evaluating facial expressions provides cues about underlying emotional states or dispositions, and is used to uncover and to verify what others are thinking, feeling, and saying (Hassin & Trope, 2000). Humans interpret threat, trustworthiness, joy, anger, sadness, and other emotions from each other's faces because it allows for a measure of predictiveness in social interactions and enables them to better adapt to social situations (Engell et al., 2007; Zebrowitz & Montepare, 2008). People are capable of making such interpretations very quickly; exposure to a facial expression for as little as 33 milliseconds is enough to make reliable judgments about trustworthiness, competence, and aggression (Engell et al., 2007; Todorov, Pakrashi, & Oosterhof, 2009). The importance of facial expressions for conveying such socially useful information is universal; irrespective of culture, people are adept at recognizing faces as expressing the same emotion (Campanella et al., 2002; Hassin & Trope, 2000) and humans develop the skill to interpret and recognize faces at a very young age (Wong et al., 2009). By no coincidence, facial information is incredibly salient, evidenced by the fact that faces are given processing priority when nested in complex presentations rife with other emotionally significant, potential distractors (Palermo & Rhodes, 2007). Put simply, facial expressions are a valuable source of information, selected over many other stimuli and kinds of information, that help form thoughts and guide people's interactions.

In Politics, Faces Matter

Politics is, at its core, a social activity (Putnam, 2001), so it is of little surprise that facial expressions can provide important cues for deconstructing a political environment. Media, citizens, interest groups, and other actors process politicians' facial expressions in order to match politicians' words with their emotions, craft narratives about candidates to inform political choice, and generally to make evaluations about personality, competence, health, intelligence and trustworthiness (Westen, 2008; Popkin, 1994; Todorov 2008; Willis & Todorov 2006; Todorov et al., 2005). From candidates' appearances, people draw inferences, particularly about candidates' competence, and these inferences predict election outcomes better than chance (Todorov et al., 2005; Ballew & Todorov, 2007; Olivia & Todorov, 2010; Spezio et al., 2008). As a whole, these findings suggest the way people process faces is pertinent to their political thoughts and behaviors.

The brain is the processing center, and is a central component in exploring the potential differences in political attitudes and behaviors. Generally, human reactions are the product of the environment and physiology such that the "body is the medium of experience and the instrument of action" (Miller, 1978, 79). People intake sensory input from their environment and then translate that information to form a behavioral output in a way that is both biological and physical (Kreibig, 2010; Wagner & Silber, 2004). The brain is not only involved in but is also responsible for this process: it translates and transmits information, as well as stimulates bodily responses, in the form of a series of electrical impulses (Luck, 2005). Because these electrical charges reflect interpretation, evaluation, and dissemination of information, it means these electrical signals may

illuminate the potential processing differences between liberals and conservatives and across those with varying levels of political participation.

This electrical activity can be measured by using event-related potentials. Event-related potentials (ERPs) measure electrical brain activity before, during, and after a behavioral response to an event. ERPs are compiled from averaging electroencephalograms (EEG) across many trials in response to discrete events, such as stimulus onset. The advantage of measuring the electrical impulses with ERPs is that it offers a continuous measure of cognitive processing that is time-locked to stimuli and responses to them (Luck, 2005, 21). Put differently, by using ERPs to measure brain activity, it is possible to directly and progressively measure changes in brain activity as they are affected by experimental conditions. Brain activity is also summative (Hardy, 2004; Luck, 2005), so although brain activity occurs rapidly (in milliseconds), processing stages involve increasingly active portions of the brain that contribute to the way people process information. ERPs make it possible to gauge brain activity as participants view facial expressions, thereby providing leverage to investigate processing differences.

Overall, this line of work fits well with the different proposals of information processing proposed previously by political scientists. Lau and Redlawsk (2001) and Lodge, Taber, and Verhulst (2011) suggest affect matters as people process information. Affect becomes infused in individuals' processing and it undergirds the conclusions people reach. Although it is possible to debate whether it is affect imbued in memory, the situation, or both, which directs people's decision-making and information gathering. The current project acknowledges that much of the processing in the brain is not conscious and recognizes that affect may differentially impact brain processing, turning on the

affect of the stimulus as well as individual processing differences (Gazzaniga, 2011; Luck, 2005; Lodge, Taber, & Verhulst, 2011). Nonetheless, this project attempts to tease out portions of the brain wave when mere automaticity is most at issue and when more levels of the brain (top-down) become engaged when presented with affect (emotion).

How Processing Faces Relates to Ideological Differences

Though people are skilled at evaluating the facial expressions of others, this does not necessarily mean all people respond and attend to facial expressions the same way. Given the various divides between liberals and conservatives in their general outlooks on life (Pinker, 2002), moral foundations (Haidt & Graham, 2007), orientations (Hetherington and Weiler, 2009), motivated social cognitions (Jost et al., 2003), preferences concerning stability and certainty (Jost et al., 2003; Oxley et al., 2008), general communications (Lakoff, 2002), brain structures (Kanai et al., 2010), and cognitive styles (Amodio et al., 2007; Schreiber et al., 2009; Westen et al., 2006; Dodd et al., 2012), it is quite clear that liberals and conservatives observe the political and social world through different lenses and that these lenses lead to different reactions to social information. Although the previously mentioned literature does not examine how liberals and conservatives process facial expressions, the works collectively suggest liberals and conservatives react differently to social information, which likely extends to facial expressions.

An example of how liberals and conservatives react differently to information can be found in Dodd et al. (2012), which showed that conservatives quickly attended to and dwelled on more aversive (negative) images than liberals. This means even when presented with the same information, conservatives pay attention and react to the

information differently than liberals. Moreover, because the researchers used eye-tracking, this suggests, at minimum, there are some automatic differences in the ways liberals and conservatives attend to information.

Vigil (2010) finds that, when given ambiguous facial stimuli, conservatives tend to interpret the stimuli as dominant or expressing the emotions of anger or disgust, whereas liberals are more likely to interpret the same facial stimuli as nonthreatening or submissive, and as emoting joy, sadness, or surprise. Thus, political ideology appears to be a marker for differences in the way individuals react to and attend to facial information. Vigil (2010) is the only work that looks at the relationship between ideology and facial expressions, but it does not address whether liberals and conservatives *process* facial expressions differently. Given their different perceptions of the same face, it is almost a certainty they do. Behavioral outputs depend on the processing differences that structure them. Further, processing in this sense refers to the potential motor, sensory, and cognitive processes that lend themselves to an overall behavioral difference. In short, processing differences feed behavioral differences and by using the paradigm in this paper, it becomes possible to understand when and where these processing differences manifest themselves and give rise to an explanation for varied behavior. Accordingly, the central goal of the research here is to document the nature of these processing differences. This portion of the project compares and contrasts the overall brain activity of liberals and conservatives over time and across five different experimental conditions: the facial expressions of fear, anger, happiness, and sadness, as well as faces devoid of emotion (neutral).

Brain Activity Related to Facial Expressions

Because of the importance of processing facial expressions, scholars interested in social cognition, psychology, and neuroscience have sought to understand how brain activity fluctuates after being presented with facial stimuli. Studies on this point, generally, have found that people processing facial information use similar brain pathways as they do when processing other salient emotional information such as provocative pictures (for a review, see Eimer & Holmes, 2007). Facial information is emotional in nature because the emotional circuitry of the brain becomes involved during processing facial information. However, multiple areas of the brain—the frontal cortex, the frontal lobe including the inferior and dorsolateral regions, superior temporal sulcus, inferior occipital cortex, middle fusiform gyrus, anterior cingulate cortex, and amygdala and orbitofrontal cortex—are involved in processing facial expressions and this poses a challenge for untangling which portions of the brain are active and for what processes, let alone uncovering their interactions (Engell et al., 2007; Said, Haxby, & Todorov, 2011). Despite what may seem commonplace and trivial to most of us as we function on a daily basis, the processing of facial expressions is an intricate process, involving many functions—recognition, identification and evaluation of the face—which rely on various regions of the brain and correspond to increasing levels of brain activity. Accordingly, many neural pathways likely become active following exposure to facial expressions and for different reasons and functions (Campanella et al., 2002; Eimer & Holmes, 2002, 2007; Engell et al., 2007; Said, Haxby, & Todorov, 2011). Facial expressions are rapidly processed and that expressions are important cues for both social interaction and

decision-making (Campanella et al., 2002; Eimer & Holmes, 2002, 2007; Kotchoubey, 2002).

The Effect of Facial Expressions on Brain Waves

Scholars have discerned stages of processing that occur over time following exposure to different facial expressions. There is no exact time that corresponds to the processing of facial information; rather, there are pertinent epochs, or temporal windows, of brain activity that follow exposure to facial information. This has led scholars to focus on particular portions of subjects' brainwaves following exposure to visual sensory stimuli. Three specific ERP components¹ of interest in this project are the P1, N170, and P2.² A complete review of all the ERP components relevant to processing facial stimuli is beyond the scope of this study. Particular ERP components are selected in this section because they are focused on in the facial (emotional) processing literature and contribute to the ensuing analysis in this project.

P1 refers to the first positive moving wave following visual stimulus onset. It typically surfaces at the lateral occipital electrode sites and peaks between 100-130 milliseconds after stimulus onset (Luck, 2005). Nearly thirty visual areas of the brain can contribute to this component, which is why it is considered as sensory-level processing (Luck, 2005; Channon & Hopfinger, 2011). Few studies have shown individual variations in the P1, with the prominent exception being that those with higher anxiety have higher amplitudes—meaning that, as a group, they have an automatic attentional bias prompting

¹ ERP components are given labels, like above, that refer to their specific polarity and position in the wave. To visualize what is being discussed, please view to the results section, which shows the ERP waveform.

²

them to over attend to most stimuli (Mueller et al., 2009). Generally, the P1 is considered to reflect initial, obligatory automatic processing, which occurs early on in the wave.

The N170 is a distinct wave that refers to a negative deflection following stimulus onset, which typically surfaces at the parietal cortex and the lateral occipital cortex and peaks between 150-200 milliseconds. The N170 component is sensitive to facial stimuli (Eimer, Holmes, & McGlone, 2003). At minimum, the N170 is a sign of “discriminative processing of some sort,” and, in this context, that means the human brain can distinguish faces from other objects by this time in the ERP wave (Eimer, Holmes, & McGlone, 2003; Luck, 2005, 31). Still, the N170 is best considered as an early phase of face processing (Sreenivasan, Goldstein, Lustig, Rivas, & Jha, 2009) and there is conflicting evidence for whether the N170 is sensitive to specific emotional expressions (Batty & Taylor, 2003; Eimer et al., 2003; Luo et al., 2010). Generally speaking, the N170 reflects a process that distinguishes emotion from neutral.

The P2 component is a distinct wave that follows the N170 component. Although the P2 component originates at anterior and central portions of the brain, the wave is also discernable in posterior regions (Luck, 2005). Following stimulus onset, the P2 appears around 200 milliseconds and continues thereafter. The post-stimulus activity of the P2 is considered to reflect higher level stages of facial expression processing, including the emotional content of the faces, which also means higher order, top-down cognitive functions may influence this ERP component (Eimer & Holmes, 2007). This also means individual differences may be more likely to impact processing at this stage (Hajack et al., 2012). The P2 is elongated and does not have a steep slope relative to the N170 and P1, suggesting people are devoting more attention to or are more slowly processing the

stimulus at this stage (Luck, 2005). The P2 component may unveil specific emotional differences because it is influenced by attentional resource allocation differences (Petroni et al., 2011).

Given the above, I hypothesize that differences will not materialize at either the P1 or N170 stages because they simply occur too early for emotion discrimination differences due to ideological sources. Given its relevance to emotion discrimination in the literature and the potential top-down influences stemming from individual differences, much attention is focused on the P2 component in this thesis. The specific nature of the expected differences between liberals and conservatives on the P2 component is an interesting matter and likely varies from emotion to emotion. The findings by Vigil (2010) stress differences between liberals and conservatives in their responses to dominant (angry, happy, disgusted) as opposed to submissive (fearful, sad, surprised) facial expressions, with conservatives being more attuned to dominant expressions. This being the case, it is expected that conservatives at the P2 stage will process dominant (but not submissive) facial expressions more quickly than liberals. An alternative set of expectations focuses on the distinction between negative (disgusted, angry, fearful) facial expressions as opposed to positive (happy) facial expressions. Given that Dodd et al. (2012) find that conservatives are quicker to dwell on (and more attentive to) negative images, it could also be that conservatives at the P2 stage process negative facial expressions more quickly.

Research Design

In the summer of 2010, a professional survey organization, using a mix of landline and cell phone numbers, generated a random sample of individuals from eastern

Nebraska that was then used to recruit 340 participants to come to a research lab for a 90 minute exercise. In return, they were promised a participant fee of \$50. After obtaining consent, the participants completed a computer survey about their political beliefs, personality, and demographic information. During this survey, the participants were asked if they were willing to be involved in subsequent projects scheduled for later in the summer. The ERP portion of the experiment drew a smaller group from the pool of the 340 participants who indicated a willingness to return for further testing (approximately 85 percent of the original sample). Beyond willingness to return, eligible ERP participants also had to be right-hand dominant (standard procedure in order to control for hemispheric influences in brain activity) and they needed to affirm that they did not have medical conditions that could interfere with ERP data collection (neurological disorders, MS, etc.). Finally, they needed to be available during the time when participants were being processed in the second wave.

Accordingly, 104 participants were processed in the EEG portion of the project. Following previous ERP work on politics (see Amodio et al., 2007), political orientation was measured using a 5-point ideology scale where 1=Strong Liberal and 5=Strong conservative. We then classified those participants who self-reported a 1 or 2 on this scale as liberals, and those who self-reported a 4 or 5 as conservatives. High-quality ERP data were obtained from 83 participants; 10 of these self-reported a 3 on the ideology scale (i.e., they identified as non-ideologues) and were excluded from our analysis given the project's focus on liberals and conservatives. The final sample includes 31 liberals and 42 conservatives (53.5 percent female). People's age in the sample ranges from 19-65, with a mean of 46.11 (standard deviation of 12.84). All people in the sample had

completed high school and close to half (45.8%) had completed at least some college, while the rest of the sample completed college or some kind of graduate degree. Almost a third (31.3%) reported making less than \$40,000 per year and nearly 40 percent (42.2%) made \$80,000 or more, with the rest between \$40,000 and \$80,000.

Once in the lab, each participant had a 128-channel Geodesic Sensor Net placed on his or her head, which recorded the electroencephalogram (EEG). The 128 Geodesic Sensor Net has unique advantages relative to other collection tools in that it does not need a ground to control for exogenous electrical activity and is recognized in the field for its use in collecting clean data—the net helps reduce random noise while capturing research participants' electrical activity. Participants' head size was measured before their arrival to the lab, and once again before the net was placed on them. Head measurements were taken to mark the vertex (center-most point) of the participant's head, so that the reference electrode could be properly located. Identifying the vertex is an important procedure because the other leads are positioned relative to this point on the head, and the recorded voltages are referenced from the vertex electrode. The net was pre-soaked in a mild saline solution—warmed, distilled water mixed with a sodium electrolyte (NaCl) and a drop of baby shampoo to enhance conductivity with the scalp and the participants' comfort. This technique also helped remove hair gels, sprays, and other debris that dry the sensors and inhibit connectivity with the scalp. Once the net was in place, the net was connected to an analogue amplifier, which collects and amplifies the electrical signals being captured by the net's sensors.

While wearing the net, the participants engaged in an emotion discrimination task, in which numerous still images were presented to participants in a randomized order.

Each image appeared for a half second (500 ms) followed by an inter-stimulus interval (a blank screen), randomized to appear from 750 ms to 1250 ms, before the next image would appear. The images were of 41 male and female faces emoting happiness, anger, fear, and neutral facial expressions. These images came from the NimStim database and have been externally validated to ensure that the faces express the claimed emotion (see Appendix for examples). Gender and race were counter-balanced to preclude these from becoming potentially confounding variables. The images appeared during 410 stimulus trials (41 models x 5 faces x 2), meaning each face was displayed 2 times. The images were displayed in the center of the screen of a 19-inch computer monitor, with the participant seated and facing the computer from approximately 60 cm away. The participants were instructed to press one of four buttons, which corresponded to the four expressions—happiness, anger, fear, and disgust. All participants were instructed to respond to all faces and follow their best judgment for selecting what expression the face emoted. This means that participants were asked to determine what emotional expression was emoted even when there was not one (neutral faces). E-Prime software, which is standard for these experiments, was used to present the images and record participants' behavioral responses to the stimuli.

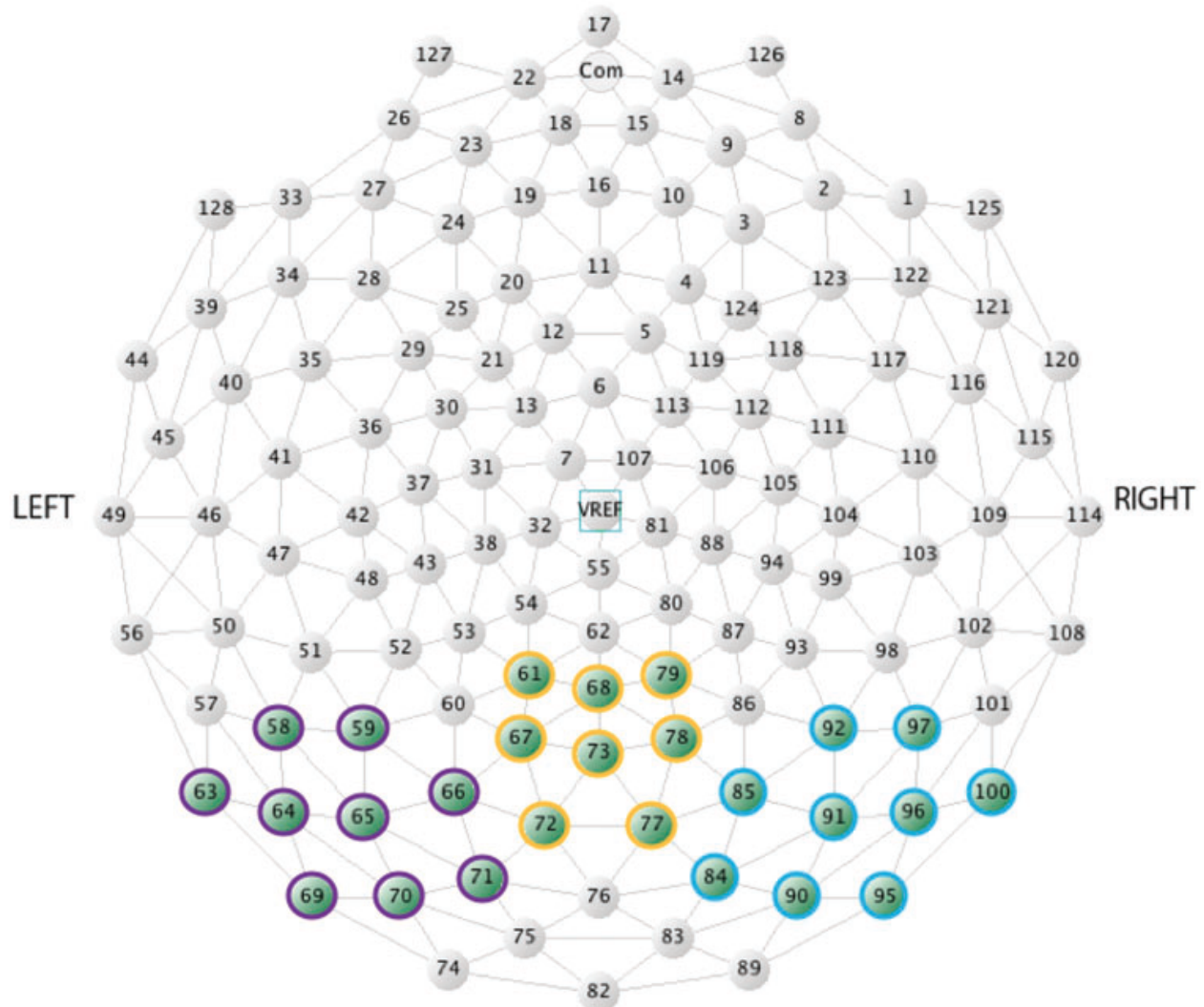
Before recording EEG data for the emotion discrimination task, electrode impedances were recorded and adjusted to less than 50 kilohms. The procedure helps ensure the electrodes have a good connection with the participant's scalp, which helps minimize external noise that can be recorded by the equipment that has nothing to do with the research participant's brain activity in response to the stimulus. Also, a filter was applied to remove electrical noise (50 Hz and above). Following this calibration period,

EEG recordings were continuously sampled at 250 Hz for the task. This means brain activity was measured every 4 milliseconds.

ERPs were derived from the raw EEG in subsequent data processing following the experiment. Eye-blinks and other movements interfering with ERP data were marked and corrected using a standard averaging procedure, which took the average of the electrical signal of the sensors nearby and replaced the bad signal with that average and calculated out the external noise that the net measured. Two brain activity measures for each identified component were taken from the averaged ERPs from each individual participant: peak amplitude, measured in microvolts (uV), is the maximum or minimum voltage of a wave form; and latency, measured in milliseconds, is the time following stimulus onset at which the peak occurs.

To assess the manner in which conservatives and liberals process faces, a mixed group factorial ANCOVA was performed. Mixed group factorial ANCOVA is an ideal statistical analysis to apply to these data because it compares and contrasts variation that occurs within and between groups—in this case, the effect of ideology and the effects of faces—of participants who experienced the same experimental conditions, while holding other variables constant.

Figure 1: Sensor Regions Employed in this Study

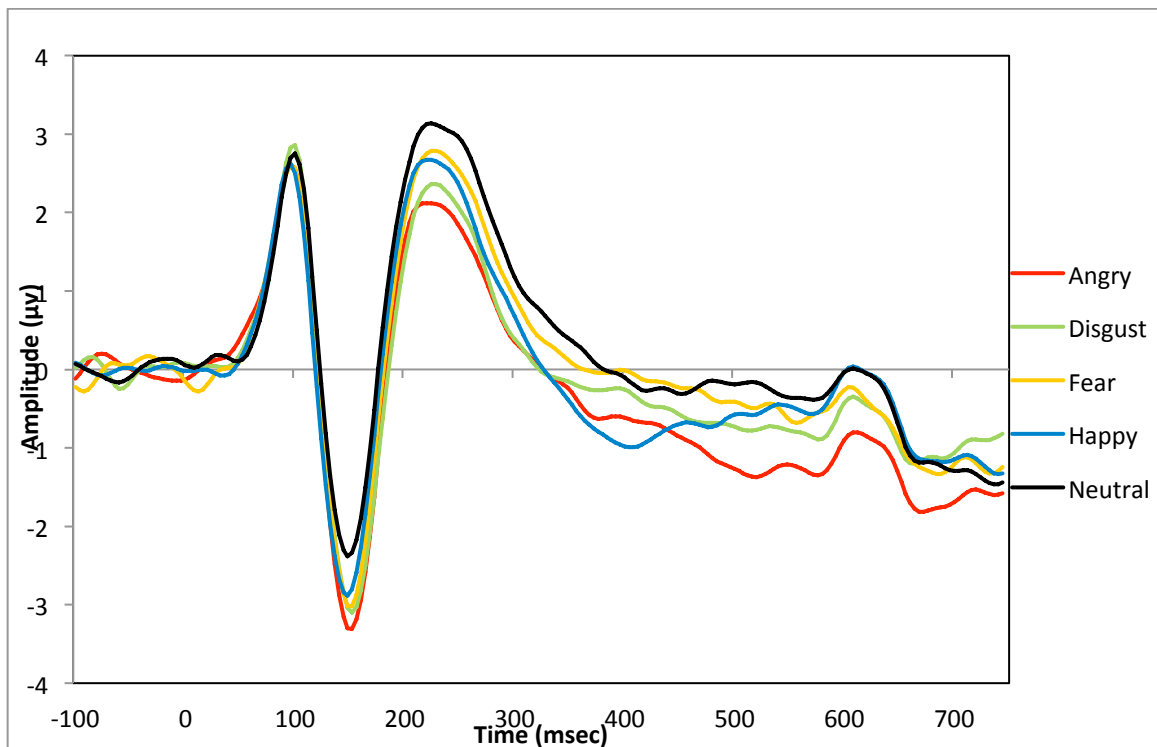


This image provides a general picture of the sensor clusters selected and used for analysis. Individual and Grand Average data were reviewed to inform these sensor selections.

Analysis indicated the particular regions most appropriate for investigation over posterior regions of the scalp (see Figure 1). Hemispheric effects were absent so the relevant regions in each hemisphere were averaged together for each particular measure. Also by way of preliminaries, the effects of gender, age, education, and income for each emotion for all of the ERP components were examined. Income and education neither correlated nor contributed to the models so those variables are not included as controls.

Age and gender, however, are included as controls because they did correlate and/or contribute to the models.

Figure 2: Wave Forms for Categories of Faces, All Participants



In order to provide a sense of the P1, N170, and P2 components, Figure 2 shows the amplitudes for all participants for each of the five categories of facial expressions. The P1, N170, and P2 components are clearly visible. Also observable is the absence of difference across emotions at P1. Differences between peak amplitude responses to emotions and neutral surface at N170 but show no latency differences. More marked differences appear in P2.

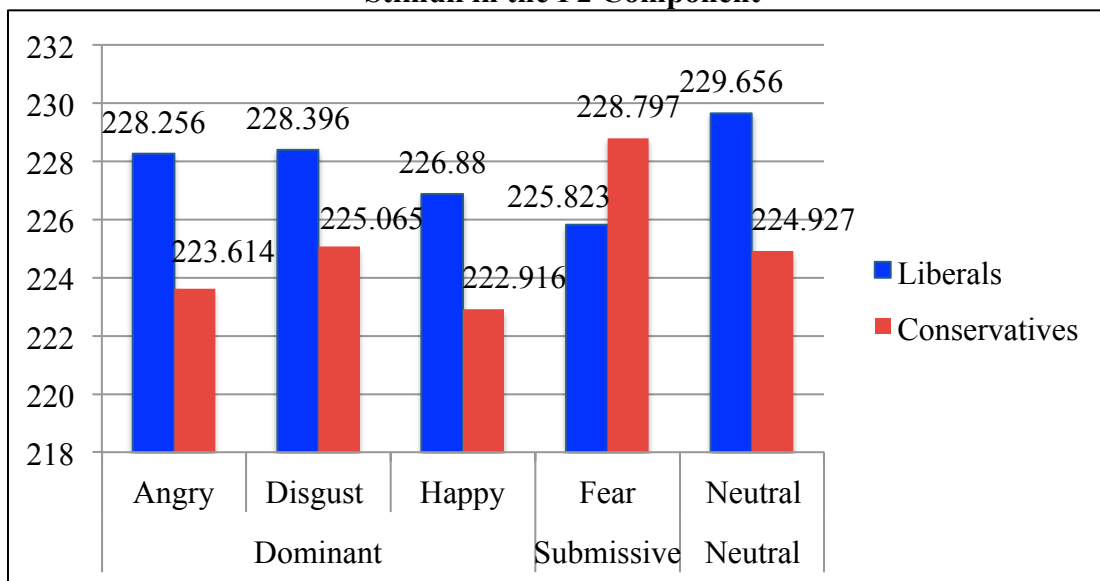
Turning to potential processing differences between liberals and conservatives, using the Greenhouse-Geisser sphericity assumptions, as hypothesized for the P1

component, no interactions were found between the emotions and political ideology ($F(3.354, 231.425)=.407, p=.770, MSe=8.964$), or main effects for emotion ($F(3.354, 231.425)=1.229, p=.30, MSe=8.964$) or ideology ($F(1, 69)=.074, p=.786$). Similarly, for the N170 component, also as hypothesized, the mixed groups factorial ANCOVA supports the null and shows that there are no interactions between the emotions and ideology $F(3.502, 241.631)=1.475, p=.216, MSe=14.967$) or a main effect of ideology $F(1, 69)=.550, p=.461$) or emotion ($F(3.502, 241.631)=1.461, p=.667, MSe=14.967$). The story is quite different for the P2 component. Here the mixed groups ANCOVA, as hypothesized, shows an interaction between ideology and emotion ($F(3.649, 251.757)=2.788, p=.031$), and, by using LSD follow-up minimum mean difference analyses ($p=.05$), shows that liberals and conservatives differently respond to particular emotions. No main effects of emotion ($F(3.649, 251.757)=.542, p=.705, MSe=73.171$) or ideology ($F(1, 69)=.977, p=.326, MSe= 679.199$) were found.

Figure 3 graphically presents the mean peak latency of the P2 component for liberals and conservatives. Indeed, the results show that conservatives do tend to respond faster than liberals across the various categories of facial expressions but the pattern is not entirely straightforward. The P2 latency for conservatives is less than that of liberals for four of the five expressions and statistically significant for three of those four. For only one type of expression (fear) does the pattern run in the other direction and that relationship is not significant. Disgust expressions generate reduced latency in conservatives but not at the $p<.05$ level. This particular pattern across emotions is in keeping with predictions and previous research. Vigil (2010) suggests conservatives are sensitive to dominant emotions (happiness, anger, and disgust) so it is reasonable to

hypothesize that conservatives will also process those emotions the most quickly and, as indicated by our results, this expectation holds for the most part. In addition, because conservatives are prone to see neutral faces as expressing dominant emotions, it is important to note that the results show that conservatives process angry, happy, and neutral faces faster than liberals—meaning neutral is processed similar to dominant emotions. The images employed in the study only included one category of submissive faces (fearful) and this is indeed the one category for which liberals seemed to process more quickly, though not significantly so. The fact that conservatives process neutral faces more rapidly than liberals is a surprising and interesting finding that deserves further testing. These results provide less support for the hypothesis that differences across the ideological spectrum with regard to processing speed will be seen between negative and positive facial expressions. The dominant-submissive distinction seems to have better traction.

Figure 3: Mean Conservative and Liberal Responses (in milliseconds) to Facial Stimuli in the P2 Component



Differences significant at $p < .05$ level for Angry, Happy, & Neutral

Conclusion

With respect to the P1 and N170 components, the findings suggest little difference in the way conservatives and liberals initially process information, an expected finding given the early and nearly automatic nature of these components, especially the P1; however, differences between liberals and conservatives appear in the P2 component and indicate that, compared to liberals, conservatives process dominant emotions more quickly. These results can be seen as roughly consistent with previous research finding that conservatives are more attentive to dominant emotions such as anger, happiness, and disgust (Vigil, 2010). In a broader sense, these results are consistent with a growing body of literature identifying deeper personality, cognitive, and physiological differences across the ideological spectrum (Alford, Funk, & Hibbing, 2005; Amodio et al., 2007; Dodd et al., 2012; Gerber et al., 2010; Gruszczyński et al., 2012; Jost et al., 2003; Kanai et al., 2011; Madsen, 1985, 1986; Mondak, 2010; Oxley et al., 2008; Schreiber et al., 2009; Smith et al., 2011; Westen et al., 2006). Like that research, it is important to note that identifying differences across the ideological spectrum is not tantamount to labeling one ideological group as superior to another. Processing dominant emotions at the P2 stage either more quickly or more slowly is not indicative of a character flaw. The results do suggest, however, that there are deep biological markers for political ideology, markers that appear not just in answers to survey items but also in physiological predispositions, cognitive tendencies, and brain activation patterns in response to emotional faces.

This project's finding situates itself well within the field. Different paradigms have been advanced on how individuals update and use information (Lodge et al., 2011;

Lau & Redlawsk, 2001), in keeping with that literature, facial information influences ideologues' information processing. The story is not clean cut, however, with the relationship between ideology and processing of emotion being contingent on both the ideology and emotion in question.

Another illuminating consideration for the broader political science literature is that the differences extolled in this project are at the not conscious stage even though, as indicated, selective attention differences can occur and do matter. Information processing of the most basic, and perhaps crucial element of interpersonal discourse and interaction—faces—exposes these differences. This project's findings point to the fact that as automatic processing continues (bottom-up), it envelops higher order processing (top-down), and differences such as ideology matters in how people selectively, though automatically, processes information.

On a general level, it is important to consider the nature of this experiment and its implications for the issue at hand—the nexus between facial processing and behavior differences for ideology. Ideological differences have long been studied on a behavioral or attitudinal level. However, these results show that when the behavior is treated as a constant—observing only correct categorization (responses) to the expressed emotion—processing differences emerge. Accordingly, this finding encourages going beyond studying behavior, because the underlying processing that structures behavior varies for liberals and conservatives. In this case, if only the behavior is considered—conservatives and liberals correctly discriminated the face—a source of differences not observable on the behavioral level is overlooked. The takeaway then is this line of research potentially

opens a new vista for explanation of the similarities and differences of liberals and conservatives.

Accounting For Ideology and Partisanship

As the previous chapter demonstrates, ideology helps illuminate variation in processing of facial information. Although this is a valuable finding and contribution, the previous section did not test if ideology contributes to processing of faces within a fuller, more robust model. This portion of the project addresses that possibility by including partisanship. The overarching argument is that ideology and partisanship are both psychological motivations and they relate to one another, especially in the respect that they both refer to people's interpretation and interaction with the political world—both are tied to information processing. Since both ideology and partisanship are given meaning by people and that meaning can be mutually reinforcing, it is important to evaluate the manner in which ideology alongside partisanship might contribute to the processing of facial information.

It is clear there is individual variation in ideology, including between those individuals who share an ideology. Even though ideologically similar people share what structures their beliefs, variation remains between ideological similar people. Shared belief systems are not the same thing as equivalent use or equivalent motivations that lead to adoption of a particular ideology (Jost & Amodio, 2012; Jost, 2009; Jost et al., 2009). This is important because, although ideology is shared with others, ideology also becomes a self-embodied and empowering concept that further guides, empowers, and becomes entrenched in human thought and action as people interpret the political world (Gazzaniga, 2011; Jost et al., 2009; Jost & Amodio, 2012; Amodio et al., 2007).

Although much research has been devoted to studying the socially motivated cognitive framework of ideology, it is important to realize that this framework advances a

conception of how people of different ideologies view the world and to what kinds of information they pay attention (Jost & Amodio, 2012). Equally relevant, partisanship is used to explain how people acquire and use information (Federico & Goren, 2009). Partisanship is viewed as how people look to and evaluate the current political environment with their ideology or draw from party cues (Campbell et al., 1960; Lewis-Beck et al., 2008; Federico & Goren, 2009; Fiorina et al., 2006). Despite their links to one another, ideology and partisanship are entwined but not interchangeable. This line of argument aligns with others who consider partisanship as psychological attachment or motivation (Campbell et al., 1960; Lewis-Beck et al., 2008). This project argues ideology is a belief system shared by groups of individuals who may have variation in what motivates that system and that those individual variations may also become embedded in patterns of information processing. Meanwhile, it is important to account for additional sources of how people may dissect information in the political world like partisanship. The point of this next portion of this project is not to undercut what was done above, but to advance it by modeling for a more complex reality by including a measure of partisanship in the model in order to ask if ideology contributes to processing of facial information in a fuller model.

Ideology is a framework of political attitudes and beliefs, meaning that it is important to consider how that framework gains traction amongst those sharing an ideology and then how this framework can become a potent motivation. Ideology is more than a mere belief system. It is a *potent* motivational force capable of structuring human thought and action (Jost et al., 2003; Jost & Amodio 2012). Ideology has been one of the most elusive concepts studied in political science, but has been generally treated as belief

system, with its evaluation turning on constraint and the cohesiveness (and inconsistencies) of beliefs (Converse, 1964; Zaller, 1992; Jost et al., 2003; Jost, 2006; Jost & Amodio, 2012; Knight, 2006). A common endpoint regarding these findings questions the value and use of ideology as a way for understanding people's attitudes and beliefs (Althaus, 2000; Converse, 1964; Zaller, 1992; Jost, 2006) which is further subdivided into debates over abstract ideology and concrete ideology (Free & Cantril, 1967; Page & Shapiro, 1992; Jost et al., 2009; Zaller, 1992). Rather than treat these findings as corrosive to the concept of ideology, it is more important to take away that political attitudes and beliefs vary on the individual level and amongst those who share that ideology. Ideology may not perfectly and similarly structure all of the attitudes and beliefs shared by those who hold it, but it is still quite meaningful (Jost, 2006).

Recent work clarifies there are underlying differences that produce ideology, providing an explanation for why there is variation amongst those who hold an ideology (Jost et al., 2003). It is not ideology itself that structures or guides people's attitudes and beliefs; there is also an undergirding structure of ideology which is fixed by two dimensions, a dualistic approach to social change (promoting or resisting) and equality (rejecting versus accepting), that collectively form a motivated social cognition (Jost et al., 2003). Although other prominent work suggests ideology stems from moral foundations (Graham & Haidt, 2007; Haidt, 2012), personality (Mondak, 2010), basic values (Schwartz et al., 2010), and genetics (Alford, Funk, & Hibbing, 2005), the general point is the same which is that underlying individual motivations, needs, and genetic elements—many of which are outside the realm of consciousness—fuse to structure and pull someone toward adopting a particular ideology. The previous bodies of work focus

on where ideology comes from. This project's focus is not on from where ideology hails or the personality, cognitive or motivational dispositions that draw someone toward adopting an ideology. This project accepts those arguments and findings, and turns to focus on the variability in the way ideology is structured and used, and once someone adopts an ideology, it can morph into a motivational source when it comes to the human mind. In short, a model attempting to explain the neurocorrelates of ideology must recognize both the multifaceted nature of ideology as well as the potential of variation of its use alongside other factors known to impact information processing, all of which come to shape the mind and information processing.

Ideology is a motivational force because it serves underlying dispositions—personal, existential, and epistemic needs. Ideology serves to minimize uncertainty, establish order, and provide understanding in the political world (Jost et al., 2003; Jost & Amodio, 2012). In essence, ideology is a way to seize on and handle information while also meeting people's individual and group needs and guiding their experiences in the political world (Jost et al., 2003). Because variability remains in how these undergirding dispositions and motivations structure ideology, a concern may be that this structure applies most, if not only, to the ideological extremes (Greenberg & Jonas, 2003). More evidence, however, has illuminated that ideological extremity does not account for or, when controlled for, washes away the relationship between the motivational sources and ideology (Jost et al., 2007). Recently, it was further proposed that ideology, like religion, joins people and enhances security and solidarity amongst those of like minds (Jost et al., 2009). Importantly, although ideology may serve needs of people, it does not follow that each ideology serves those needs equivalently across ideological groups (Jost & Amodio,

2012). This is an important observation because ideology then fulfills differential psychological needs across the groups and even within groups, even though those needs are more similar within an ideological group.

While work on ideology has been validated on many grounds and across cultures, it still remains possible that even though ideology may be something that binds groups of individuals together, it falls short when attempting to capture its motivations and use, all of which may lead to different behaviors and information processing patterns (Lewis-Beck et al., 2008; Jost et al., 2009; Jost & Amodio, 2012). Put simply, ideology—no matter its origin—is not an all-encompassing concept. There are subsets of people within each ideology and their use of ideology varies, which can lead to differences in conservatives' and liberals' interpretations and behaviors (Jost et al., 2009; Lewis-Beck et al., 2008). Clearly, there is no evidence that ideology is the sole medium by which people acquire, process, and react to information. In fact, as highlighted above and what follows, multiple elements contribute to what ideology is and how it is used.

It is also important to briefly note that many have taken issue with the unidimensionality of ideology, or self-placement on the ideological scale, because of the large degree of heterogeneity in people's attitudes within a given ideology (see generally, Feldman & Johnson, 2009). Ideology has been a strong predictor of attitudes and behaviors (Feldman & Johnson, 2009; Lewis-Beck et al., 2008). Rather than become enveloped by this debate, a reasonable conclusion is ideology is necessary but insufficient for understanding how people are attached to and use their belief systems and process information.

Partisanship as a Correlate of Information Processing

Partisanship has long been recognized as a source of information in the political world, both in the form of how someone uses it in conjunction with their ideology or in relation to how people process cues from political elites (Campbell et al., 1960; Lewis-Beck et al., 2008; Fiorina, 2005). In this respect, partisanship is both a source of information and a way of processing information; it is also a strong psychological motivator (Campbell et al., 1960; Lewis-Beck et al., 2008). In fact, the potency of ideology and partisan identification stems from the meaning people give them—strong conservatives give their ideology different meaning than do other ideological groups (Feldman & Johnson, 2009). Previous scholars have proffered that party identification reflected some kind of “affective orientation” to the group (Lewis-Beck et al., 2008; Campbell, et al., 1960), which fits nicely with Jost et al.’s (2003) framework of ideology as motivated social cognition. Not only does partisanship enhance understanding of the way people might collect and process information, but also it meets some emotional needs. Partisan identification fosters in-group attachments, which has an important impact on ideology (Devine, 2011). Devine (2011) shows that an ideological identity exists such that as people become more attached to their partisan identity, it strengthens the connection to their ideology, almost as a reinforcement mechanism. In other words, there is a strong relationship between partisan attachment and ideological attachment, but it is not necessarily reciprocal across all of the groups when considering in the context of Feldman and Johnson’s (2009) finding. Thus, ideology and partisanship are intertwined motivations that vary across individuals and groups of individuals.

By accepting ideology as a motivating social cognition, it follows that this opens the door to other motivating forces, especially other kinds of psychological attachments, which may tighten or loosen the bonds of ideology on the behavior of the individual or how they process information. Specifically, this conclusion is shaped by the following theory and findings outlined above: (1) ideology and partisanship are psychological motivations; (2) they are related to one another and even have a reinforcing effect on one another (but in different ways for those in and across ideological groups); and, lastly, (3) ideology and partisanship both function as a source and motivator for information processing and gathering. Accordingly, partisanship is relevant and should be considered when attempting to understand how those of particular ideologies interpret and interact with the social world.

Prior to testing this argument, it is salient to consider how the beliefs can become ingrained in brain functionality. The brain, as suggested above, is structured by experience, but it is also influenced by people's attitudes and beliefs: "there is a cacophony of influences that guide our behavior and judgments" (Gazzaniga, 2011, 179). To simplify his argument, Gazzaniga (2011) posits the brain is structured by both experience and genetics, suggesting that people are not simply "hardwired" so that they are subject to the chemical substructure and genetic architecture of their brains. He concludes multiple influences, internal and external, lead to people's thoughts and behaviors. The conclusion then is people's experiences, the way they experience the world, can be a driving force in reshaping their brain.

There are many different explanations for the shaping of people's brains but, perhaps, the following example will contextualize and cement the meaning of this

discussion. The process of “binding” (Gazzaniga, 2011; Shermer, 2011) gives insight into how neural networks form and perform specific functions. The brain is the processing center, which means it is responsible for integrating a plethora of information, gathered from the senses, as well as for the neurochemical process which gives rise to people’s ability to stream together what they experience and even what they think. The connections span from a single neuron all the way, for example, to the fusiform face area, an area of the brain (fusiform gyrus) that is responsible for facial recognition. Neurons develop and grow together—bind—resulting in a network that can fire for specific purposes. A certain set of neurons fire when a person sees and recognizes say their grandmother, which is also imbued with affect for how that person feels about their grandmother (Gazzaniga, 2011; Shermer, 2011). This phenomena occurs with politicians as well (Shermer, 2011), who found processing differences when people were presented with morphed pictures of President Obama. Inzlicht et al. (2009) found processing differences regarding religiosity, meaning intensity of religious beliefs give rise to processing differences—the implication here is the intensity of beliefs help form the mind and the way it processes information. There is strong evidence that automatic processing occurs and is manifested in brain activity, but this turns not simply on genetics and experiences but also on beliefs and behaviors. People with different belief systems have different brain information processing as indicated above and by other research (Amodio et al., 2007; Inzlicht et al., 2009; Weissflog et al., 2010). Moreover, this processing may be moderated by the kind and strength of attachment to a belief system.

Given what is discussed above, I hypothesize ideology will still contribute to processing, such that processing differences between liberals and conservatives will

remain within a model including partisanship that controls for age and gender. I am positing the effect on ideology on the P2 will remain, but not expecting differences to emerge prior to this in the brainwave. The model includes an interaction term for ideology and partisanship, because of the different meaning that people can give to these terms and operates under the assumptions that these meanings have implications for information processing when it comes to brain functionality. The lower order simple effects of ideology and partisanship are also included. I hypothesize a simple effect of ideology but not a simple effect of partisanship after controlling for age and gender. The presumption is that people possess an ideology—especially when considered via Jost and colleagues’ framework—but not necessarily a partisan attachment. An interactive effect is presumed, such that the relationship between ideology and processing of emotion will turn on partisan attachment. I propose that partisanship should enhance processing efficiency for both ideological groups, but the lack of partisan attachment will slow processing.

The research design and sample are exactly the same as above. A series of mixed groups factorial ANCOVAs are performed to test the hypotheses and, where appropriate, follow-up analyses are performed. Partisanship was measured on an eight-point scale from strong Democrat to strong Republican, with an option for “other”. For the ensuing analyses, this item was recoded to drop those who considered themselves as other.

Results

Before evaluating if ideology is uniquely related to processing of facial information, it is important to test the assumption that ideology is related to partisanship. Unsurprisingly, partisanship is related to ideology, ($r=.650$, $p<.001$) such that strong

conservatives tend to have higher partisanship scores or a tendency to identify as strong Republicans and strong liberals tend to have higher partisanship scores or a tendency to identify as strong Democrats. This conforms to expectations.

The general linear model was used for these analyses.³ For the P1, using Greenhouse-Geisser corrections, looking at within-subject effects, there is no simple effect for emotion ($F(3.302, 211.338)=1.164, p=.326, MSe=8.734$), which is expected because as mentioned earlier, facial emotions are not typically thought to have an impact on the P1. Contrary to the hypothesis, however, there is a significant interaction between emotion and ideology ($F(3.302, 211.338)=2.603, p=.047, MSe=8.734$). There is a significant interaction between emotion and partisanship, ($F(6.604, 211.338)=3.113, p=.005, MSe=8.734$). There is also a significant three-way interaction between emotion, ideology, and partisanship, ($F(6.604, 211.338)=2.38, p=.026, MSe=8.734$).

LSD follow-ups ($p=.05$; $LSD_{mmd}=3.3614$) reveal the pattern of this interaction. Keep in mind that the following are automatic attentional differences, and they occur quite early on in processing. For faces emoting anger, liberals who identify themselves as Democrats are processing faster than conservatives who identify themselves as Republicans (See Table 1, below). Liberals and conservatives, who identify themselves as Independent, process at equivalent speeds.

Table 1: P1 Latency Responses to Angry Faces

Partisanship	Emotion: Angry	
	Liberals	Conservatives
Democrat	93.8776 (n=14)	91.333 (n=3)

³ SPSS automatically centers variables in this model.

Independent	96.1619 (n=15)	96.0330 (n=13)
Republican	108.8571 (n=1)	97.3791 (n=26)

For disgusted faces, liberals who identify themselves as Democrats process faster than conservatives who identify themselves as Republicans (See Table 2, below). Like for angry faces, Independent liberals and conservatives process equivalently.

Table 2: P1 Latency Responses to Disgust Faces

Partisanship	Emotion: Disgust	
	Liberals	Conservatives
Democrat	95.2143 (n=14)	93.2381 (n=3)
Independent	96.3429 (n=15)	97.0220 (n=13)
Republican	107.1429 (n=1)	98.8242 (n=26)

For fear, the processing pattern is similar to anger and disgust. For faces emoting fear, liberals who identify themselves as Democrats process faster than conservatives who identify themselves as Republicans (See Table 3, below). Again, Independent liberals and conservatives process equivalently.

Table 3: P1 Latency Responses to Fear Faces

Partisanship	Emotion: Fear	
	Liberals	Conservatives
Democrat	95.3673 (n=14)	94.2857 (n=3)
Independent	98.5524 (n=15)	97.2088 (n=13)

Republican	103.8571 (n=1)	99.1923 (n=26)
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For faces emoting happiness, the processing pattern is also similar; liberals who identify themselves as Democrats process faster than conservatives who identify themselves as Republicans (See Table 4, below). Similarly, Independent liberals and conservatives process equivalently.

Table 4: P1 Latency Responses to Happy Faces

Partisanship	Emotion: Happy	
	Liberals	Conservatives
Democrat	93.6939 (n=14)	91.0476 (n=3)
Independent	96.0381 (n=15)	96.2308 (n=13)
Republican	96.8571 (n=1)	97.2692 (n=26)

For neutral faces, the processing pattern continues; liberals who identify themselves as Democrats process faster than conservatives who identify themselves as Republicans (See Table 5, below). Independent liberals and conservatives process equivalently.

Table 5: P1 Latency Responses to Neutral Faces

Partisanship	Emotion: Neutral	
	Liberals	Conservatives
Democrat	93.6939 (n=14)	91.0476 (n=3)
Independent	96.0381 (n=15)	96.2308 (n=13)

Republican	96.8571 (n=1)	97.2692 (n=26)
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There are no between subjects effects for partisanship ($F(2, 64)=1.105, p=.338, MSe=421.586$), ideology ($F(1, 64)=.739, p=.396, MSe=421.586$), or their interaction ($F(5,64)=.349, p=.706, MSe=421.586$). This means there are no wholesale differences across the emotions accounted for by ideology, partisanship, or their interaction at this stage of processing.

Clearly these differences indicate there are processing differences and similarities for liberals and conservatives which are conditional on partisanship at the P1. This supports the general hypothesis that partisanship and ideology influence information processing. If they are Independent, liberals and conservatives process similarly for all emotions. If they are partisan, liberals tend to process all of the faces faster than do conservatives. This is an intriguing, although unexpected finding. As indicated, the differences between liberals who are Democrats and conservatives who are Republicans occur irrespective of with they are presented. Given that this occurs at the P1, this is strong evidence for the case that partisanship and ideology need to be considered alongside of one another, because they have an interactive effect when it comes to how at least facial information is automatically processed.

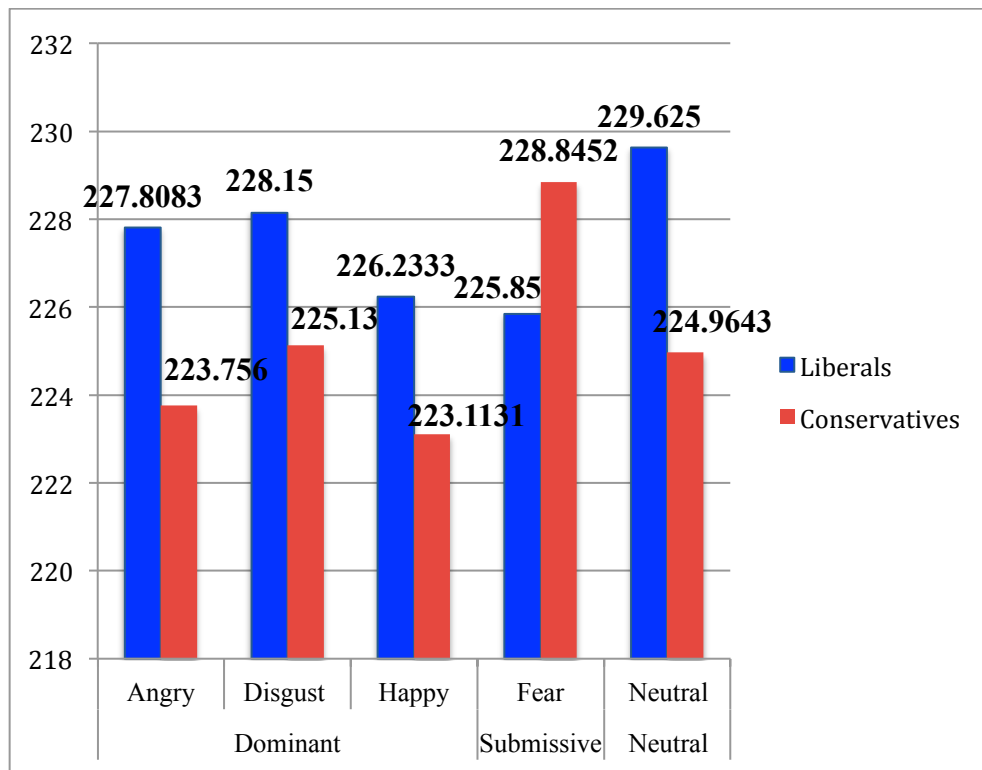
As hypothesized, using Greenhouse-Geisser corrections and looking at within-subject effects for the N170, there is no simple effect for emotion ($F(3.473, 197.978)=.489, p=.717, MSe=15.083$). There is not a significant interaction between emotion and ideology ($F(3.473, 197.978)=.708, p=.568, MSe=15.083$). There is a non-significant interaction between emotion and partisanship, ($F(6.947, 197.978)=.263,$

$p=.977$, $MSe=15.083$). There is also no three-way interaction between emotion, ideology, and partisanship, ($F(6.947, 197.978)=.488$, $p=.841$, $MSe=15.083$). This suggests there are no discriminatory processing differences captured by ideology, partisanship, or their interaction at this stage of processing.

For the P2, using Greenhouse-Geisser corrections and looking at within-subject effects, there is no simple effect for emotion ($F(3.667, 234.674)=.500$, $p=.720$, $MSe=73.851$). There is not a significant interaction between emotion and ideology ($F(3.667, 234.674)=.856$, $p=.483$, $MSe=73.851$). There is no significant interaction between emotion and partisanship, ($F(7.334, 234.674)=.285$, $p=.964$, $MSe=73.851$). There is no three-way interaction between emotion, ideology, and partisanship, ($F(7.334, 234.674)=.566$, $p=.791$, $MSe=73.851$).

Interestingly, there is a significant relationship between subjects effect for ideology, ($F(4.469, 683.439)$, $p=.038$, $MSe=683.439$). Liberals' mean response was 235.530 (Std err.=4.272) and conservatives' mean response was 225.043 (Std err.=2.628). An LSD follow-up (at $p=.05$) on this between-subjects simple effect confirms there is a difference between liberals and conservatives processing at the P2 stage, with liberals being slower to process than conservatives. The pattern underlying the simple effect is, however, misleading. Like in the first section of the project, liberals are slower to respond to angry and neutral faces. One difference is that liberals process happy faces at equivalent speeds as conservatives, whereas before they were significantly different. They process the other faces equivalently. The general pattern is that conservatives process faster than liberals, irrespective of emotion, although some of the underlying effects that give rise to the ideology simple effect are not significant.

Figure 3: Mean Conservative and Liberal Responses (in milliseconds) to Facial Stimuli in the P2 Component



Differences significant at $p < .05$ level for Angry & Neutral

Conclusion

With respect to the P1 components, the findings suggest an important difference in the way conservatives and liberals initially process information when partisanship is taken into account. This was not an expected finding given the early and nearly automatic nature of these components. That being said, the finding is a demonstration of the combined influence of ideology and partisanship on information processing. Liberals initially process facial information more rapidly than conservatives irrespective of emotion but, throughout the course of processing, conservatives process the facial information faster. Recall that the P1 reflects obligatory, automatic differences, so individual differences are not expected to impact the waveform at this point. Normally,

marked differences prompt such differences at the P1. For instance, people who have high social anxiety, which becomes a biological property of the way they process information, over-attend and devote many resources to processing, so this can manifest itself at the P1 stage (Mühlberger et al., 2009; Mueller et al., 2009; Wieser et al., 2009; Rossignol et al., 2007, 2012; Sehlmeier et al., 2010). This is not the case for those with lower social anxiety, whose brainwaves at the P1 would not show such a pattern.

The P2 component is where more individual differences (top-down effects) are expected to matter, so people's beliefs, life experiences, and so forth can impact the way they process information. Notably, this is still quite automatic in nature, which is why findings at this point in the wave are a fairly robust measure for how individual differences can become automated and produce processing differences. For the P2, the results indicate conservatives process dominant emotions more quickly compared to liberals. This fits with what was found above, because the pattern of similarities and differences between liberals and conservatives do not flip. In fact, because this result was obtained in a more robust model, and it stands out as a stand-alone between-groups factor; one can be fairly confident that ideology is unique, deep marker for processing differences as well as biological differences between individuals.

The Link Between Political Participation and Faces

Ideological and partisan differences exist for how faces are processed, but it also stands to reason that political participation may correlate with facial processing differences. Political participation, in this project, refers to four basic categories: voting, campaign activities, contacting government officials, and local community activities (Verba & Nie, 1987; Verba, Schlozman, & Brady, 1995). As people scan their environment, they unconsciously evaluate that environment for emotional significance, discerning emotional states and friend from foe. This provides information crucial for adaptive behavior, providing immediate information about the emotional states of others. This information gathering process could manifest itself and apply to many kinds of participatory behavior: voting, contacting officials, discussing politics, and taking part in campaign activities. If faces really are one of the bases for human's social interaction and they shape behaviors, then how people process faces is relevant to political behaviors.

This chapter is structured by two general questions: one, is political participation related to facial processing and, two, do those who participate less in politics exhibit signs that it is costly for them to process facial information? This section argues that facial information is pivotal to both social interaction and political participation. However, even though people are quite adept at interpreting and recognizing faces and extracting salient social information from their environment, it does not follow that people experience similar costs to engage in facial processing. So even though many take for granted their ability to interpret and process faces, cognitive resources are expended which allow people to perform such tasks. For some people, however, these costs are quite high. Broadly, this work asserts one potential explanation for why some participate

less: it is costly for them to partake in even basic, fundamental social interaction. Low participators expend many cognitive resources to process faces, a pattern consistent with those with high anxiety.

When attempting to unearth and discover why political participation had changed or declined in the U.S., Putnam (2001) settled on the notion that people were engaging less with one another: they were bowling alone. He found participation was floundering in cornerstones of American democracy such as civic organizations and churches, among many others. Political participation was not just declining, many forms of participation were. Putnam attributed the decline in political participation to a lack of bonding and bridging social capital, the consequence of which was the deterioration of the social and political fabric of the U.S. At the heart of his observations and theory, Putnam asserted that the connections people form with one another are powerful, even central to the balance and vitality of American democracy.

Well before Putnam, scholars have searched for the reasons why people do and do not participate in politics. The general framework for their conclusions turns on the benefits and costs of political participation. Rational views of voting behavior raise the question of why people even vote when the costs likely outweigh the benefits (Downs, 1957). One explanation is that social norms foster a desire to participate, enervating an inner desire to appease others and live up to social expectations, which then confers social benefits like a positive image of one's self while harming those who do not participate (Coleman, 1988, 1990; Knack, 1992; Panagopoulos, 2010). In some sense, some people develop a sense of political efficacy, a psychological desire to participate in politics, because they then derive some kind of pleasure or develop a stronger self-image;

of course, this also affects those who tend not to participate, where the social pressure may disenfranchise and make them alienated from politics (Finifter 1970; Milbrath & Goel, 1977; Seeman, 1959). The underlying theory is that people respond to others' perceptions and social pressure, and they want to project a socially desirable image of themselves or avoid shame (Buffacchi, 2001; Coleman, 1988, 1990; Knack, 1992; Panagopoulos, 2010; Posner & Rasmusen, 1999; Tadelis). In a field experiment, Gerber et al. (2008) tests this theory and shows that social pressure—publicizing people's voting records—is a powerful tool, one that can impel people to vote; another article confirms other uses of this paradigm, especially face to face canvassing with these voter records to fuel voter participation (Davenport, 2010). In essence, prompting emotional reactions, either a sense of pride and accomplishment or shame, can be a powerful force driving behavior (Brader, 2005; Marcus et al., 2000; Neuman et al., 2007; Valentino et al., 2011). The drawback, in this case, is when social pressure is exerted, people may respond differently. Eliciting positive emotions, like pride, may stimulate participation, while negative emotions may prompt anxiety (Panagopoulos, 2010). Although inducing reactions to social pressure may increase participation, particularly voting, there is a potential pitfall at play. People will respond to social pressures differently, because there are important individual differences. At minimum, how to entice people to participate in politics hinges on human interaction.

Though much of the aforementioned work has provided crucial advancements in knowledge and theory, I posit an additional explanation and theory regarding why some people participate in politics and others do not. Previous work takes for granted the necessary social skills and basic interactive mechanisms that can even lead someone to

respond to social pressure, let alone the social pressure that those who participate less in politics may already experience. I am not referring to the variety of factors that enhance the likelihood to participate in politics, such as: free time, money, civic skills, and education (Verba, Scholzman, & Brady, 1995). In fact, what I refer to is much more basic, although an overlooked element of social interaction, the ability of people to process and interpret facial information. A large proportion of the literature seems to assume that basic social skills are in place and are shared by most people. In truth, the equipment is in place, but the costs to use it are not as stable as one might presume. Those who do not participate in politics may experience a great deal of social pressure already, perhaps more than just in politics but social life in general. If this is the case, those who tend to participate less may experience a form of anxiety, raising their costs to participate. This is a salient point to consider, because it is an often-noted conclusion that voting bears a lower cost relative to the other kinds of participation listed above (Verba & Nie, 1972, 1987; Verba, Scholzman, & Brady, 1995).

Some of the literature mentioned in other chapters, highlighted that facial information is used for decisions regarding competency, trustworthiness, and a host of other factors. Indeed, presentation of faces alone predicts election outcomes better than chance (Todorov et al., 2005; Ballew and Todorov, 2007; Olivia & Todorov, 2010). Few, if any, seem to contest that facial information is relevant to political participation. If it is as Putnam argues, that social interactions and connections are the bedrock of political participation and even democracy, then the most basic element of this process is how people are processing and viewing others' faces, and using them to either engage or disengage in the social/political arena.

An additional consideration is that politics may be stressful and, in particular, prompt anxiety, which may hinder an individual's ability to process information and participate in politics (Stanton et al., 2010; Waismel-Manor et al., 2011; French et al., 2011). Political participation requires social interaction, which can produce social anxiety for some. So it is fair to expect that social anxiety, which is an emotional disposition, may color political attitudes and behaviors (Miller, 2009). For instance, those with high social anxiety tend to be cautious in their interactions with others and minimize human interaction; social anxiety can also cause autonomic arousal, characterized by nervousness (Miller, 2009). Accordingly, social anxiety may quell political participation, especially as the interaction costs increase with more individually taxing political behaviors, from voting to say contacting public officials or discussing politics.

There is an issue in the literature here that must be observed. It is known that anxiety, among other emotional reactions, impact political attitudes and behaviors (Huddy et al., 2005; Jost et al., 2007; Jost et al., 2003; Ladd, 2008; Marcus et al., 2000; Nueman et al., 2007). The argument is emotion, such as anxiety, is infused into information updating or processing (Marcus et al., 2000; Lodge & Taber, 2000, 2005; Taber & Lodge, 2006). The assumption is that as a person is exposed to information, it is evaluated via a combination of memory infused with affect, coloring interpretation of political information and evaluations of candidates. Some also argue anxiety spurs attention, encouraging those who are anxious to pay more attention and even make better decisions (Lau & Redlawsk, 1997; Lau, Anderson, & Redlawsk, 2008). The reality is more complicated, nevertheless. Anxiety is involved in information processing, but it has a conditional ability to enhance attention and improve decisions.

Anxiety, especially social anxiety, is a double-edge sword when it comes to information processing. As already noted, social anxiety can lead to a withdrawal from social interactions, but it also can lead to hyper-attention and expending too many cognitive resources. Redlawsk et al. (2010) propose there is an affective tipping point, at which point people avoid evaluating new information. Similar to this line of thinking, there is an automatic affective tipping point in information processing, such that a certain level of (social) anxiety may stymie one's ability to participate in politics. Social anxiety produces stress, which increases cortisol levels and literally inhibits the ability of the brain to process information (Gazzaniga, 2009). On one hand, this argument accepts that a certain level of anxiety may increase attention, but, on the other, recognizes there are limitations to the benefits of anxiety. High levels of anxiety or attention (over-attending) may overtax a system, expending too many cognitive resources, in which case the one of the few options for someone is to withdraw to re-establish equilibrium.

Many ERP studies establish a connection between social anxiety and biased information processing of faces (Kolassa et al., 2007, 2009; Mühlberger et al., 2009; Mueller et al., 2009; Wieser et al., 2009; Rossignol et al., 2012; Sehlmeier et al., 2010). To somewhat simplify this body of work, they find increased P1 amplitude to both neutral and emotional faces is related to high social anxiety, so those with high social anxiety automatically over-attend and devote many resources to processing compared to those with lower social anxiety (Kolassa et al., 2007, 2009; Mühlberger et al., 2009; Mueller et al., 2009; Wieser et al., 2009; Rossignol et al., 2012; Sehlmeier et al., 2010). Socially anxious individuals are, thus, drawn to emotional faces and this reaction to emotional faces can be unproductive. Socially anxious individuals' hyper-attentiveness

can abate their desire to be in social situations, even prompt them to avoid new experiences or new ideas (Miller, 2009). Obviously, in the context, of political participation, experiencing high amounts of anxiety can be counter-productive, meaning people partake less in politics.

Pulling everything from above together, the hypothesis is those who are less prone to participate in politics are more socially anxious and their P1 waveform will exhibit this social anxiety with increased amplitude, which means more attentiveness. Given that some kinds of participation require more interaction or are more individually cumbersome, it is also expected that the increased attention will be more strongly related to activities that require more social interaction, so higher order participation than voting itself.

This portion of the project analyzes the same ERP data as the previous sections. In total, the same 105 people participated in the ERP and TST experiments. In addition to considering different forms of political participation, it analyses cortisol data collected from a Trier Stress Test (TST). The subjects participated in the two phases of the experiment—the ERP experiment and the TST. Although there were not survey questions squarely addressing social anxiety, cortisol serves as an adequate proxy for two reasons. The first is the purpose of the TST, which is to place individuals in a socially stressful situation—prepare a speech and perform arithmetic, among others. Accordingly, the design fuels social pressure. Put alternatively, as one undergoes the TST, anxiety is expected to increase as the experiment progresses (Hellhammer & Schubert, 2011). Cortisol may index how anxiety increases, which is routinely collected as part of the TST (Hellhammer & Schubert, 2011). Second, surveys regarding social anxiety somewhat

miss the mark on capturing the anxiety that individuals directly experience. Cortisol measures tap into the increase in anxiety that individuals experience and, therefore, is a more direct measure of anxiety than a survey might be—though the relevant survey items and cortisol levels typically are correlated but this varies somewhat depending on if the survey was administered prior to or after the stress test (Hellhammer & Schubert, 2011).

Political participation is broken down into voting and non-voting. Actual voting records were obtained, so this is not self-reported voting behavior. Actual voting is composed of three elections—the general 2008 election, 2006 midterm, and the 2008 primary election. Non-voting is composed of participants' yes/no responses, with yes coded higher, if they: attended a political rally, contributed money to a campaign, worked on a campaign, and contacted elected officials. It also includes how often they discussed politics, which if they talked very often was a one, and each degree of talking less being a fraction of one.

Results

French et al. (2012) already analyzed some of the cortisol data and how they relate to political participation. They report baseline cortisol levels are negatively correlated with voting frequency and non-voting political participation. Since they use baseline cortisol, however, it is necessary to see if there is a relationship between how much cortisol increases, which is a better index of anxiety experienced during the experiment. Using the square root of max cortisol to correct for skewness and after trimming two outliers ($n=103$), there is a negative linear relationship ($r=-.21$, $p<.05$) between max cortisol and non-voting political participation. There is a negative linear relationship between actual voting and max cortisol, ($r=-.395$, $p<.001$) which mirrors

what French et al. (2012) found with baseline cortisol. The max cortisol is positively correlated with P1 amplitude, but only in response to certain faces (See Table 6, below). Max cortisol is positively related to P1 amplitude of disgust and fear on the two-tailed level, and neutral on the one-tailed level. This fits what was hypothesized above, which was that higher cortisol levels (as an index of experienced social anxiety) are related to larger P1 amplitudes of neutral and some emotional faces. Most of the other studies do not employ as many emotions in their experiments; they typically compare one emotion to neutral, such as fear or disgust, though some do argue that social anxiety occurs in response to all social stimuli (Kolassa et al., 2007, 2009). As for participation, it is clear that there is a difference drawn around the kind of participation that is being considered. Actual voting is not correlated with P1 amplitudes, whereas other more socially taxing kinds of participation are.

Table 6: Correlations Between Cortisol, Non-Voting and Voting Participation with P1 Amplitude

	Anger	Disgust	Fear	Happy	Neutral
Max Cortisol					
r	.148	.274	.234	.141	.205
p	.210	.019	.046	.235	.085
(n=73)					
Non-Voting Participation					
r	-.224	-.250	-.166	-.225	-.215
p	.042	.022	.134	.041	.051
(n=83)					
Voting- Participation					
r	-.090	-.082	-.064	-.064	-.036
p	.434	.478	.580	.579	.756
(n=78)					

Discussion

Although these are just correlations between cortisol levels and processing of faces, it is quite clear that there is a relationship between stress and/or anxiety experienced during the Trier Stress Test (TST) and information processing. Given the relationship between non-voting participation and max cortisol, it stands to reason that those who are devoting more attentional resources to process the faces are also those who experience more stress and anxiety during the TST. These people tend to not participate in non-voting kinds of political participation, which have higher social costs than voting. This fits with what many have argued regarding the different kinds of political

participation and the costs associated with them (Verba & Nie, 1972, 1987; Verba, Scholzman, & Brady, 1995).

As delineated above, others have argued that attention may increase with anxiety and stress, which literally is the case (if P1 amplitudes increase, this means attention increases). However, for those who this happens to, they tend to not participate in certain forms of politics. Given that this occurs at the P1 stage, it suggests these individuals internalize the pressure and respond to it by allocating more resources, but this comes at a cost. This is an obligatory, automatic difference in the allocation of cognitive resources, meaning these individuals may experience social anxiety and stress. Also, since higher cortisol levels are obtained for them, it is possible that these kinds of people remove themselves from politics because of how taxing, it may be for them to participate in politics and to pay attention to politics. I have argued this phenomenon is likely the double-edged sword of social anxiety, where attention might increase but it might also lead to a decrease in more socially taxing forms of political participation.

Although the discipline has recognized that different kinds of political participation require more from people and there are many theories regarding why people even participate in politics, there still is a lack of understanding why some people do not participate in politics (Plutzer, 2002). A compelling explanation is that politics is too costly for them—time, money, education, getting away from work, etc—and not worth the social benefits (Verba & Nie, 1972, 1987; Verba, Scholzman, & Brady, 1995). For future research, it is now appropriate to consider the differential costs for individuals in terms of their emotional and interpersonal dispositions like social anxiety. It seems that the costs for socially anxious people to participate in politics may be heightened because

of already high social costs for them to be social, or they feel and experience the social pressure of politics differently than those who do participate. In many respects, it may be cost prohibitive for socially anxious people to participate in politics.

Politics may be quite stressful for those who do not participate. Some have argued those do not participate almost lack an emotional connection to politics (Lewis-Beck et al., 2008). It may well be the case, however, that politics evokes too much emotion—stress and anxiety—which turns them away from certain kinds of politics. Future research should explore this notion because, if some are driven away from politics because of the social costs, it is necessary to not only confirm this, but also find ways to lower those social costs.

There are weaknesses with some of the measures employed in this section and one in particular should be noted. The cortisol measures employed here indexes stress and anxiety, and given the nature of the experience, this is likely social. However, it is a proxy measure for social anxiety. Future research should consider the role of social anxiety as a hindrance to political participation, but likely do so with cortisol measures as well as different scales that predict anxiety. Although those with higher cortisol levels were experiencing more anxiety or stress, it is impossible to tell given the measures of this study if that is more a trait-state difference, the situation, or an interaction of the two. Future designs should take this into account. As indicated above, since others have found a relationship between increased P1 amplitudes and anxiety, we can remain confident in this project's cortisol findings as an index of anxiety and how cortisol relates to low participation.

Conclusion

The brain is an important frontier for political science research. Politics is in the brain; it is a part of who people are and how they process information. Future research needs to be conducted in this vein, to say, see how citizens process information from elites, how individual differences matter at this stage, and then how this affects people's political attitudes and behavior.

However, it is necessary to study these things as directly as possible. Studying the brain at the speed it functions opens the door to directly studying concepts long since considered in political science research—information processing. Not to mention, it is a viable tool for detecting differences when observed behaviors are the same—such as correctly categorizing a face. This project has demonstrated processing differences exist even when behavioral responses are equivalent. This is a resounding finding that cannot be ignored. It shows that more is occurring underneath the surface of a behavior.

Appendix I- A Sample of Faces Employed



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