Handedness and Motivational Asymmetries as Precursors to Personality and Political Ideology

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Katie L. Broadwell

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Dr. Chad J. Marsolek, Advisor
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Abstract

Recent research and theorizing in political psychology have favored a social cognitive model of political ideology, in which conservative attitudes arise from a need for psychological security in a threatening world. In keeping with this worldview, conservatism has been linked to a greater tendency to withdraw from threats, while liberalism has been associated with approach-related behaviors. However, several conflicting findings from other research streams belie such straightforward explanations, and the relative dearth of neural evidence makes it difficult to trace political approach and withdrawal motivations back to their roots in the brain. Connecting these motivational tendencies to neural activity would help establish a more nuanced causal model of political ideology, but doing so first requires a meaningful explanation grounded in theory. Parallel findings in another area of research suggest one such possibility. Big Five personality domains demonstrate relationships with measures of approach and withdrawal motivation, while maladaptive personality traits appear to show similar motivational connections. Importantly for purposes of theory development, the measures of approach and withdrawal associated with the Big Five have also been independently associated with activity in specific brain areas. EEG studies have shown that approach motivation corresponds to increased left-hemisphere activation in frontal areas whereas withdrawal motivation relates to greater frontal right-hemisphere activation. Therefore, cerebral motivational asymmetries present a plausible mechanism by which brain activity could influence levels of approach and withdrawal motivation, which in turn could lead to differences in personality and political ideology. Since adequately powered neuroimaging studies are often financially and logistically prohibitive, an additional

benefit of this model is that it can be tested using a proxy variable that also demonstrates unique associations with the variables of interest. Handedness has long been tied to hemispheric lateralization, likely due to shared genetic influences, with empirical evidence supporting a relationship between left- and inconsistent-handedness and increased right-hemisphere activity. Right- and consistent-handedness, on the other hand, appear to be related to greater left-hemisphere activation. Using handedness in lieu of hemispheric activation, while not without its drawbacks, made it possible to indirectly test the aforementioned model in the present study in a larger online sample ($N = 499$) and to investigate how handedness, an often-overlooked variable in most areas of psychology, related to personality and political constructs. Participants from the University of Minnesota and Amazon's Mechanical Turk completed a series of online survey measures to address the broader question of whether approach and withdrawal motivation explain any observed relationships between handedness and personality and political ideology. Additionally, the current study tested a variety of relationships between variables that are rarely included in the same study (e.g., recently developed measures of maladaptive personality and political ideology). Another aim of the present study was to explore methodological issues that have plagued the various literatures it connects, such as the artificial dichotomization of handedness scores and differing theoretical and operational definitions of approach and withdrawal motivation. In an effort to address divergent results from questionnaire and behavioral measures in the literature, I also designed an approach/avoidance task for inclusion in the study. Results indicated that approach and withdrawal motivation may partially account for relationships between handedness and personality and political ideology, although

additional research is needed to clarify unexpected findings. Results from the present study are interpreted in terms of conflicting theories from the political, cognitive, and personality literatures, and future research is proposed to address lingering uncertainties in this domain of study.

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Introduction

Handedness and its Origins and Outcomes

Historical findings of handedness differences. One of the most readily apparent individual difference variables, handedness has been stereotyped, investigated and recorded through the millennia. Disagreements about the origin of handedness differences date back nearly as long to the time of the first Greek philosophers. Aristotle, who believed that nature is fundamentally asymmetrical, proposed that humans are mostly right-handed because the blood flow to the right side is warmer and healthier (Hopkins & Ronnqvist, 1998). His teacher Plato theorized that humans originally exhibited left-right symmetry, but erroneous educational practices caused a leftward shift in children. Plato associated left-handedness with deviance or pathology, and such arguments have been frequent throughout human history as left-handers have long been a minority. Even wear patterns on stone tools dated between 8,000 and 35,000 BC provide evidence for a large proportion of right-handers in the population (Coren, 1994).

Estimates of the percentage of left-handers in the population typically fall around 10% (Coren, 1994; Ellis, Marshall, Windridge, Jones, & Ellis, 1988). Some evidence suggests that strong left-handers actually make up just 2-3% of the population, with the remainder of the 10% taken up by individuals who are weakly left-handed (Hardie & Wright, 2014). Estimated percentages of non-right-handers in the population can be as high as 25% if ambidextrous individuals are included as well (Corbetta, Williams & Snapp-Childs, 2006). Although these numbers remain fairly consistent across the human species, there are some notable cultural differences.

These cultural disparities were highlighted by Raymond and Pontier (2004), who examined handedness data for more than 1 million individuals across 14 countries during a span of 76 years. They discovered that countries varied widely in the proportions of people who used their left hand for various tasks. For example, they found that 19.6% of participants in Papua New Guinea used their left hand for throwing, but just 7.1% of U.S. participants did. Faurie, Schiefenhvel, leBomin, Billiard, and Raymond (2005) took a novel approach to cross-cultural handedness research by interviewing individuals from traditional societies such as the Baka, the Inuit, and the Eipo. They also found that left-handedness rates varied widely across societies, with the frequency of left-handers ranging from 3.3% to 26.9%.

These variations between countries can be partially explained by the prevalence of left-handed stereotypes. In many cultures and in religions such as Islam, the left hand is seen as unclean. Hygienic functions are therefore allotted to the left, while eating is performed by the right hand. In the Christian tradition, the left side is synonymous with evil; even the word "sinistrality," based on "sinister," is indicative of the long-standing tradition that the left side is the bad side (Grimshaw & Wilson, 2013). These beliefs and practices appear to shrink the natural left-handedness rates when cultures adopt them. For example, the beginning of public school in Great Britain in the 1880s coincided with teachers paying increased attention to handedness and strongly encouraging students to use only the right hand for writing. This widespread phenomenon was at least partially responsible for left-handed rates dropping to an all-time low of 3% for individuals born between 1880 and 1900 (McManus, Moore, Freegard, & Rawles, 2010). It is clear from these studies that although general estimates of left-handedness fall around 10%, this number can vary dramatically due to numerous factors, some of which are ignored in current handedness research.

Just as humans exhibit an overall rightward asymmetry, many animal species demonstrate a marked preference for the left or the right side of the body. According to Corballis (1997), parrots tend to use their left foot, and only 12-13% of parrots are right-foot dominant. In a similar vein, Vallortigara (2006) found that chickens and pigeons both display a leftward bias when searching for food. He also found that toads exhibit goal-dependent body asymmetry: they preferentially attack other toads on the left and prey on the right.

In animals more closely related to humans, population-level handedness biases are slightly harder to interpret. Some studies have found no right-hand bias in the great apes (Annett & Annett, 1991; Byrne & Byrne, 1991) while others posit a more nuanced view of handedness. Evidence for population-level biases in New World monkeys is slight, but a few studies have found right-hand biases in the Old World monkeys and the great apes (Hopkins & Ronnqvist, 2003). These predilections are more obvious in studies that examine tool use or responses to experimental manipulations, as opposed to studies that only examine food-reaching behaviors. Hopkins (2013) also found that both captive and wild chimpanzees exhibit right-hand population biases, although consistency in hand use is markedly greater in humans. A meta-analysis by Hopkins (2006) suggests that genetic closeness to humans predicts right-handedness. Chimpanzees and bonobos share the most genetic overlap with humans and also exhibit the strongest population-level right-handed asymmetries. The more genetically distant orangutan and gorilla do not show the same right-handed bias, however.

MacNeilage, Studdert-Kennedy and Lindblom (1987) examined numerous studies of primates in the field and proposed that a left-hand bias in prosimians and New World monkeys evolved to a right-hand bias in the great apes. This theory also supports an evolutionary view of handedness in which preference for one hand arose before bipedalism and language (Hopkins & Ronnqvist, 1998). The precise reasons for this progression remain unclear, although Hopkins (2006) discusses theories that suggest handedness evolved due to differences in postural habits, foraging needs, brain structures, or social customs. McManus, Davison, and Armour (2013) contend that genes for right-handedness also coded for other evolutionarily beneficial outcomes, leading to an increased frequency of right-handers in great ape populations. Determining what factors led to the evolution of human population-level handedness biases could explain why right-handers predominate. It could also help explain why some human individuals, like the great apes, are less consistent in their hand use.

Handedness degree and direction. Although many individuals are strongly right- or left-handed, some demonstrate mixed or inconsistent patterns of handedness. According to one theory, mixed patterns of handedness in adulthood occur because of a weak left-handed preference that has been culturally nudged toward the right-handed end of the spectrum. Searleman and Porac (2003) found that young inconsistent and consistent left-handers were equally likely to experience right-shift attempts, typically in the form of parents or teachers encouraging the children to use their right hand for more activities. However, the inconsistent-handers were more likely to successfully switch to using their right hand exclusively for a number of activities, particularly writing.

Other explanations of mixed handedness propose that non-right-handedness arises due to environmental influences acting in concert with genetic influences. This hypothesis suggests that the handedness spectrum ranges from consistent to inconsistent handedness, not from right to left, and is backed by analyses of Oldfield's (1971) Edinburgh Handedness Inventory (EHI). The EHI contains 10 questions about which hand the participant uses to do common tasks such as drawing, writing, or throwing. Respondents indicate whether they exclusively use one hand to do a task, whether they use one hand a majority of the time, or whether they use both hands equally. Their scores are then summed to give a total handedness score ranging from -100 to +100, with -100 indicating complete left-handedness and +100 equating to complete right-handedness. In their factor analysis of the EHI, Christman, Prichard, and Corser (2015) discovered a two-factor solution for inconsistent/weak right-handedness and a one-factor solution for consistent/strong right-handedness. For inconsistent-handed individuals, the EHI questions about writing and drawing loaded on a separate factor than the rest of the EHI questions, whereas only one factor was derived for consistent-handed individuals. Christman et al. (2015) speculated that the two factors may represent the separate genetic and environmental contributions to inconsistent-handedness, while the one factor for consistent/strong right-handedness may indicate that this factor is solely genetic-based. According to supporters of this hypothesis, categorizing roughly 50% of people as inconsistent-handers and 50% as consistent-handers better aligns with genetic and evolutionary theories than the historical 90-10 right-left split (Christman & Prichard, 2016).

These hypotheses about the origins of mixed handedness highlight some important questions that have consumed the field: Should handedness be considered a dichotomous variable, split between left- and right-handers or between consistent- and inconsistent-handers? Or is it better to conceptualize handedness as a continuous variable, ranging from strongly right to mixed to strongly left? Additionally, if handedness is dichotomous, which distinction (inconsistent versus consistent or right versus left) is the critical one? Hardie and Wright (2014) argue that this lack of a consensus has made handedness research confusing and methodologically problematic. The debate is also complicated by the difficulty of recruiting strong left-handers, as they comprise such a small percentage of the population. This means that while the strong- or consistent-handedness category should theoretically include both strongly right- and strongly left-handed individuals, in practice the vast majority of consistent-handed individuals in studies are right-handed.

Researchers who group participants into either inconsistent-/mixed-handed or consistent-/strong-handed categories also vary widely in their treatment of consistent left-handers. For example, Prichard, Propper, and Christman (2013) summarize a number of studies supporting their claim that the inconsistent/consistent dichotomy is more empirically relevant than the right/left dichotomy. In these studies, a median EHI cutoff of +80 (a score indicating fairly consistent right-handedness) was used to separate consistent-handers from inconsistent-handers, with individuals scoring lower than 80 assigned to the inconsistent-handedness group. This use of +80 as a cutoff score typically results in roughly equal numbers of participants in a sample being categorized as inconsistent-handers or consistent-handers, making it popular with many researchers (although the practice does have its critics). Prichard et al. (2013) also noted the presence of some consistent left-handers in the studies, who would have likely scored around -100 on the EHI. It is unclear whether those strong left-handers were assigned to the inconsistent-handedness group in accordance with the below-80 cutoff or grouped with the consistent right-handers. It is even possible they were left out of the analyses altogether, as Prichard et al. (2013) indicated that most of the studies only compared inconsistent-handers to consistent right-handers. Beaton, Kaack and Corr (2015) also reported that many researchers studying consistent and inconsistent handedness purposely choose to not recruit strong left-handers or drop them prior to analyses (e.g., Christman, Henning, Geers, Propper, & Niebauer, 2008).

These concerns may seem overstated since strong left-handers make up a relatively small portion of the population, but some studies have found interactions between handedness consistency and direction. In one such study by Lyle, Chapman, and Hatton (2013), consistent right-handers showed more anxiety than inconsistent right-handers, but consistency had no similar relation to anxiety for left. In another, consistent left-handers took significantly longer to begin a card-sorting task than either inconsistent-handers or consistent right-handers (Wright, Watt & Hardie, 2013). These findings emphasize the importance of analyzing data from both consistent left-handers and consistent right-handers when trying to determine whether degree or direction of handedness is most important, or whether handedness is dichotomous or continuous.

There is also evidence that the EHI, the most frequently used handedness measure in the literature, can overestimate the prevalence of mixed-handers (among other substantial problems). Some researchers have proposed eliminating three of the 10 activities on the inventory due to item redundancy and lack of discriminant validity (e.g., Milenkovic & Dragovic, 2013). Williams (1991) noted that the wording of the instructions likely biases individuals toward an either-hand response, leading to inflated estimates of the mixed-handed population size. He also pointed out that the scoring system of the EHI does not distinguish between very strong right-handers and moderately strong right-handers. Participants who answer that they use their right hand exclusively for all tasks and participants who answer that they use their right hand the majority of the time for all tasks are both categorized as completely consistent right-handers.

These problems are compounded by the frequent use of revised versions of Oldfield's original inventory, often with no acknowledgement by the authors that a revised version is being employed. Edlin et al.'s (2015) review of 889 articles published over a 14-year span found notable inconsistencies in how the EHI was both used and described. For example, the number of questions on revised versions of the EHI ranged from one to 31, compared to the original instrument's 10-item format, although typically the only citation included was for the original EHI. Researchers used various response formats, response labels, and cutoff scores for right-handedness. While these choices may seem minor to researchers, they can have a significant effect on results. The number of response options, for instance, can influence how many individuals are categorized as mixed- or strong-handed. According to Edlin et al. (2015), EHI variations with just two response options (left or right) result in more individuals being categorized as completely strong-handed than formats with five or more options, which result in much higher percentages of mixed-handers.

Most striking of all was how many researchers failed to report these important distinctions. Edlin et al. found that only 22.1% of the articles reported a cutoff score, and of the articles that did report a cutoff score, only 27.6% used Oldfield's original cutoff of zero. Just 18.9% of the reviewed articles noted the use of a different version of the EHI, but an analysis of the remaining articles showed that more than 20% of those articles also used a revised version of the EHI. Only 11% of articles described some or all of the questions they used, and more than half of those articles included one or more questions that were not part of the original EHI. The field's lack of consensus regarding structural and methodological modifications to the EHI has troubling ramifications for replication and comparison across handedness studies.

Some researchers have argued that handedness should be conceptualized as a continuous, not a categorical, variable, due in part to the continuous numerical format of the EHI (Hardie & Wright, 2014; Beaton, Kaack, & Corr, 2015). Assuming they are correct in this assertion, transforming handedness into a dichotomous variable presents a host of statistical issues that researchers often overlook (MacCallum, Zhang, Preacher & Rucker, 2002). In addition, researchers should include measures of both direction and degree of handedness in their analyses to account for any interactions between the two measures such as those found by Lyle et al. (2013) and Wright et al. (2013). A few rare studies have analyzed both direction and degree as continuous variables and have used the absolute value of EHI scores to measure degree of handedness. This approach is statistically the best option and it should be employed more frequently in handedness research as dichotomization results in the loss of information and reduces statistical power, among other drawbacks. Currently, however, handedness researchers employ vastly different statistical approaches, some of which amplify the aforementioned measurement problems. Agreeing on a cutoff point when using dichotomization is similarly contentious, although many default to using +80 due to its popularity in the field. Some studies employ a basic left versus right dichotomy, so that anyone using their left hand for even one activity is considered a left-hander, while others completely omit inconsistent-handers from the analyses (Hardie & Wright, 2014). As previously discussed, others focus only on consistency or inconsistency of handedness, regardless of direction, or remove consistent left-handers from datasets, while still others use a three-part model to compare consistent-left, consistent-right and inconsistent-handers. Many of these approaches can lead to greater confusion and make it more challenging to compare results across studies in the same field.

Differences in cognitive processes. Although measurement and sampling issues are pervasive in handedness research, researchers have still uncovered many differences between individuals with varying degrees or directions of handedness. These distinctions are apparent in both cognitive processes and in self- and other-ratings of personality and psychopathology, and they illustrate how handedness interacts with other better-researched psychological variables in sometimes subtle but significant ways.

Memory accuracy is one area of cognition in which strong right-handers appear to differ from mixed-handers. Christman, Propper, and Dion (2004) showed that right-handers exhibited higher rates of false episodic memories for critical lures on a word list than mixed-handers, and mixed-handers showed better memory performance overall. In an extension of this study, Propper, Christman and Phaneuf (2005) gave participants journals to record the 10 most unusual events that happened to them over the course of six days. One week after completing the journal, participants were tested for their recall of the memories they had recorded. Participants with a score of at least +85 (the median score) on the EHI were considered strong-handers, and participants with a score between -80 and +80 were considered mixed-handers. One caveat was that no participants fell into the strong left-handed category, so all participants were either mixed- or right-handed. Propper et al. found that mixed-handers had higher mean accuracy scores than strong-handers when recalling episodic memories. They also found the same results when they analyzed handedness as a continuous variable by correlating the absolute values of EHI scores with mean accuracy scores.

Edlin, Carris, and Lyle (2013) found that even when the memory task was far simpler, mixed-handers showed better memory than strong-handers. They had participants complete tasks using either their right or left hand and varied the ratio of right-to-left hand use across conditions. Mixed-handed individuals were better able to recall which hand they had used for a unimanual action, such as rolling dice or snapping their fingers, regardless of the ratio of hand use. Finally, it appears that mixed-handers and strong-handers tend to focus on different types of memories during introspection. Niebauer (2004) found that mixed-handers were more likely to engage in self-reflection than strong-handers, who exhibited a greater tendency toward the more negative thinking style of self-rumination. However, these well-documented memory effects do not appear to extend to prospective memory, as Sahu and Christman (2014) found no effects of handedness on either a self-report prospective memory questionnaire or a performance test.

Findings involving handedness and general cognitive ability are less consistent. Some research indicates that the closer a child is to the "point of indecision" at the center of the laterality scale, the more he or she will display verbal and academic deficits (Crow, Crow, Done, & Leask, 1998; Corballis, Hattie, & Fletcher, 2008). A similar finding by Peters, Reimer, and Manning (2006) revealed a deficit for ambidextrous individuals, although this performance decline was observed only in mental rotation and spatially oriented tasks. Conversely, Mayringer and Wimmer (2002) found no deficits for children at the center of the handedness scale, and Casey (1995) found that moderate right-handers actually outperformed strong right-handers and non-right-handers in scholastic achievements. Nicholls, Chapman, Loetscher, and Grimshaw (2010) found that inconsistent-handers, and inconsistent right-handers in particular, outperformed consistent right-handers and consistent left-handers on a test of general cognitive ability. Interestingly, the findings were much stronger for the performance measure of handedness (tapping a circle on a touch screen with each index finger as fast as possible) than for the hand preference measure. This could be partially due to construct contamination, however, as reaction time measures such as tapping speed are positively correlated with cognitive ability. Nicholls et al. also found that on the whole, left-handers scored lower on general cognitive ability than right-handers.

Other studies have found an IQ advantage for left-handers, although again, research is divided on the topic. Left-handers appear to perform better on the Medical College Admission Test and score particularly highly in verbal reasoning (Halpern, Haviland, & Killian, 1998). Annett and Manning (1989) also found that left-handed primary school children scored higher on IQ tests. After summarizing a number of IQ-handedness studies from the 1970s onward, Faurie et al. (2008) concluded that no clear-cut relationship exists between intellectual ability and hand preference. They suggested that this could be partially due to increased IQ variance among left-handers and greater heterogeneity among left-handers' general cognitive abilities. This explanation merits further investigation, as it partially contradicts the results of a recent study by Papadatou-Pastou and Tomprou (2015). Following a series of five meta-analyses of studies on handedness and IQ, the authors concluded that although left-handers were over-represented in intellectually disabled populations, they were not any more likely than right-handers to be intellectually gifted.

Beyond the strictly intellectual domain, individuals with different degrees and directions of handedness show marked differences in certain cognitive variables. Some studies indicate that mixed-handers score higher than strong-handers on measures of creativity, possibly due to their increased cognitive flexibility. Shobe, Ross, and Fleck (2009) discovered that mixed-handers produced more original, distinctive, and appropriate uses for an object in an alternate-uses creativity task. Similarly, Sontam, Christman, and Jasper (2009) found that mixed-handers switched back and forth between categories more than strong-handers when they were asked to name as many animals as they could in one minute. Sontam and Christman (2012) likewise found evidence that mixed-handers have more diffuse associative networks, although instead of testing category fluency, they measured priming for ambiguous words. For example, the ambiguous word "bank" has both a dominant meaning (a financial institution) and a subordinate meaning (a river bank). Mixed-handers exhibited priming for both the dominant and subordinate meanings of ambiguous words, whereas strong-handers only showed priming for the dominant meaning of the word. An alternative explanation for this discrepancy could be that mixed-handers have difficulty suppressing the secondary meaning of an ambiguous word, although as far as I am aware this possibility has not been investigated.

Cognitive processing styles also appear to vary depending on degree of handedness. For instance, recent research suggests that mixed-/inconsistent- and strong-/consistent-handers update their beliefs differently. A number of studies in this line of research suggest that mixed-handers are faster at updating perceptual representations of ambiguous figures (Christman, Sontam, & Jasper, 2009), are more likely to update their beliefs (Jasper, Fournier, & Christman, 2014), and show more cognitive dissonance due to "over-updating" of their beliefs (Jasper, Prothero, & Christman, 2009). Mixed-handers are also more likely to believe in evolution (Niebauer, Christman, Reid, & Garvey, 2004), more gullible (Christman, Henning, Geers, Propper & Niebauer, 2008), more likely to fall for the Barnum Effect (Chan, 2018), and more susceptible to recency effects when weighing conflicting arguments (Jasper, Kunzler, Prichard, & Christman, 2014). In general, these results suggest that mixed-handers are more likely and willing to alter their beliefs when they encounter new information, regardless of the quality of that information.

Other findings suggest that right- and left-handers have different spatial representations of "good" and "bad" that subtly influence their actions. Casasanto et al. (2009) found that even a common schema—associating good with the right side of space and bad with the left side—can be altered depending on handedness. Participants had to sort "bad" and "good" animals from a story to boxes on either the right or left half of a screen and also had to attribute abstract positive and negative concepts to an "alien" on either the right or left half of the screen. Left-handers more frequently associated good animals and concepts with the left side of space and bad animals and concepts with the right, while right-handers exhibited the opposite pattern. Only 1 in 100 participants guessed that the researchers were interested in handedness, demonstrating that many people are unaware of these cognitive biases. Interestingly, the response patterns remained the same even when participants responded orally, indicating that the results extended beyond simple manual-motor explanations.

These results were further supported by Casasanto and Jasmin (2010), who recorded the words and gestures of presidential candidates during the 2004 and 2008 presidential debates. Raters, who were not permitted to view the accompanying gestures, categorized all of the phrases spoken by Kerry and Bush (both right-handers) and McCain and Obama (both left-handers) as either positive or negative. Casasanto and Jasmin found that when the right-handed candidates used positive-valence clauses, they were more likely to gesture with their right hand, but when speaking about something negative, they would more frequently use their left hand. The left-handed candidates were more prone to link positive clauses with left-handed gestures and vice versa.

These studies demonstrate that handedness predicts a wide variety of cognitive variables, including general cognitive ability, episodic memory, belief updating and the use of spatial schemas, but researchers have not successfully tested theories that integrate all these findings. Researchers studying related topics, such as psychopathology's correlation with handedness, have been somewhat more successful in their attempts to theoretically assimilate disparate findings, although challenges remain.

Differences in psychopathology. In the past few decades, psychological investigations into handedness have occasionally focused on personality and psychopathology. The general consensus is that non-right-handedness is positively correlated with psychopathology and less-desirable personality characteristics. This theory is supported by numerous studies, such as a large-scale study by Denny (2009). Denny discovered that left-handedness was associated with a 5% greater chance of experiencing depression in a sample of 27,482 individuals. Elias, Saucier, and Guylee (2001) also found increased incidences of depression in left-handers, but the effect was restricted to left-handed males. In comparison, weakly right-handed and weakly left-handed participants in Milenkovic and Paunovic's (2015) study exhibited higher rates of depression, but strong left-handers did not. Other research suggests that non-right-handers may also be more prone to anxiety, along with depression. While the aforementioned study by Lyle et al. (2013) demonstrated that consistent right-handers showed greater anxiety than inconsistent right-handers, left-handers were more anxious overall. These differences between handedness groups may become even more apparent during stress-evoking situations. Originally, Wright and Hardie (2012) found no differences in trait anxiety between right- and left-handers. When they introduced an anxiety-provoking computerized task, however, left-handers subsequently showed higher increases in state anxiety.

Non-right-handedness also appears to be associated with symptoms of schizophrenia and psychopathy. Francks et al. (2003) reviewed a number of studies that positively linked diagnosed schizophrenia to left-handedness, and Barnett and Corballis (2002) also reported a relationship between non-right-handedness and clinically diagnosed schizophrenia. A meta-analysis by Sommer, Ramsey, Kahn, Aleman, and Bouma (2001) provides additional support for this association, as the authors found that the prevalence of non-right-handers was greater in patients with schizophrenia than in healthy controls. The connection between non-right-handedness and psychopathology is apparent even in adolescence, with van der Hoorn et al. (2010) finding that the left- and mixed-handers in their sample of 2,096 adolescents were significantly more likely to be withdrawn, anxious and depressed and to exhibit psychosis-related maladaptive thought patterns.

Evidence suggests that consistent- and inconsistent-handers may also differ on a specific type of schizotypal personality trait, magical ideation. Magical ideation involves hallucinatory-type thoughts, beliefs in the paranormal, and convictions that one can influence the behaviors of others through rituals, thoughts, and energies. Inconsistent-handers appear to more frequently engage in this type of thinking (Barnett & Corballis, 2002; Chan, 2018), which in a heightened form is similar to some symptoms of schizophrenia. For instance, Badzakova-Trajkov, Haberling, and Corballis (2011) successfully replicated Bryson, Grimshaw, and Wilson's (2009) finding that people who reported frequent use of both hands were higher in magical ideation than consistent-handers. One caveat, however, was that the relationship between mixed-handedness and magical ideation in the two studies only held for hand preference questionnaire measures and not for performance-based measures such as dot-filling or finger-tapping tasks. This is hypothesized to be due to the greater suggestibility and openness of individuals high in magical ideation, which leads them to incorrectly recall their hand use as more ambidextrous than it is in reality. However, it could also be the case that performance-based measures (e.g., the fairly simple task of finger-tapping) are not as good at detecting varying levels of handedness consistency and may not be highly generalizable. This questionnaire-versus-performance measures debate is common in the field, and is further complicated by findings that preference and performance measures of handedness correlate highly with one another even when they diverge in their relationships with other measures (e.g., Badzakova-Trajkov et al., 2011).

Even in non-clinical populations, left- or mixed-handers are more likely than right-handers to exhibit maladaptive or undesirable personality traits. Shobe and Desimone (2016) found that inconsistent-handers who took the Short Dark Triad (a personality measure of narcissism, Machiavellianism, and psychopathy) scored higher on psychopathy than consistent-handers, although they emphasized that the vast majority of those individuals scoring high on psychopathy would not have met the criteria for a clinical diagnosis. Using the Interpersonal Adjectives Scale, Coren (1994) found that left-handers scored higher on dominance and arrogance and lower on nurturance. Beratis, Rabavilas, Papadimitriou, and Papageorgiou (2011) used the Eysenck Personality Questionnaire to differentiate between non-clinical left- and right-handers on a number of symptom fields, and they too found that left-handers exhibited a slightly greater tendency toward psychopathology. Neuroticism was positively correlated with some of the same symptom fields for left- and right-handers, but right-handers also showed associations with obsessive-compulsive symptoms. Left-handers, however, showed associations between Neuroticism and even more symptom fields: psychoticism, paranoid ideation, interpersonal sensitivity, phobic anxiety, and somatization. Other psychological issues such as hyperactivity have also been found more frequently in mixed- and non-right-handers (Peters et al., 2006).

Some studies do contradict this apparent link between psychopathology and non-right-handedness. Killgore, DellaPietra, and Casasanto (1999) did not find any personality rating differences between left- and right-handers, although they did not include items directly measuring psychopathology, and Furnham's (1983) research failed to support a previously discovered connection between neuroticism and left-handedness. Other more recent studies (e.g., Badzakova-Trajkov et al., 2011) explain previously observed connections as artifacts of the type of handedness measure used. However, the current consensus in the field seems to be that non-right-handedness is at least slightly associated with increased risk for certain types of psychopathologies. Recent explanations proffered by researchers in this area involve genetic processes or abnormalities that result in both non-right-handedness and greater risk of psychopathologies, particularly schizophrenia.

Explanations of hand preference development. Until recently, most genetic models of handedness postulated the existence of a single gene with two alleles. Annett (1998) developed a right-shift theory based on a single-gene model with additive effects, which led to Klar's (2003) random-recessive model. In this newest formulation of the single-gene model, a dominant allele leads to right-handedness, but a recessive allele is random and can result in either right-handedness or non-right-handedness, partially mediated by environmental influences. Researchers have also been attempting to find a candidate single gene for quite some time. Francks et al. (2003) found that chromosome 2p12-q11 was linked to relative hand skill, a measure that is highly correlated with dominant writing hand. In follow-up experiments, the researchers found that the same chromosome was linked to schizophrenia, but only when inherited paternally. They stated that the causative effects of the gene on non-right-handedness and schizophrenia helps explain the co-occurrence of the two. However, most researchers, including Francks et al., agree that a single-gene model of handedness is far too simplistic and does not account for enough variance. In large genome-wide association studies, no single-nucleotide polymorphism has yet reached significance across the genome, which provides additional evidence against the theory that a single gene determines handedness (Armour, Davison, & McManus, 2014).

To replace the former single-gene models, multifactorial genetic models have been proposed for the ontogenesis of handedness. McManus et al. (2013) estimate that at least 30-40 undiscovered loci are likely related to handedness. Ocklenburg, Beste, and Gunturkun (2013) reviewed a number of studies on the involvement of various candidate gene groups in handedness development. They also outlined recent hypotheses that genes that help form the corpus callosum and contribute to left-right hemispheric asymmetries also relate to handedness formation. Ocklenburg et al. noted that in multiple studies, some of the genes that purportedly influence handedness only showed significant associations in clinical populations. This further strengthens the theory that a mutual genetic cause underlies both non-right-handedness and psychopathology.

Research on fluctuating asymmetries has potential to further illuminate this association. The more a trait deviates from bilateral symmetry, the greater the functional asymmetry, which is an indicator of developmental instability. Developmental instability occurs when genotypes are inaccurately translated into phenotypes (Thomas et al., 2008).

Thomas et al. (2008) measured the width and length of various appendages on their participants, including their ears, hands, wrists, and feet. The researchers found that greater levels of fluctuating asymmetries were associated with higher schizotypy scores. Since Means and Walters (1982) found that non-right-handed males have larger left hands, and right-handed males have larger right hands, handedness-specific functional asymmetries could provide a method to further explore how gene expression leads to handedness and psychopathology.

Although a genetic link is empirically supported, the degree to which handedness is genetically or environmentally influenced is contested in the literature. Klar (2003) raises a number of issues that a purely genetic account of handedness cannot address. First, even two non-right-handed parents will have right-handed offspring almost half of the time, and second, cultural influences can cause rightward shifts in hand preference. Finally, 18% of monozygotic twins are discordant for handedness. Among discordant twin pairs, being the first-born twin is associated with a greater probability of left-handedness, possibly due to the greater effect of trauma on the first-born as opposed to the second-born twin (James & Orlebeke, 2002). Vuoksimaa, Koskenvuo, Rose, and Kaprio (2009) also concluded that greater trauma during birth likely explained why twins and triplets were more likely to be left-handed than singletons. Birth weight is also correlated with left-handedness in singleton births, with left-handers weighing less on average at birth than their right-handed counterparts (James & Orlebeke, 2002). Even hair-whorl direction, which correlates with handedness, varies in a manner that suggests a combination of genetic and environmental influences (Klar, 2003; Klar, 2004). Klar proposes that the random-recessive model is the best explanation for these findings, although multifactorial genetic models that include environmental factors could also account for the results.

Other explanations for the development of handedness preferences rely even more heavily on environmental or evolutionary hypotheses (e.g., Laland, Kumm, Van Horn, & Feldman, 1995; Bishop, 2001). The theory that environmental factors are intrinsically linked to the development of handedness is bolstered by findings such as Denny's (2012) discovery that breastfed children are significantly more likely to be right-handed. Coren (1992) asserted that handedness is mainly a learned behavior, although he suggested that brain damage or abnormal testosterone levels during pregnancy can also result in non-right-handedness. Differences in hand preferences due to intrauterine testosterone levels are thought to be further influenced by seasonal fluctuations. A meta-analysis by Jones and Martin (2008) showed that a disproportionately greater number of left-handers were born during the spring and early summer in the Northern Hemisphere. However, Stoyanov, Nikolova, and Pashalieva (2011) and Tran, Stieger, and Voracek (2014) found that for males only, left-handed births were more frequent in the winter months. The researchers explain this seasonal anisotropy by invoking the Geschwind-Galaburda cerebral lateralization theory, which suggests that left-handedness may be caused by a delay in left-hemisphere maturation directly resulting from higher testosterone levels in utero (Tran et al., 2014). This theory is also used to explain why multiple studies have found higher incidences of left-handedness among males than females. Female sex hormones vary throughout the year, so these researchers posit that increased exposure to testosterone and androgens during pregnancy at certain times of the year results in a greater chance of left-handed offspring. More specifically, heightened intrauterine testosterone exposure during summer days with longer photoperiods, combined with the already higher levels of testosterone in male fetuses, should lead to an increase in births of left-handed males in the winter months. These findings contradict previous studies, such as those in Jones and Martin's 2008 meta-analysis. However, the authors of the more recent studies accounted for statistical issues in earlier studies and used larger sample sizes than the studies included in the meta-analysis, so their results may be more reliable.

Evolutionary explanations for the ontogenesis of handedness are similarly mixed. The basic argument in support of an evolutionary model is the persistence of left-handers in the general population. If non-right-handedness conferred no evolutionary benefits, the number of left-handers should have diminished over time (unless left-handedness covaried with other beneficial genes). Evidence from Ruebeck, Harrington, and Moffitt (2007) indicates that left-handed males have higher incomes, while Llaurens, Raymond, and Faurie (2009) found that left-handers outperform right-handers at the top levels of many sports. Faurie et al. (2008) found that left-handers were more prominent in high-level and high-paying positions in a company, and women who attained a higher educational level were more likely to be left-handed. Faurie and Raymond (2004) also noted the increased prevalence of left-handers in violent societies, possibly due to their superior combat abilities. However, these evolutionary benefits may be offset by left-handers' increased mortality rates and increased susceptibility to accidents, particularly in industrialized nations (Llaurens et al., 2009). Some research even indicates that left-handers may be at greater risk of a compromised immune system, as they are more likely to have adverse reactions to pharmaceutical drugs and to require reduced drug dosages due to adverse side effects (Coren, 1998). The ways in which evolution has shaped handedness preferences at a population level are still unclear, but the rapidly expanding investigation into the genetic bases of handedness should help tackle this question.

Hemispheric asymmetries and handedness. Many genetic explanations of handedness development simultaneously address the development of hemispheric lateralization, since the two variables are closely related. Cerebral lateralization was deduced in early hominid species through measurements of skeletal asymmetries, supporting the hypothesis that cerebral lateralization and handedness both stretch far back in human history and have long been intertwined (Hopkins & Ronnqvist, 1998). Many theories about lateralization, such as the aforementioned Geschwind-Galaburda theory, propose that hand preference arises due to cerebral lateralization or genes that code for both lateralization and handedness. These theories have been refined and supported by neuroimaging studies designed to test the strength of the relationship between the two variables, although the precise causal nature of the relationship is still under investigation.

Francks et al. (2003) and Geschwind, Miller, DeCarli and Carmelli (2002) found that non-right-handedness was associated with reductions or reversals of both functional and structural brain asymmetries, which are usually biased toward the left hemisphere (although see Good et al., 2001). For example, language is lateralized to the left hemisphere in 97% of right-handers but only 60% of left-handers (Geschwind et al., 2002). Among the remaining left-handers, 30% show no dominant language hemisphere and 10% show a right-hemisphere dominance for language. Additionally, the dominant right-handed gene proposed in Klar's (2003) model has been linked to left-hemisphere dominance. Since many of these studies use right/left dichotomization, mixed-handers are included in the left-hand category and results pertaining to left-handers typically apply to all non-right-handers. However, a few studies have documented increased right-hemisphere dominance among more consistent left-handers. For instance, Knecht et al. (2000) attributed right-hemisphere language dominance to 27% of strong left-handers.

Further evidence comes from studies of monozygotic twins that find language lateralization correlates strongly with handedness. Sommer, Ramsey, Mandl, and Kahn (2002) compared pairs of monozygotic twins who were both right-handed with monozygotic twin pairs consisting of one left-handed twin and one right-handed twin. In twin pairs concordant for handedness, their hemispheric lateralization scores correlated at .74, while in twin pairs discordant for handedness, each twin's lateralization score correlated only .18 with the other's. Furthermore, twin pairs concordant for handedness showed significantly greater left lateralization than the discordant pairs, reinforcing the finding that non-right-handedness is associated with decreases in left cerebral lateralization. One interesting finding was that familial left-handedness also correlated with reduced left-lateralization and greater lateralization agreement among discordant twin pairs (Sommer et al., 2002). In other words, a family history of non-right-handedness increases the odds that both right-handed and left-handed individuals will display lateralization patterns more closely resembling those of typical left-handers.

It is important to note, however, that a few studies have failed to find such dramatic hemispheric differences in language lateralization between right- and left-handers. One representative study by Haberling, Corballis, and Corballis (2016) had equal numbers of right- and left-handers engage in language processing while undergoing an fMRI scan. Unsurprisingly, they found that right-handers showed strong left-hemisphere lateralization for various aspects of language processing; however, left-handers also showed similar patterns of left-hemisphere bias. Overall, right-handers showed somewhat stronger lateralization, and left-handed individuals were more likely to show reduced lateralization or occasional reversals, but the differences were not as striking as estimates from earlier studies (e.g., Knecht et al., 2000).

Another key finding linking brain structure to handedness is that corpus callosum size and density appear to differ between left-, right-, and mixed-handers. This difference is hypothesized to result in reduced left cerebral lateralization and greater interhemispheric communication in individuals with larger corpora callosa. According to Westerhausen et al. (2004), right-handers have smaller and less dense corpora callosa than left-handers, while Gorynia and Egenter (2000) found that familial left-handedness was a marker for increased interhemispheric interaction. Similarly, Luders et al. (2010) reported that inconsistent-handers had significantly thicker corpora callosa than consistent handers. Additionally, although mixed-handers showed the greatest thickness, when they contrasted the scans of left-handers and right-handers who were equally consistent in their hand use, the left-handers had slightly greater thickness than the right. Habib et al.'s (1991) results were not restricted to just inconsistent-handers, as they found that non-right-handers overall had larger corpora callosa than consistent right-handers. After accounting for differences in handedness measurement and methodology across these studies, there still appears to be a general trend toward greater interhemispheric interaction for non-right-handers. Therefore, non-right-handers should theoretically perform better on tasks that require integrating information rapidly across both hemispheres or greater right-hemisphere involvement.

This non-right-handed advantage has been tested, specifically in the area of memory. Lyle, McCabe, and Roediger (2008) found that strongly right-handed participants performed worse than non-right-handers on memory tasks that required greater hypothesized hemispheric interaction (e.g., verbal paired associate recall). However, when the memory tasks did not involve interhemispheric interaction (e.g., face recognition), the two groups performed equally well. Platek, Myers, Critton, and Gallup (2003) observed a left-handed reaction time advantage for responding to self-descriptive adjectives, even when the participants were all right-handed. They attributed this superior left-handed performance to increased right-hemisphere access as self-description is thought to be right-hemisphere dependent (Platek et al., 2003). These studies provide evidence that right-hand dominance is linked to contralateral left-hemisphere dominance, and non-right-handedness is associated with reduced asymmetry, greater interhemispheric interaction, and potentially greater activation of right-hemisphere processes.

Hemispheric Asymmetries and Approach/Withdrawal Motivation

Review of research on motivational hemispheric asymmetries. The studies reviewed so far connecting handedness and cerebral lateralization suggest that any ability or bias that is predominantly left-lateralized should be more prevalent in consistent- and/or right-handers. Left- and/or inconsistent-handers, however, should exhibit more right-lateralized abilities and biases. A more thorough understanding of the respective strengths of the left and right hemispheres is therefore a necessary foundation for hypotheses linking lateralized abilities or traits to handedness.

As mentioned previously, the left hemisphere is the dominant hemisphere for language production and comprehension in the majority of individuals, while the right hemisphere preferentially handles visuo-spatial processing. Facial processing and attentional processes appear to be governed to a greater degree by the right hemisphere, while the left hemisphere is activated more strongly during internal thought and observation of gestures and actions (Corballis, 2014; Haberling et al., 2016). A number of explanations have been proposed for these divisions of labor between the two halves of the brain. Rogers, Zucca, and Vallortigara (2004) suggest that splitting up certain types of tasks between the hemispheres enhances multitasking ability, while Ringo, Doty, Demeter, and Simard (1994) point to the beneficial reduction in processing time when information is handled entirely by one hemisphere, without the need for interhemispheric transfer across the corpus callosum. By eliminating the duplication of some neural networks in each of the hemispheres, asymmetries also allow for an increase in the overall neural capacity of the brain (Vallortigara, 2006).

One asymmetry that has attracted increasing attention during the past two decades is the differentiation of motivational processing between the right and left hemisphere. A growing number of studies indicate that the right frontal hemisphere preferentially handles withdrawal-related motivational processes, while left frontal areas are more strongly associated with approach-related motivational processes, although the distinction may not be as straightforward as originally thought. Approach motivation is generally defined in this literature as moving toward a reward or desired outcome, while withdrawal motivation is defined as retreating from a threat and/or inhibiting one's responses. These motivational hemispheric asymmetries could potentially help explain some observed differences between right-, left- and inconsistent-handers, as handedness is related to hemispheric dominance. Although the correlation between the two is far from perfect, the aforementioned studies as well as evidence that will be discussed in this section suggest that handedness can be considered a proxy of sorts for hemispheric dominance. If the hemispheres have different approach and withdrawal orientations, then one can hypothesize that right-, left- and mixed-handers may have correspondingly different approach and withdrawal motivations as well.

Motivational asymmetries were selected as a topic of interest in the current study for several reasons. First, approach and withdrawal motivation influence a wide-ranging spectrum of human thought processes and behaviors. Learning, conditioning, social relationships, the display of emotion, psychological disorders, personality traits, academic achievement and political ideology are just some of the domains thought to be affected by these fundamental motivational orientations. Second, approach and withdrawal motivation have been studied by researchers for multiple decades and across psychological areas, so there is ample research on how these motivational processes interact with other key variables included in the current study. However, some of those studies lack convincing theoretical explanations for why approach and withdrawal motivation relate to a given variable in the first place. Studying motivation in the context of hemispheric asymmetries provides a possible neural explanation for those associations. Third, given the primacy of approach and withdrawal motivations in daily life, research on this topic should benefit individuals and enhance our understanding of the role motivation plays in personality disorders or in the development of opposing political beliefs, for example. Finally, frontal hemispheric asymmetries in approach and withdrawal motivation have been well-documented in the cognitive and neuroscientific fields. Although there are some conflicting findings that will be discussed, electroencephalography (EEG), functional magnetic resonance imaging (fMRI), and behavioral studies have generally supported distinct left- and right-hemisphere roles in motivational processes. This level of agreement makes it easier to formulate clear hypotheses about how handedness, with its connections to hemispheric asymmetries, might relate to motivational asymmetries and in turn to other personality and political variables.

Harmon-Jones (2003b), a leader in this area of inquiry, described three possible hypotheses about how the right and left hemispheres are involved in emotional processing. First, the valence model endorses the idea that the right hemisphere is more involved in the expression and processing of all negative emotions, while the left hemisphere plays a larger role in positive-emotion processing. A second possibility, called the motivational direction model, hypothesizes that the same left-frontal cortical regions are involved to a greater degree in approach-oriented emotions, while right-frontal regions handle more withdrawal-oriented emotions. Finally, the third hypothesis—the valenced motivational model—proposes that the left hemisphere plays a special role in approach-oriented emotions, but only when those emotions are positive ones. The right hemisphere, conversely, is associated with only negative withdrawal-related emotions.

Some studies do provide broad support for the valence model, including a left-hemisphere role in suppression of negative affect. Jackson et al. (2003) found that participants who had higher baseline levels of left prefrontal activation, as measured by EEG, were more successful when instructed to suppress negative affect. Additionally, Davidson and Fox (1989) reported that 10-month infants who cried after maternal separation exhibited less left and greater right-frontal baseline EEG activation compared to infants who did not cry at all. Adult participants who showed greater baseline left-frontal activation scored higher on positive affect and lower on negative affect on the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988), compared to participants with greater right-frontal activation. In a demonstration of how far-reaching these affective hemispheric asymmetries may be, Flo et al. (2011) measured alpha frequency band activity during various stages of sleep after participants were exposed to mild electroshocks and sounds that had previously been paired with shocks. They found that after being exposed to the unpleasant stimuli (which did not wake them up), participants showed greater left than right frontal alpha asymmetry, which indicates greater frontal-right activation as increases in alpha frequency indicate decreased activity in that brain area.

Other studies provide evidence that the division between the hemispheres goes deeper than positive and negative affect and relates specifically to motivation. A meta-analysis conducted by Murphy, Nimmo-Smith, and Lawrence in 2003, when researchers were starting to systematically explore the connection between cortical asymmetries and approach/withdrawal motivation, found an association between left-hemisphere activation and approach motivation. Although Murphy et al. did not detect any right-hemisphere associations with withdrawal motivation, later studies have found consistent evidence for both a right-hemisphere bias toward withdrawal motivation and a left-hemisphere bias toward approach motivation. Fetterman, Ode, and Robinson (2013) wanted to discover whether the left and right hemispheres responded differently to approach and withdrawal words, so they first presented neutral auditory primes to participants' left or right hemisphere. They found that after priming the left hemisphere, participants were faster and more accurate at categorizing approach-related verbs (e.g., pursue, seek, advance). After priming the right hemisphere, participants' performance improved when sorting withdrawal-related verbs (e.g., avoid, escape, retreat).

In other studies that agree with the second and third motivational models, Coan and Allen (2004) and Harmon-Jones, Gable, and Peterson (2010) found that greater withdrawal tendencies were related to increased right frontal EEG activity, both when participants were at rest and when they were emotionally aroused. Additionally, increases in right frontal activation have been linked to greater vigilance toward angry faces and amplified avoidance of happy faces (Perez-Edgar, Kujawa, Nelson, Cole, & Zapp, 2013). Some researchers have linked positive approach motivations like joy to increased baseline activity in the left frontal cortex (Ekman & Davidson, 1993) while others have found relative increases in left frontal activity when participants are anticipating a reward (Shankman, Sarapas, & Klein, 2011).

Reward and risk can be considered roughly analogous to approach and withdrawal motivation (Harle & Sanfey, 2015) and appear to share the same hemispheric associations. Drake and Ulrich (1992) found that participants with more active left hemispheres, as measured by EEG, showed greater sensation-seeking and risk tolerance.

Gonzalez, Dana, Koshino, and Just (2005) showed that when participants had to make choices framed in terms of loss and risk, they showed greater right-hemisphere activation in frontal and parietal areas. This finding is consistent with that of Ernst et al. (2003), who found that when individuals were asked to compare short-term gains to long-term losses, they displayed greater right frontal activation. Lastly, Sobotka et al. (1992) discovered that during a reaction-time game, participants displayed greater left-frontal EEG activation on reward trials that resulted in monetary gains and greater right-frontal activation on punishment trials when they lost money. These findings all support a greater left-hemisphere role in approach-related, reward processes and a right-hemisphere bias toward withdrawal and risk assessment.

As can be seen in this sampling of studies, EEG, specifically alpha frequency band activity, is a common method in this literature (although some have criticized the heavy use of EEG when measuring frontal asymmetries due to its spatial limitations; see Rutherford & Lindell, 2011). EEG is frequently used to measure resting frontal cortical asymmetry, which Harmon-Jones (2003b) recommended considering a stable trait since it exhibits test-retest reliability and is similar across baseline sessions. In line with this view, Gotlib (1998) found a link between depression, decreased left frontal activity, and increased right frontal activity. Frontal asymmetries also appear to be associated with other dispositional tendencies, such as a tendency towards nostalgia. Tullett, Wildschut, Sedikides, and Inzlicht (2015) reported that participants who were more prone to nostalgia also showed increased right frontal activity at rest. Since nostalgia often co-occurs alongside withdrawal-oriented emotions such as sadness, the researchers suggested that the finding was likely due to the right hemisphere's withdrawal motivation bias. Other researchers have discovered that greater right frontal activity correlates with an increased preference for familiar faces over novel faces (Harmon-Jones & Allen, 2001). Interestingly, even stable biological processes such as immune function appear to relate to hemispheric asymmetries. Davidson (2003) found that people with greater left-prefrontal activation produced more antibodies in response to a flu vaccine, while those with more right-prefrontal activation had lower counts of natural killer cells.

General tendencies toward depression and nostalgia and a preference for novelty are examples of stable traits, providing evidence that these links between the right and left hemispheres and their respective approach/withdrawal motivations are not transient, but important psychological features. However, results from other studies have highlighted the need to account for potential moderating variables and to consider state-related changes in approach and withdrawal motivation alongside trait measures. According to estimates derived from multiple studies, changes due to temporary states account for anywhere from 50 to 60 percent of the variance in EEG measurements of frontal asymmetry, with stable traits making up the remainder (Papousek et al., 2018). Harmon-Jones et al. (2010) note that detecting stable trait asymmetries is easier when comparing more extreme groups (e.g., clinical populations), which could help explain why a growing number of studies have found state-dependent asymmetries but failed to find baseline asymmetries at rest. In Cole, Zapp, Nelson, and Perez-Edgar's (2012) EEG study, socially withdrawn individuals did not differ from others when the authors measured resting frontal asymmetries. However, after taking part in activities designed to increase anxiety levels (watching a video of an anxious person giving a speech and then preparing and giving their own speech), socially withdrawn participants showed greater right-frontal asymmetries than the other participants.

Trying to regulate one's emotions during stress also elicits frontal asymmetries that are absent during at-rest measurements. Goodman, Rietschel, Lo, Costanzo, and Hatfield (2013) had participants engage in a challenging N-back cognitive task while experiencing unpredictable bursts of painful nerve stimulation and viewing oversized, negatively arousing photos. Although no frontal asymmetry differences were apparent between the two groups at baseline, analyses of the state EEG measures painted a different picture. Participants who reported better regulation of their emotions during the stressful events showed increased left-frontal activation, which the authors attributed to the left hemisphere's approach-related role in preventing withdrawal from threatening or painful stimuli. Stewart, Coan, Towers, and Allen (2014) also found that although patients with major depressive disorder (MDD) did not differ in baseline EEG asymmetry measurements from patients without MDD, adding an emotionally challenging task resulted in the MDD group exhibiting lower left frontal activity during conditions designed to elicit both approach and withdrawal motivation. A similar disconnect between state and trait measures was observed by Beeney, Levy, Gatze-Kopp, and Hallquist (2014) in their investigation of the effects of both personality disorder type and personal rejection on EEG hemispheric asymmetries. Once again, although there were no initial differences in asymmetries at baseline between participants with bipolar disorder (BPD) and participants with major depressive disorder (MDD), differences arose following personal rejection during a computerized game. Participants with BPD showed greater left-hemisphere activation post-rejection, while participants with MDD showed increased right-hemisphere activation.

The researchers note that this pattern of results aligns with clinical evidence that MDD patients benefit from therapy designed to reduce their withdrawal-oriented behaviors and increase their approach motivation, while patients with BPD often need treatments that help them better inhibit their socially destructive approach-related behaviors. This is important as it shows that even when clinical evidence suggests two groups should differ in approach and withdrawal motivation, those differences can remain invisible until evoked by situational factors. Another study by Shankman, Klein, Tenke, and Bruder (2007) lends additional support to the claim that asymmetry differences between populations tend to emerge during activities related to approach or withdrawal motivation. The authors found that individuals with early-onset depression did not show increased left frontal activity during a reward-based activity designed to evoke approach motivation, although control participants and individuals with late-onset depression did. Coan, Allen and McKnight's (2006) Capability Model suggests that rather than being outliers, these studies finding null results at rest but asymmetries during tasks or activities point to a fundamental feature of motivational hemispheric asymmetries: namely, that individuals will have different capabilities for approach and withdrawal motivation depending on their current situation or emotional state. Coan et al. recommend including more situational and emotional variables in study designs, instead of viewing approach/withdrawal motivation solely as a stable continuum. They also contend that this model will help researchers determine which individual differences in motivation persist across emotions or situations, make sense of findings where the same individual shows high approach motivation in some situations but high withdrawal motivation in others, and explain failures to detect previously-observed motivational asymmetries at rest. According to Coan et al., one additional benefit of this model is that it allows for the possibility that an individual's motivational asymmetries could be altered and improved through practice.

There is some preliminary evidence in support of this intriguing claim, as researchers have discovered various ways to temporarily change hemispheric activation. For example, individuals can receive biofeedback training to learn to increase frontal asymmetries in a right or left direction through reward tones. In one study by Allen, Harmon-Jones, and Cavender (2001), participants successfully accomplished this task and even showed emotional responses in line with their more-activated hemisphere: participants trained to activate their left hemisphere exhibited more happy facial expressions, while right-hemisphere-trained participants showed more sad expressions while watching films. In a more recent study, Harmon-Jones, Gable, and Price (2011) discovered that instructing participants to lean forward while viewing photos of desserts (meant to induce approach motivation) resulted in greater left frontal activity. However, there is no evidence that either of these effects extended beyond the lab or resulted in any permanent changes.

Another method of altering asymmetries makes use of the handedness-hemisphere link. EEG evidence indicates that 90 seconds of clenching one's left hand increases right hemisphere activity, and vice versa (Harmon-Jones, 2006). Propper, McGraw, Brunye, and Weiss (2013) used this technique to test whether clenching one hand activated the contralateral hemisphere's memory biases. Propper et al.'s results supported Habib, Nyberg, and Tulving's (2003) model of hemispheric asymmetries, in which left prefrontal regions are more strongly involved in encoding while right prefrontal regions play a more prominent role in retrieval of episodic memories. Propper et al. found that a combination of right-hand clenching before encoding (activating the left hemisphere) and left-hand clenching before retrieval (activating the right hemisphere) resulted in the best episodic memory performance.

If hand clenching triggers these types of hemispheric asymmetries, would it also elicit approach/avoidance asymmetries? Some studies suggest that it does. Peterson et al. (2008) found that contractions of one hand increased relative frontal EEG activation in the contralateral hemisphere. When right-handed participants clenched their right hand (activating the left hemisphere), they displayed greater persistence when attempting to solve problems that had no solution. They also demonstrated more aggression, which is likewise considered an approach-related behavior. Harmon-Jones (2006) found similar results, with left-hand contractions resulting in greater right frontal EEG activation and right-hand contractions resulting in greater left frontal EEG activation and reported approach affect. Harle and Sanfey (2015) similarly found that right-hand contractions that activated the left hemisphere led to approach behavior: Participants made higher monetary offers and took more risks to maximize their financial reward in social economic decision games. These findings also appear to extend beyond hand-clenches. Bassel and Schiff (2001) found that tactile stimulation of the right arm led to greater persistence on unsolvable puzzles compared to left-arm stimulation. Even slight differences in manual responses can elicit frontal hemispheric asymmetries. In one study by Sobotka, Davidson, and Senulis (1992), when participants were instructed to press their finger to respond (approach-oriented response), they displayed greater left frontal EEG activity. However, when they had to respond by lifting their finger (withdrawal-oriented response), it resulted in comparatively greater right frontal activity.

Since even temporary hand movements appear to activate the contralateral hemisphere and its associated approach or withdrawal biases, it is plausible that frequently using one's dominant hand could reinforce and strengthen any handedness-hemisphere links formed in utero. Answering this question is challenging, however, as research on handedness and resting frontal asymmetries is scarce. While many researchers have explored frontal EEG asymmetries, as in the studies discussed above, the majority purposely recruited entirely right-handed samples so as to eliminate noise and better detect any hemispheric laterality effects. To the best of my knowledge, only two studies have specifically investigated handedness-based differences in EEG resting asymmetries. One study by Brookshire and Casasanto (2012) investigated left- and right-handers' (but not inconsistent-handers') EEG activation across the left and right hemispheres and its relation to BAS scores. They found that right-handers' BAS scores were positively associated with left-hemisphere activation, as would be expected based on previous research, while left-handers' BAS scores were positively associated with right-hemisphere activation. However, the results were weaker at the pair of frontal electrodes they analyzed and were instead centered around temporal and parietal areas, suggesting their findings were not mainly due to frontal asymmetries. A second study by Propper, Pierce, Geisler, Christman, and Bellorado (2012) focused exclusively on frontal areas. They recruited participants of varying degrees of handedness, although due to the low numbers of consistent and inconsistent left-handers, they chose to only include data from participants scoring above a 0 on the EHI. The researchers found that inconsistent-handed participants had increased levels of right frontal activation relative to left hemisphere activation at rest. In addition, inconsistent-handers had greater right frontal activity than consistent-handed participants. Although left-handers were excluded from the analyses and there were no differences in hemisphere activation for consistent-handers, Propper et al.'s (2012) results provide support for the hypothesis that inconsistent-handedness is associated with greater right-frontal activation than consistent-handedness.

Regularly activating the contralateral hemisphere through dominant hand use, in conjunction with any genetically based predispositions toward hemisphere dominance, could also result in experimentally detectable approach and withdrawal behaviors. Although researchers have used a number of different methods and employed varying definitions of approach and withdrawal motivation, there does appear to be some support for this possibility. Mixed-handers, who should theoretically show a right-hemisphere bias, tend to focus more on potential costs of a risky decision, while strong-/right-handers, who should theoretically show a left-hemisphere bias, instead focus on potential benefits of that same decision (Christman, Jasper, Sontam, & Cooil, 2007). In addition, mixed-handers appear to show greater loss aversion, action inertia, and sunk-cost effects (Westfall, Jasper, & Christman, 2012) and are more persuaded by negative framing and more likely to be prevention-focused than promotion-focused (Jasper, Woolf, & Christman, 2014), all of which are behaviors that seem to be motivated by a desire to withdraw and avoid future threats. Wright, Watt, and Hardie (2013) also found evidence that left-handers, who should demonstrate stronger right-hemisphere processing, took longer to begin a task than right-handers, another behavior that could theoretically be driven by higher levels of withdrawal motivation.

Although these studies provide additional support for the hypothesis that the left hemisphere, and by extension strong- or right-handedness, is associated with approach motivation and the right hemisphere, along with left- and mixed-handedness, is more strongly linked to withdrawal motivation, they do not help differentiate between the second and third models outlined by Harmon-Jones (2003b). One way to arbitrate between the two models is to record brain activity during the experience of a negative approach-related emotion such as anger. Harmon-Jones and Allen (1998) theorized that anger should be considered an approach motivation as it requires action and encourages taking steps to interact with others. Does anger activate the right or the left hemisphere? Or in other words, does the affective component of the approach or withdrawal motivation matter? The second and third motivational models diverge in their predictions. According to the second motivational direction model, any approach motivation, positive or negative, should activate the left hemisphere, so anger should result in left-hemisphere activation. The third valenced motivation model, which suggests that only positive approach emotions should lead to left-hemisphere activation, would instead predict no left hemisphere effects for anger. In their test of these questions, Harmon-Jones and Allen (1998) measured the trait anger of participants and found that it positively correlated with greater levels of baseline left frontal activity.

A number of follow-up studies have replicated these results, lending credence to Harmon-Jones' second motivational model. Hewig, Hagemann, Seifert, Naumann, and Bartussek (2004) demonstrated that participants who scored high on trait anger and low on anger control also had greater left-frontal cortical activation, while Beeney et al. (2014) found trait hostility scores positively correlated with left-hemisphere activation. The aforementioned meta-analysis by Murphy et al. (2003) also found left hemisphere activity was associated with anger. Harmon-Jones and Sigelman (2001) showed that when participants were insulted, they exhibited more left cortical activity than participants who were not, lending support to the hypothesis that both trait and state anger are linked to left-hemisphere frontal activation. Greater left-frontal activity is additionally associated with biological markers of anger such as increased blood pressure and heart rate (Harmon-Jones, 2003a).

Participants' intentions and feelings of ineffectiveness can also lead to different patterns of left-hemisphere activation. For example, when participants thought they could fix an anger-causing situation, they showed greater left-frontal activity, but not when they thought they were helpless to change the situation (Harmon-Jones, Sigelman, Bohlig, & Harmon-Jones, 2003). This relationship between anger, asymmetrical left-hemisphere activation, and intent to act generalizes to participants who score highly on certain maladaptive personality traits. Papousek et al. (2018) compared the responses of individuals high in either Antagonism or Detachment to sound recordings of other people shouting aggressively or desperately crying. Participants scoring high on Antagonism showed greater relative left-frontal activation to the angry shouting, while individuals high in Detachment showed the opposite pattern of greater relative right-frontal activation while listening to the crying. Affective ratings taken during the EEG recording supported the authors' interpretation that these activation patterns reflected increased approach or withdrawal motivation. Participants high in Antagonism reported feeling less threatened by the aggressive shouting (i.e., more willing to potentially confront the aggressor) while high-Detachment individuals said they were more bothered and annoyed by the crying (i.e., more motivated to withdraw from the stimulus).

The link between anger and left-hemisphere activation has also been supported by studies investigating hand contractions and subsequent frontal hemisphere activation. Peterson, Gravens, and Harmon-Jones (2011) had participants engage in either left-hand or right-hand contractions before undergoing an event designed to leave them feeling angry and ostracized. Right-hand contractions, activating the left hemisphere, resulted in greater feelings of anger as well as relatively increased left frontal activity compared to right-hand contractions. Anger at being ostracized also led to greater left-hemisphere activation independently of hand contraction. These results provide further evidence that anger is a negative approach motivation that activates the left hemisphere, in addition to supporting Harmon-Jones' second motivational direction model. Regardless of valence, the left hemisphere plays a larger role in approach-oriented processing while the right hemisphere is more involved in withdrawal motivation.

Measuring approach and withdrawal motivation. Most researchers investigating questions relating to these hemispheric motivational biases choose to use one specific model, the BIS/BAS, so additional discussion of these systems is necessary. Gray and McNaughton (1982, 2000) developed a framework to evaluate behavioral inhibition and activation that shares many features with Reinforcement Sensitivity Theory (RST), from which it was originally derived (Gray, 1970). In its earliest incarnation RST proposed the existence of two separate factors, Anxiety or sensitivity to punishment and Impulsivity or sensitivity to reward, which are heavily involved in learning, classical conditioning, personality, and emotion. RST will be discussed in more detail further on in the context of its relationship with other theories of personality such as Eysenck's theory. It has since been refined and reworked into the current BIS/BAS model. The BIS (Behavioral Inhibition System) has been defined in various ways, some of which will be discussed later in more detail, but can be broadly conceptualized as a system that inhibits prepotent behavior, passively avoids threat, and monitors ongoing conflicts in the environment (McNaughton & Corr, 2004). After detecting a conflict, the BIS inhibits the original goal and increases vigilance to threats (Nash et al., 2011). Examples of items in the BIS measurement scale include: "I feel worried when I think I have done poorly at something" and "Criticism or scolding hurts me quite a bit" (Carver & White, 1994, p. 323).

The BAS (Behavioral Activation System), on the other hand, involves approaching rewards and activating behaviors that will lead to desired outcomes. Interestingly, it is also hypothesized to be involved in actively fleeing an aversive stimulus or conditioned punishment. Items in the BAS measurement scale include: "I go out of my way to get things I want" and "I crave excitement and new sensations," (Carver & White, 1994, p. 323). The BAS is also related to positive affect and the dopaminergic reward circuitry (Wacker, Mueller, Pizzagalli, Hennig, & Stemmler, 2013) and is comprised of three subscales: Fun-Seeking, Drive and Reward Responsiveness (Carver & White, 1994). Carver (2006) describes the BAS as a discrepancy-reducing loop that serves to eliminate the distance between an environmental input and a desired goal state, while the BIS is a discrepancy-enlarging loop that compels the individual to put more (real or psychological) distance between themselves and an undesired state.

Newer conceptualizations of the BIS/BAS also involve the Fight-Flight-Freeze System (FFFS) that taps into fear as opposed to anxiety, which is instead measured by the BIS. According to this theoretical view, the BIS acts as a conflict detector that inhibits the BAS and indirectly excites the FFFS, resulting in a less independent, more interconnected model (Smillie, Pickering, & Jackson, 2006). McNaughton and Corr (2004) also contend that the current BIS needs to be more clearly differentiated from the FFFS, with the BIS involved in approach-avoidance conflict and risk assessment and the FFFS involved in general fear and threat detection. Opinions differ on whether separating the FFFS from the BIS is an ideal solution, and many researchers continue to use the original BIS/BAS without analyzing the FFFS. Research on the construct validity of the original Carver and White BIS/BAS scales, however, seems to indicate that a two-factor solution may be best, with the BIS items tapping into anxiety and the FFFS items relating to fear responses (Heym, Ferguson & Lawrence, 2008; McNaughton & Corr, 2004).

Since the FFFS has only recently been included in these types of studies, it is still unclear whether it may be more closely related to withdrawal or approach motivation. Running away in fear, for example, would be a goal-directed behavior and might involve approach motivation, but the experience of fear itself could be tied more closely to withdrawal. However, there is less ambiguity when it comes to the traditional BIS/BAS. A number of studies support the empirical claim first made by Sutton and Davidson (1997) that the BIS and BAS systems measure withdrawal and approach motivations, respectively, although this assertion also has its critics.

Anxiety symptoms, including social anxiety, show positive associations with the BIS and weak or no associations with the BAS, while the BAS has been linked to positive affect and reduced depression symptoms (Bijttebier, Beck, Claes, & Vandereycken, 2009). Participants in Keune, Bostanov, Kotchoubey, and Hautzinger's (2012) study who tended to ruminate—a habit the authors characterized as negative, passive, and inhibition-focused—also scored higher on the BIS compared to participants who engaged in active mindfulness. Furthermore, the BIS is related to an increased attentional bias to negative and threatening information, while the BAS is associated with greater sensitivity to rewards. Peterson, Gable, and Harmon-Jones (2008) found that individuals with high BIS scores showed more startle eyeblinks overall, while high-BAS individuals blinked less frequently during the viewing of pleasant appetitive pictures. They also discovered that individuals high in BAS showed reduced P300 amplitudes in response to startle probes presented while viewing the pleasant pictures. Conversely, individuals high in BIS showed greater N100 amplitudes to startle probes during both pleasant and unpleasant pictures. Individuals high in BAS also exhibited faster processing of appetitive pictures overall, as measured by event-related potential (ERP) data (Peterson et al., 2008). In summary, these findings indicate that high-BAS individuals have early attentional biases toward potentially rewarding stimuli, while high-BIS individuals remain easily startled even while attending to positive stimuli.

Given these findings, the BIS and BAS could theoretically also be linked to right and left motivational hemispheric asymmetries. Brain areas hypothesized to be critical for the BAS include the left prefrontal cortex along with the amygdala and the basal ganglia. The BIS is also thought to include the (right) prefrontal cortex, the amygdala, and the basal ganglia but has been linked to the right temporal polar region, the hypothalamus, and the septo-hippocampal system as well (Hewig, Hagemann, Seifert, Naumann, &

Bartussek, 2006). To date, BIS/BAS research has focused mainly on left and right frontal areas. For example, Davidson (1998) found that individuals with greater left prefrontal EEG activation had higher relative BAS to BIS scores compared to individuals who exhibited more right prefrontal EEG activation. Balconi and Mazza's (2009) results showed increased frontal right-hemisphere activation during negative emotions for high-BIS participants and increased frontal left-hemisphere activation during positive emotions for high-BAS participants. These results have been corroborated by several studies showing positive associations between relative left frontal asymmetries and BAS scores (DePascalis, Cozzuto, Caprara, & Alessandri, 2013; Barros-Loscertales et al., 2010; Keune et al., 2012; Amodio, Master, Yee, & Taylor, 2008; Harmon-Jones & Allen, 1997; Wacker et al., 2013; Berkman & Lieberman, 2010).

The majority of these studies also collected data on the BIS; however, they found no correlations between overall BIS scores and resting frontal asymmetry. Wacker, Chavanon, Leue, and Stemmler (2010) also failed to find any connection between BIS levels and resting hemispheric asymmetry even though their analyses included parietal and temporal regions along with frontal areas. In a 2008 study, the same authors also found a positive relationship between the FFFS and left anterior regions, providing some preliminary evidence that it may be more of an approach-related trait. However, the association between trait BIS and frontal asymmetries was more complex as frontal hemispheric associations with the BIS differed depending on the type of ending participants were told to imagine for an anxiety-producing story (Wacker, Chavanon, Leue & Stemmler, 2008).

This lack of a consistent connection between the BIS and resting frontal asymmetry has been echoed in other studies. Davidson (1998) described failures to replicate previous findings of a BIS-right frontal activation link, while Schmidt and Fox (1994) found that individuals low in sociability (presumed to be higher in BIS) actually displayed greater left-hemisphere activation. In contrast with these findings, however, Shackman et al. (2009) reported that higher scores on the BIS predicted greater right prefrontal EEG activation. Many researchers have suggested that these conflicting results could be due to issues with how the BIS is defined and measured. Berkman, Lieberman, and Gable (2009), for example, argue that the BIS should be construed as a system that handles conflict detection and inhibition, not a system that detects aversive stimuli. Other researchers agree, with DePascalis et al. (2013) stating that the BIS is not synonymous with a predisposition for avoidance, but should be viewed as an evaluative system that analyzes potential response conflicts or threats. DeYoung (2010a) describes the role of the BIS as slowing or inhibiting an approach toward a reward when danger is involved. According to this definition, BIS activation should occur whenever an approach-avoid, approach-approach or avoid-avoid conflict arises and should be thought of as more passive compared to the active avoidance of the FFFS (DeYoung, 2010a).

As mentioned earlier in descriptions of the BIS/BAS structure, the FFFS and BIS have often been conflated in research. This problem is compounded by the fact that the FFFS questions themselves are a subset of the original BIS questions in the BIS/BAS scales. A newer model of approach/withdrawal motivation aims to clearly separate the two constructs and explain various discrepancies in the existing literature. This model, often called the behavioral activation-behavioral inhibition model of anterior asymmetry

(BBMAA), differs from the original motivational direction model in a number of ways and is partially based on Gray and McNaughton's (2000) revision of the BIS/BAS to include the FFFS. Crucially, the BBMAA model posits that any form of behavioral activation, whether approaching a reward or avoiding a threat, would be left-lateralized while right frontal areas would direct any conflict-related inhibitions or increases in vigilance. This relegates both the BAS and FFFS to the left frontal hemisphere, with BIS-related processes taking place preferentially in the right.

In one study supporting this refined interpretation of the BIS, Wacker, Chavanon, Leue, and Stemmler (2010) found that participants who scored high on the BIS also exhibited more right frontal activation when inhibiting their response on a Go/No-Go task. They also showed a greater anterior shift in the P300 component, a common marker of response inhibition. Both findings further reinforce the role of the BIS as a conflict monitor. Other tests of the BBMAA model have produced results that directly contradict the original motivational direction model. In another study by the same authors, participants were first told to visualize different scenarios, such as having to take an important exam or being confronted by aggressive individuals in an alley at night (Wacker, Chavanon, Leue, & Stemmler, 2008). In each scenario, participants were told to imagine having to approach a threatening object or person (such as the professor administering the exam) in order to achieve a related goal. In one version, the scenario would end with the participant being told to visualize running away or otherwise actively avoiding the threatening stimulus (FFFS activation). In the other version, the scenario would end with the participant stuck in a state of indecision and unable to either approach or avoid the threat (BIS activation).

Wacker et al. (2008) found that the FFFS scenario resulted in less right frontal activity than the BIS scenario and participants' self-ratings of withdrawal/FFFS motivation correlated with greater left frontal activity. They also found that a measure of trait BIS sensitivity (designed to capture both BIS and FFFS) was differentially associated with frontal hemispheric asymmetries. Trait BIS sensitivity correlated with left frontal activity when the participant imagined the FFFS ending to the scenario and with right frontal activity when the participant imagined the BIS ending. The authors argue that this pattern of results is better explained by the BBMAA model as the original motivational direction model is unable to account for withdrawal motivation eliciting left frontal activation. Findings such as these illustrate the importance of including both the FFFS and BIS in any study involving motivational hemispheric asymmetries and of taking competing understandings of the BIS/BAS into account when constructing new theoretical models.

Even the more clearly defined BAS encounters replication problems, however. Wacker, Chavanon, and Stemmler (2010) reported results of four separate EEG studies, none of which found a link between BAS and left-frontal asymmetry. Shackman, McMenamin, Maxwell, Greischar, and Davidson (2009) also failed to find any correlations between BAS and frontal asymmetries, while Hewig et al. (2006) reported that individuals high in BAS had greater frontal activity in both hemispheres, not solely the left. The discrepancies are not limited to hemispheric asymmetries, as some findings have called into question the construct validity of the BAS scale itself. In one such example, Smillie and Jackson (2005) had participants either press a key to earn points (approach) or press a key to avoid losing points (active avoidance). Neither behavioral outcome was associated with the Carver and White BIS/BAS scales in any way. While the results aligned with the authors' conception of the BIS as uninvolved in active avoidance, they speculated that the original BAS measure needs additional empirical scrutiny and perhaps revision. However, other researchers have had greater success when testing BIS/BAS levels during realistic motivational situations, and have proposed them as superior alternatives to resting-state measures.

As the aforementioned Capability Model suggests, trait differences in approach and withdrawal motivation may not become apparent until a situation evokes them. Studies such as those by Berkman and Lieberman (2010) and Wacker et al. (2013) only found significant correlations between left frontal activation and BAS scores when participants were actively engaged in an approach-related task (e.g., when male participants were interacting with female experimenters they rated as highly attractive in the Wacker et al. study). These results further demonstrate the importance of the Capability Model and the need for realistic experimental tasks that evoke approach and withdrawal motivation. By relying predominantly on resting-state measures of the BIS and BAS alone, researchers may mistakenly conclude that those measures are uncorrelated with frontal hemispheric asymmetries, leading to further confusion in the field.

Findings on handedness and the BIS/BAS have been similarly conflicted. According to the evidence reviewed so far, the most likely prediction would be that left-handers, with their higher levels of right-hemisphere activation and withdrawal motivation, should score higher on the BIS while right-handers should score higher on the BAS for the opposite reasons. Hardie and Wright (2014) found partial support for this hypothesis. Consistent left-handers, who should theoretically employ more right-hemisphere processes, scored significantly higher on the BIS. However, their results varied depending on whether degree or direction of handedness was analyzed and whether handedness was considered a continuous or dichotomous variable. Wright, Hardie and Wilson (2009) found similar results regarding left-handers and the BIS, although they found that left-handed females were the only ones to score significantly higher than other participants. Beaton, Kaack and Corr (2015) also discovered that left-handers had higher BIS scores than right-handers. However, these differences vanished if they categorized participants by handedness strength/consistency instead of using a dichotomous left/right definition. Although the relationship between BIS and handedness varied slightly depending on the definition of handedness used, each study still found a significant relationship between the two variables while none of the studies found any such effect for the BAS. Since very few studies have specifically examined relationships between handedness and the BIS/BAS, more research is needed to explain this discrepancy. It would also be worthwhile to explore whether these associations become more readily apparent in a realistic experimental context.

Moving beyond the BIS/BAS. Although the BIS/BAS has largely dominated the field of approach/withdrawal research in recent decades, other ways of measuring behavioral motivation have been proposed. One such alternative is Eliot and Thrash's (2010) Approach-Avoidance Temperament Questionnaire, which has good test-retest reliability and offers an additional way of determining an individual's predisposition to approach or withdraw from a variety of threats and incentives. Elliot and Thrash's theory allows for the possibility that additional brain structures beyond those typically associated with the BIS/BAS are linked to approach and avoidance. They hypothesize that each of the two temperaments functions as a broad, partially independent yet interconnected neurobiological network.

The PANAS has also been used to measure approach and withdrawal motivation by equating them with positive affect and negative affect, respectively. Some criticisms leveled at this instrument include the opinion that likening motivational tendencies to affective tendencies is an oversimplification (a point further reinforced by Harmon-Jones' second motivational direction model). However, the PANAS does converge somewhat with the BIS/BAS, indicating that both may be tapping into similar latent variables. Gable, Reis, and Elliot (2000) found that positive affect as measured by the PANAS was predicted by BAS scores, while negative affect was predicted by BIS scores. Additionally, people who scored highly on the BAS reported more positive events in a weeklong diary study compared to those with low BAS. Participants high in BIS did not appear to encounter more negative events in their daily lives, but they did react more strongly to those negative events when they occurred. Using complementary measures such as the PANAS and the Approach-Avoidance Temperament Questionnaire may allow researchers to better answer some of the competing questions outlined in this section, such as the ongoing debate about the explanatory power and accuracy of the BBMAA and motivational direction models or the lack of consistent findings linking hemispheric asymmetries to BIS measures or handedness to the BAS. They may also help compensate for issues related to the construct validity and design of the BIS/BAS scales themselves.

Although there is ample evidence to indicate that a relationship between approach-avoidance motivation and hemispheric dominance likely exists, there are still a number of questions to address. Do measures of approach and withdrawal motivation such as the BIS/BAS relate to personality traits or political ideology measures, for instance? If so, do individuals with different handedness preferences, and by extension different hemispheric asymmetries, also show differences in those approach- and withdrawal-related traits across various psychological domains? Furthermore, if approach and withdrawal motivation exhibits relationships with both handedness and other personality or political measures, could it be acting as a mediator between them? The fundamental role of approach and withdrawal in many psychological variables makes this a tenable hypothesis. For instance, do left- and/or inconsistent-handers, who should exhibit greater withdrawal motivation as a consequence of their right-hemisphere asymmetries, also score higher on withdrawal-related personality traits because of that increased withdrawal motivation? Such a finding could indicate that approach and withdrawal motivations are accounting for at least part of the relationship between handedness/hemispheric asymmetries and various personality outcomes. If one wishes to answer this and other similar questions by using approach and withdrawal motivations as mediator variables, it is necessary to delve further into these constructs. One way to do this is by examining findings about approach and withdrawal motivations that come from other areas of inquiry, such as personality and political psychology.

Personality and Approach/Withdrawal Motivation

Applying the approach/withdrawal distinction in new domains. Although RST originally sprang from the animal literature, it has been readily adopted in recent years by psychologists who wish to explain phenomena as diverse as goal achievement, close relationship satisfaction, the underlying structure of the Big Five, and cognitive control. The increasing popularity of this theory is due in part to the belief that approach/withdrawal distinctions are broadly applicable across numerous domains, a view that makes sense in light of the hemispheric asymmetries literature outlined previously. If approach and withdrawal tendencies are indeed associated with hemispheric asymmetries and if they vary across individuals, this would suggest that an individual's brain-based predispositions toward approach and withdrawal could lead to similar patterns in their behavior, emotions, and personality. This hypothesis is supported by the fact that psychologists from different areas of inquiry have independently converged on the approach/withdrawal distinction, although they often call it by different names and measure it with dissimilar scales. For example, Gable et al. (2003) highlighted the commonality of the approach/withdrawal construct when they discovered that different measures of approach and withdrawal motivation shared a high amount of variance across four separate studies. These measures varied from coping scales to temperament scales to personality questionnaires, yet when combining the measures, the hypothesized two-factor solution was optimal, with appetitive (approach) items loading on one factor and aversive (withdrawal) items loading on another. The authors caution that their results do not imply that an approach/withdrawal component in one measure is identical to that found in another, but rather that processes in many different domains share important elements, one of which is the approach/withdrawal distinction.

The usefulness of the approach/withdrawal construct across disparate domains is illustrated by recent advancements in research on goal setting. In the past, self-esteem researchers did not typically divide goals into approach-oriented goals and avoidance-oriented goals. However, once they started employing that distinction, they discovered that high self-esteem was negatively associated with avoidance (compared to approach) goals (Heimpel, Elliot, & Wood, 2006). Park (2010) also found that self-confident individuals were more likely to set approach-motivated goals when faced with a threat to their self-image, while insecure individuals fell back on avoidance goals or simply decreased their approach motivation. Perfectionism, which relates to both goal-setting and self-esteem, has also been linked to approach and withdrawal motivation. Stoeber and Corr (2015) found that three different subtypes of perfectionism (self-oriented, other-oriented and socially prescribed perfectionism) all exhibited varying relationships with the BAS, BIS and FFFS scales from the Reinforcement Sensitivity Theory Personality Questionnaire (RST-PQ; includes four BAS subscales, a BIS scale, a separate FFFS subscale, and two subscales measuring “Fight” and “Panic”). For example, individuals high in self-perfectionism scored highly not only on the BAS scale, but on the BIS and the FFFS as well, emphasizing the multifaceted nature of the construct. Stoeber and Corr (2015) also discovered that the BIS and multiple RST-PQ BAS subscales mediated the relationship between perfectionism and positive and negative affect in various ways. For example, they found that BAS goal-drive persistence mediated the negative relationship between self-oriented perfectionism and negative affect, while the BIS mediated a positive relationship between the same two variables. These results provide additional support for the idea that approach and withdrawal motivation may function as mediating variables across many domains.

Individuals in close relationships who are more likely to set approach goals than avoidance goals also show different preferences for relationship qualities. Those who set a higher number of approach goals are more likely to rate passion as very important in a relationship, while those who prefer to set avoidance goals rate security as a more desirable trait (Gable & Impett, 2012). The research on goals and approach/avoidance motivation even extends into the physical health domain. Elliot and Sheldon (1998) had participants track both their personal goals and health issues for two months. They found that individuals who more frequently set personal avoidance goals complained of more physical ailments such as headaches, nausea, and shortness of breath. Findings such as these illustrate the prevalence of approach and avoidance motivations in day-to-day life and their psychological ramifications.

Combining RST and personality research. Studies from personality psychology that incorporate measures of approach/withdrawal are fairly common. This observation is easily explained by the fact that approach/withdrawal motivation has long been viewed as a personality trait itself, or at least a factor that influences other personality traits. Research on RST and approach/withdrawal scales naturally overlaps with research on other personality measures, such as the five-factor model developed by McCrae and Costa (1987). However, these two personality theories developed somewhat separately and researchers have only recently begun to study those areas of intersection in greater detail. Part of the reason for this lack of cohesion is that theoretical goals differed dramatically between developers of the RST, who favored a top-down approach, and developers of five-factor personality taxonomies such as the Big Five, who mostly employed a bottom-up, data-driven approach based on the lexical hypothesis (the hypothesis that words describing important personality traits in a society are added to its language over time). Smillie, Pickering and Jackson (2006) argue that trait measures of RST lack the psychometric rigor employed in other personality inventories and state that explanation of personality is only a “compelling by-product of RST” (p. 321). This is because RST was primarily conceptualized as a theory that would identify the neurophysiological correlates of positive and negative reinforcement. Nonetheless, explaining how these neurophysiological processes contributed to the formation of personality traits became an important goal for RST researchers. They suggested that punishment and reward sensitivity formed axes in the personality factor space, and they used inventories such as the Eysenck Personality Questionnaire (EPQ) to test that hypothesis (Eysenck & Eysenck, 1975). Gray, who developed the RST, proposed that rotating the EPQ domains of Extraversion and Neuroticism between 30 and 45 degrees should respectively form a reward sensitivity axis, also referred to as Impulsivity, and a punishment sensitivity axis he called Anxiety (Gray, 1970; Pickering & Corr, 2008; Zelenski & Larsen, 1999). By incorporating RST into Eysenck’s widely used personality theory, Gray paved the way for future research devoted to understanding how physiological aspects of the brain contribute to broader personality traits.

According to Eysenck’s theory of personality, introverts have greater cortical arousal than extraverts, and this high arousability explains their susceptibility to neurotic disorders (Eysenck & Levey, 1972). In Gray’s reworking of Eysenck’s theory, sensitivity to reward or punishment was instead considered to have greater explanatory value. Gray proposed that individuals high in Impulsivity were more sensitive to reward signals, while high-Anxiety individuals paid particular attention to signals of punishment.

Anxiety and Impulsivity became the primary axes, while Extraversion and Neuroticism were explained as combinations of an individual's sensitivity to reward and punishment and the experienced strength of a reward or punishment (Pickering & Corr, 2008). Psychoticism, the third component of Eysenck's personality structure, did not have a clearly defined role. In the decades following the development of RST and its subsequent revisions, many researchers converged on the findings discussed in the previous section: measures of BAS are generally associated with positive affect, while BIS and FFFS are associated with negative affect. This line of research quickly expanded to include analyses of Eysenck's original personality domains Extraversion and Neuroticism, and their relationships with affect and approach/withdrawal motivation.

Researchers have found that Anxiety does correlate positively with Neuroticism and negatively with Extraversion, as predicted by the original RST model (Gomez, Cooper, & Gomez, 2000). Studies conducted in the wake of the development of Gray's RST also support his predictions regarding Impulsivity, which has been shown to correlate positively with both Neuroticism and Extraversion (Gomez et al., 2000). However, the strength of these correlations differs markedly depending on the study, and some components of Impulsivity are even inversely correlated with the personality domain of Conscientiousness, in addition to Extraversion and Neuroticism (Whiteside & Lynam, 2001). When affect is added to the equation, this relationship becomes even more complicated. Typically, however, EPQ Extraversion is associated with greater susceptibility to experimentally-induced positive affect, while EPQ Neuroticism is associated with an increased propensity for experimentally-induced negative affect (Gomez, Cooper & Gomez, 2000).

These Neuroticism–negative affect and Extraversion–positive affect links have been supported by multiple empirical studies. Lucas and Fujita (2000) measured positive affect in a number of ways: the PANAS, a different daily measure of positive affect, and a joy scale. They also administered the NEO Personality Inventory (NEO-PI; Costa & McCrae, 1985), the EPQ and Goldberg's 10-item Extraversion scale, in addition to having the participants' peers complete extraversion ratings. Across the five studies, every measure of positive affect correlated with every measure of Extraversion, with correlations as high as .71 and an average Extraversion-positive affect correlation of .47. In a similar vein, Rusting and Larsen (1997) found that experiencing positive affect following pleasant imagery correlated with high levels of Extraversion, while high levels of Neuroticism predicted greater negative affect after viewing unpleasant images. In agreement with these previous findings, Gable et al. (2003) showed that negative affect and EPQ Neuroticism loaded on the same factor while positive affect and EPQ Extraversion loaded together.

Even experimentally manipulating state Neuroticism or Extraversion produces changes in experienced affect. McNiel and Fleeson (2006) had participants take part in two discussions. During the first discussion, one participant was told to act extraverted while one was told to act introverted; the roles were swapped for the second session. During all discussions, a neutral observer watched for changes in the participants' positive and negative affect. Afterward, participants completed self-reports of their positive and negative affect levels. McNeil and Fleeson found that when participants were instructed to act extraverted, both their self and other reports showed an increase in positive affect. In a second study using the same methodology, McNeil and Fleeson told participants to act neurotic during one discussion and stable during the next. When instructed to act neurotic, participants subsequently exhibited more negative affect than when told to act stable, but order mattered in this case: the increase in negative affect only happened when participants first were told to be stable and then were told to act neurotic. The researchers explained this discrepancy by invoking past research suggesting that outside observers have more difficulty judging internal traits such as Neuroticism, hence the greater variability in Neuroticism ratings. Regardless, their findings suggest that Extraversion and Neuroticism are not only correlated with positive and negative affect, but appear to exert a causal effect as well.

The findings are not as clear-cut when one examines Gray's initial factors of Impulsivity and Anxiety, however. Given that Impulsivity is most strongly linked to Extraversion in the original RST and Anxiety is most strongly linked to Neuroticism, one would expect Impulsivity to also correlate with positive affect and Anxiety with negative. Surprisingly, this does not seem to be the case. In a factor analysis of personality traits taken from Eysenck's, Gray's and Cloninger's taxonomies, Zelenski and Larsen (1999) found that three factors emerged: reward sensitivity, impulsivity-thrill seeking and punishment sensitivity. The researchers had participants record their global affect for four weeks while at home and work, and they also manipulated participants' affect by showing them positive or negative photos in the laboratory. Reward sensitivity was linked to greater positive affect in both real-life reports and laboratory settings, while punishment sensitivity was associated with more negative affect across the board. In comparison, impulsivity-thrill seeking had very small correlations with either positive or negative affect, suggesting that positive affect and Extraversion (with its reward-seeking components) are more closely linked than positive affect and Impulsivity.

These conflicting findings in the literature likely stem from issues related to the measurement and definition of both Extraversion and Impulsivity. Impulsivity has been folded into the current BAS, and the BAS now encompasses a greater proportion of items that relate to reward sensitivity and approach motivation, as well as items that could be considered more traditionally representative of Impulsivity. The current consensus is that the BAS appears to be more closely related to Extraversion than to Impulsivity, while the BIS is more closely related to Neuroticism than to Anxiety by itself. Smillie et al. (2006) found that measures of Impulsivity did not predict reward-contingent learning as well as EPQ-Extraversion, while Smits and Boeck (2006) cited numerous studies that found links between BIS and Neuroticism as well as BAS and Extraversion. Gable et al. (2003) also argue that Extraversion is an appetitive personality trait while Neuroticism is aversive. Additionally, Elliot and Thrash's (2002) article explaining their Approach and Avoidance Temperament model, a revision of the BIS/BAS, outlines similar findings. Measures of behavioral activation, Extraversion and positive affect all loaded on one factor that they termed Approach Temperament, while measures of behavioral inhibition, Neuroticism, and negative affect clustered together in the Avoidance Temperament factor. The authors contend that the measures comprising each factor share a common neurobiological core of either sensitivity to positive, rewarding stimuli or sensitivity to negative, punishing stimuli. Even Gray has acknowledged that the traits of Neuroticism and Extraversion (while still described as blends of Anxiety and Impulsivity) are more suitable proxies for the BIS and BAS, with Neuroticism being comprised of both BIS and FFFS elements (Gray & McNaughton, 2000).

These sensitivities to stimuli also translate into greater positive or negative affect in laboratory experiments, and the effect is mediated by Extraversion and Neuroticism. Larsen and Ketelaar (1989) gave either false negative feedback or false positive feedback to participants during an experimental task, with the intention that the negative feedback would be punishing and the positive rewarding. They found that individuals who were exposed to the rewarding, positive feedback and were also high in Extraversion showed a greater upward shift in mood compared to participants low in Extraversion. Participants high in Neuroticism who were also exposed to the punishing stimuli showed the most drastic increase in negative mood, while low Neuroticism seemed to act as a buffer of sorts and resulted in less of a negative mood change. This study, which clearly links sensitivity to reward and punishment with Extraversion, Neuroticism and affect, shows that even close to 30 years ago, researchers were beginning to recognize the importance of Extraversion and Neuroticism when studying approach and withdrawal motivations.

This theoretical shift away from Impulsivity and Anxiety and toward Extraversion, Neuroticism and the BIS/BAS is likely due to a corresponding shift in personality psychology toward a greater acceptance of Five Factor models as the dominant models in personality. For example, Elliot and Thrash used the NEO Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1989) in their exploration of approach and avoidance temperaments. Researchers no longer need to rely solely on measures such as the EPQ since they now have the ability to measure Agreeableness, Conscientiousness, and Openness/Intellect in addition to Extraversion and Neuroticism. Consequently, they are gaining a better understanding of how approach and withdrawal motivations might interact with personality facets and domains to produce positive or negative outcomes. This enhanced understanding of the neural mechanisms behind personality traits has already offered valuable insights into how the BIS/BAS may mediate relationships between brain structure and personality variables. It has also helped researchers formulate clearer hypotheses about the relative contributions of approach and withdrawal motivation to each of the Big Five personality traits.

Understanding the Big Five through an approach/withdrawal lens. Just as researchers have linked approach and withdrawal motivations to asymmetries in hemispheric activation, personality neuroscience researchers have begun to probe more deeply into the neurobiological substrates of the Big Five. Dopamine and serotonin, two neuromodulators that play a crucial role in countless human activities, have been shown to influence the development and expression of each Big Five trait, and these effects extend to the level above the original Big Five factors. Digman (1997) and DeYoung (2006) showed that two higher-order factors exist above the Big Five domains, and the existence of these two metatraits helps explain the previously puzzling but persistent intercorrelations among the Big Five. The first metatrait, Plasticity, includes the factors Extraversion and Openness/Intellect and is strongly associated with the dopaminergic system. Exploration, both cognitive and behavioral, is the core component of Plasticity (DeYoung, 2010b). In comparison, the metatrait Stability consists of Agreeableness, Conscientiousness, and reversed Neuroticism and is largely dependent on serotonin. It plays a chiefly inhibitory role and is involved in a variety of activities including suppressing antisocial impulses such as aggression and regulating one's mood (DeYoung, 2010b).

Genetic studies have found links between the serotonergic system and the three factors comprising Stability (Sen, Burmeister, & Ghosh, 2004; DeYoung, 2010b), as well as associations between Extraversion and dopamine (DeYoung, 2010b). More recent evidence also connects Openness/Intellect to greater dopaminergic activity (DeYoung, 2013). This is important for the study of approach and withdrawal motivations in the Big Five, as dopamine is linked to reward—specifically incentive responses to uncertainty. For example, increased firing of dopaminergic neurons occurs following an unexpected reward, which signals a greater likelihood of goal attainment and pushes the individual to engage in further exploration and approach behavior (DeYoung, 2013). As mentioned earlier, the BAS has also been directly linked to dopaminergic activity. Serotonin, conversely, is involved in restraining behavior and avoiding antisocial outcomes, and so could be perceived as withdrawal-related. Therefore, a general hypothesis about the relationship between approach/withdrawal and personality at the metatrait level would posit an association between Stability and withdrawal motivation, and between Plasticity and approach motivation. However, although there is some evidence to support this, the reality is more nuanced and requires a closer examination of each Big Five factor both at the domain level and the narrower aspect levels.

Extraversion. Extraversion is perhaps the most-studied Big Five domain and typically exhibits the greatest degree of overlap with approach motivation as measured by the BIS/BAS and similar scales. Smits and Boeck (2006) found that Extraversion related positively to all three BAS scales, with correlations reaching .69 for BAS-Fun seeking and Extraversion, but was negatively correlated with BIS. Segarra, Poy, Lopez, and Molto's (2014) results provided additional confirmation of this positive correlation between Extraversion and the BAS. Just as in Smits and Boeck's (2006) paper, Segarra et al. found that Extraversion exhibited the highest correlation with BAS-Fun Seeking (r = .45), but it also correlated with BAS-Reward Responsiveness (r = .27) and BAS-Drive (r = .24). Mitchell et al. (2007) used the NEO Personality Inventory – Revised (NEO-PI-R; Costa & McCrae, 1992) and a 48-item Sensitivity to Punishment (SP) and Sensitivity to Reward (SR) questionnaire (Torrubia, Avila, Molto, & Caseras, 2001) to test whether the five personality domains predicted reinforcement sensitivity scores. The results of their regression analyses were consistent with those of Smits and Boeck (2006): Extraversion was negatively associated with SP scores, but positively associated with approach-related SR scores. Finally, Keiser and Ross (2011) discovered that five of the six NEO-PI-R Extraversion facets positively predicted BAS scores (with the exception of the Warmth facet, which was found to have suppressor effects).

These findings are not surprising. According to DeYoung (2010b), Extraversion is the factor most synonymous with sensitivity to reward and positive affect. Examples of extraverted approach behaviors abound: being assertive at work, choosing to attend parties, enjoying conversations with new people, and readily taking charge in novel situations. Other items, such as laughing frequently, having fun, and showing one's feelings when happy clearly depict the relationship between Extraversion and positive affect. In the NEO Personality Inventory – Revised (NEO-PI-R; Costa & McCrae, 1992), one Extraversion facet is termed "Positive Emotions," and in the International Personality Item Pool-NEO (IPIP-NEO; Goldberg, 1999), the corresponding facet is labeled

“Cheerfulness,” emphasizing the overlap between Extraversion and positive affect. In addition to their empirical studies discussed earlier, Lucas and Fujita (2000) conducted a meta-analysis of 47 studies on Extraversion and positive affect. They found an average meta-analytic correlation of .37 between the two constructs, providing further support for the robustness of this relationship.

These connections between Extraversion and approach extend to the neural level, as some researchers have found commonalities in brain activation patterns among individuals high in both BAS and Extraversion. Gray et al. (2005) found that both higher Extraversion and BAS scores were associated with reduced activity in various brain regions (bilateral lateral PFC, bilateral parietal cortex and dorsal ACC) during a 3-back working memory task. To explain this result, the authors referred to previous findings that dopaminergic areas of the brain are involved in cognitive control and updating goal states, and that extraverts tend to have more active dopaminergic circuits than introverts. They hypothesized that this enhanced efficiency would explain the decreased hemodynamic response in the extraverts and high-BAS individuals during the working memory task. Some imaging studies have failed to find consistent results across high-BAS and high-Extraversion participants, however. Montag et al. (2013) showed that male participants high in Extraversion had larger volumes of gray matter in the left hemisphere than in the right. The results did not extend to female or high-BAS participants, illustrating the need for future research on this topic, but are interesting nonetheless as they support a link between the left hemisphere and the approach-related trait of Extraversion.

Additionally, results from fMRI and MRI studies depict strong associations between Extraversion levels and increased activity in various reward centers of the brain. Cohen, Young, Baek, Kessler, and Ranganath (2005) found that the more extraverted a participant was, the more activity he or she showed in the nucleus accumbens, orbitofrontal cortex (OFC) and amygdala after receiving a reward. Mobbs, Hagan, Azim, Menon, and Reiss (2005) also found increased activity in the orbitofrontal cortex for more extraverted participants when they viewed humorous cartoons, while DeYoung et al. (2010) reported positive correlations between Extraversion and increased medial OFC volume. Dopamine is critical to the function of many of these neural reward areas, and Extraversion specifically relates to one type of dopaminergic neuron (DeYoung, 2013). Value coding dopaminergic neurons vary their firing rates depending on the degree to which a given stimulus exceeds (or does not meet) expectations. For example, if an outcome was more rewarding than was predicted given prior experiences, the value coding neurons would increase their firing. These neurons differ in location and function from salience coding neurons, which appear to relate more strongly to Openness/Intellect and will be discussed in that section. Since value coding neurons relate particularly to unpredicted reward and the evaluation of new experiences, their connection to Extraversion provides another source of evidence linking approach motivation to this Big Five domain.

One intriguing question is whether different aspects of Extraversion may relate more or less strongly to approach behavior. The Big Five Aspect Scales (BFAS), developed by DeYoung, Quilty, and Peterson (2007) from factor analyses of the facets in each Big Five domain, measure two intercorrelated yet distinct aspects of each domain.

In the case of Extraversion, these two aspects are Assertiveness and Enthusiasm. DeYoung (2010b) notes that Assertiveness is more related to the dopamine-powered drive to achieve reward and "wanting" in general, whereas Enthusiasm, which consists of enjoying or "liking" social rewards, evokes more activity in endogenous opioid systems. Although both Assertiveness and Enthusiasm should be related to approach motivation, it is possible that Assertiveness could exhibit an even stronger correlation.

In line with this possibility, De Feyter et al. (2012) discovered that Extraversion had a positive, albeit indirect, effect on academic motivation, which they considered an approach motivation. At the same time, Extraversion had a direct and negative effect on actual academic performance. They hypothesized that while highly extraverted students have the drive and motivation to study and attain rewards (similar to Assertiveness), they simultaneously want to socialize instead of study (similar to Enthusiasm), which leads to conflicting academic outcomes. This could also help explain the findings of Bipp, Steinmayr, and Spinath (2008), who found that although Extraversion was inversely related to avoidance goals in work performance, as expected, it was not positively related to approach performance goals. Finally, researchers have found that the relationship between Extraversion and work performance varies depending on the specific subset of approach motivation being measured. Barrick, Stewart, and Piotrowsky (2002) measured three different types of approach motivation in the work environment: accomplishment striving, communion striving and status striving. Employees who were highly extraverted engaged more frequently in status striving, and status striving mediated the positive correlation between Extraversion and job performance. However, the other two types of motivation did not.

The downside to these studies is that although they included behavioral measures akin to Enthusiasm and Assertiveness, they did not directly measure those two BFAS aspects. Therefore, no conclusions can be made about the strength of the relationships between Enthusiasm and Assertiveness and broader approach motivation. However, one of the most comprehensive analyses to date of the relationship between approach motivation and the two BFAS aspects of Extraversion helps answer this question. Quilty, DeYoung, Oakman, and Bagby (2014) tested a number of possible solutions for modeling an approach factor comprised of both BAS sensitivity and extraversion. Using a number of measures including the BAS scales, the Extraversion facets from the NEO PI-R, and the BFAS, they found that the best solution consisted of three factors: assertiveness, enthusiasm and sensation seeking. The two BFAS aspects of Extraversion, Enthusiasm and Assertiveness, loaded strongly on their eponymous factors, while the less-related factor of sensation seeking was associated with multiple subsets of an impulsivity scale. The BAS Drive scale loaded most strongly on assertiveness, the BAS Reward Responsiveness scale loaded on enthusiasm, and the BAS Fun-Seeking scale loaded on sensation seeking. Another interesting finding was that the NEO PI-R facet of Positive Emotions loaded on the enthusiasm factor, which provides additional information about precisely how positive affect may be linked to general approach motivation. In summary, Quilty et al.'s results confirm and extend other findings strongly linking Extraversion with approach motivation, while their discovery of negative correlations between Neuroticism and the factors of assertiveness and enthusiasm further reinforces earlier claims regarding Neuroticism.

Neuroticism. While Extraversion appears to be the Big Five domain most closely related to approach motivation, Neuroticism is the top candidate for the domain that best encompasses withdrawal motivation: One of the two BFAS aspects of Neuroticism is even called Withdrawal. As expected given previous research using other personality measures, researchers who investigate correlations between the Big Five and the BIS/BAS typically find a strong BIS-Neuroticism association and a negative association with the BAS subscales (Smits & Boeck, 2006; Gable, Reis, & Elliot, 2003). Mitchell et al. (2007) found that NEO-PI-R Neuroticism was the best predictor of Sensitivity to Punishment scores, while Keiser and Ross (2011) and Segarra et al. (2014) showed that NEO-PI-R Neuroticism positively predicted both BIS and FFFS scores. In their model of approach motivation, Quilty et al. (2014) demonstrated negative correlations between Neuroticism and the enthusiasm and assertiveness factors derived from the model.

A few researchers have attempted to identify longitudinal (and perhaps causal) relationships between the BIS and Neuroticism by first measuring broad temperamental factors related to motivation in early childhood and then following up with personality measures in later adolescence and young adulthood. One such study by Deal, Halverson, Havill, and Martin (2005) first had teachers rate children kindergarten-age children on a temperament scale of impulsivity and inhibition, which they equated to measures of the BAS and BIS (unfortunately relying on the older construal of the BAS as impulsivity-driven). Once the children reached high school and college, their parents rated their adolescent or adult children's personalities on Big Five traits using the NEO-FFI (Costa & McCrae, 1992). Deal et al. found that the children who were categorized by their teachers as high in both impulsivity and inhibition received higher ratings in Neuroticism from their parents over a decade later and were specifically rated as more antagonistic, negative, and fearful.

Neuroimaging studies provide further support for the hypothesis that withdrawal motivation and negative affectivity form the core of Neuroticism. Neuroticism is associated with increased resting activity in areas such as the amygdala, insula, and anterior cingulate cortex (ACC), all of which play a role in conflict detection or in processing threatening or punishing stimuli (DeYoung, 2010a). When new or threatening stimuli are presented, these brain areas also show heightened activation in neurotic individuals compared to more emotionally stable ones. For example, Gray et al. (2005) discovered that participants with increased Neuroticism and heightened BIS sensitivity showed greater rostral ACC activation during a 3-back working memory task (a challenging task that requires frequent updating of information). Neuroticism has also been directly linked to the hemispheric asymmetries discussed throughout this literature review. When participants high in Neuroticism viewed a face gazing directly at them, they showed greater relative right-frontal EEG activity (Uusberg, Allik, & Hietanen, 2015). Not only is this finding in the expected direction based on previous research on hemispheric asymmetries and withdrawal motivation, but it was also driven by the BFAS Withdrawal aspect of Neuroticism. This lends greater credence to the authors' argument that the right-hemisphere activity represented participants' desire to avoid faces with anxiety-inducing direct gazes.

Numerous empirical findings suggest that neurotic individuals will mentally withdraw from tasks sooner than other individuals and are less motivated to complete tasks or perform well on them. For example, Pailing and Segalowitz (2004) found that

Neuroticism predicted how invested a person was in a task. The researchers measured error-related negativity ERP components, which are electrophysiological brain responses that peak 40-100 ms after a participant makes an error (in this case, an incorrect key press). Individuals low in Neuroticism showed consistently high error-related negativities (ERNs) throughout the trials, regardless of the incentives for accuracy. According to the researchers, this indicated their strong motivation to perform well at the task. Highly neurotic individuals, on the other hand, showed a lack of overall motivation: they exhibited greater ERNs only when the rewards for accuracy were very high, and their ERNs decreased as the study progressed, suggesting disengagement or withdrawal from the task. Komarraju, Karau, and Schmeck (2009) also found evidence in the academic domain that individuals high in Neuroticism show more disengagement and lack of motivation. They reported that neurotic individuals scored higher on measures of amotivation, a construct that indicates a lack of both intrinsic and extrinsic motivation and a failure to respond to environmental influences in educational settings. Lounsbury, Sundstrom, Loveland, and Gibson (2003) also found a significant negative relationship between academic motivation and Neuroticism. Robinson (2007) suggested that this amotivational tendency likely springs from neurotic individuals' weakened ability to employ various forms of cognitive control.

Other results paint a more complex picture, however. In contrast to the studies above, some researchers have found no significant influence of Neuroticism on academic motivation or achievement (Heaven & Ciarrochi, 2012; Chamorro-Premuzic & Furnham, 2008), and a meta-analysis of 80 studies by Poropat (2009) agreed with those findings. De Feyter et al. (2012) did discover a positive indirect effect of Neuroticism on academic motivation and achievement. However, it only appeared when coupled with high levels of Conscientiousness and self-efficacy, and the researchers stated it was likely not due to any sizeable benefit conferred by Neuroticism itself. Instead, they suggested the effect was due to students with very high levels of Emotional Stability failing to study for tests since they were overconfident that they would succeed. In another apparently contradictory finding, Bipp et al. (2008) discovered that all six facets of Neuroticism in the NEO-PI-R were positively related to approach goal orientation in academic work. At the same time, however, they found that five of the six NEO-PI-R facets were positively related to avoidance goal orientation and one facet was related to work avoidance.

These mixed findings could be explained by a more detailed examination of the two BFAS aspects comprising the larger Neuroticism domain. The first aspect of Withdrawal, in accordance with its name, should be associated with greater withdrawal motivation, inhibition of responses, and sensitivity to threat. This hypothesis is supported by multiple studies, including the aforementioned results from Uusberg et al. (2015) and Quilty et al.'s (2014) discovery that the Withdrawal aspect was chiefly responsible for the negative correlation between Neuroticism and assertiveness and enthusiasm. The second aspect of Volatility could show somewhat different associations. Volatility is more strongly associated with negative emotions such as anger (DeYoung, 2010a), and the BFAS Volatility items describe people who are easily irritated, angered, and annoyed and whose emotions vary widely. As previously discussed, trait and state anger are related to increased left-frontal activation and anger is considered an approach motivation. DeYoung (2010a) even suggests that Volatility could serve as an indicator of individual FFFS levels. Therefore it is quite possible that Volatility would show a weaker association with withdrawal motivation and a stronger one with approach motivation. This potentially significant difference highlights the importance of using aspect scales such as the BFAS alongside broader measures of the Big Five domains when studying approach and withdrawal motivations.

The next two domains of the Big Five that will be discussed—Conscientiousness and Agreeableness—resist ready classification into an approach/withdrawal taxonomy. This is partially due to the high degree of overlap between Extraversion and Neuroticism (but not the other Big Five factors) and the original BAS and BIS. Openness/Intellect seems more likely to be associated with approach than withdrawal motivation, although this prediction is not as well supported as the prediction that Extraversion is associated with approach. Another part of the problem is the abundance of research on Extraversion and Neuroticism and the paucity of research on the remaining Big Five domains, although researchers have started closing the gap in recent years. This growing literature allows for hypotheses linking approach and withdrawal motivations to Conscientiousness, Agreeableness and Openness/Intellect, but the connections are more tenuous, making this area ripe for future exploration.

Conscientiousness. Research on Conscientiousness is emblematic of this convoluted state of affairs. Several researchers have found connections between Conscientiousness and behaviors suggestive of approach motivation. The theoretical justification for this link is that since Conscientiousness includes a constellation of behaviors directed toward goal attainment—carrying out plans, tidying up, getting down to work quickly, maintaining a strong sense of purpose—it must be strongly related to approach motivation. In support of this view, Conscientiousness has been found to positively relate to intrinsic and extrinsic academic motivation, GPA, approach performance goals, and overall academic success, and it is the best predictor of GPA and academic motivation among the Big Five (Bipp et al., 2008; McGeown et al., 2014; Komarraju et al., 2009; De Feyter et al., 2012). Poropat's (2009) meta-analytic results indicate that Conscientiousness scores are as good a predictor of academic grades as measures of intelligence. Two influential meta-analyses also agree that Conscientiousness is the best predictor of performance in the workplace among the Big Five, regardless of job type or job performance criteria (Barrick & Mount, 1991; Hurtz & Donovan, 2000).

Although these results seem to support a relationship between Conscientiousness and approach motivation, the causal mechanism behind the findings is unclear. As De Feyter et al. (2012) observed, the connection between Conscientiousness and academic success could be due to approach motivation, so that conscientious students are more driven to outperform their classmates, earn good grades, and succeed in the academic arena. Conversely, the effect could be due to withdrawal or avoidance motivation. Conscientious students may excel academically because of their fear of failure and bad grades as well as their desire to avoid punishment. Additionally, the inclusion of Conscientiousness in the Stability metatrait (related to behavioral restraint and inhibition of antisocial behaviors) provides some empirical backing for the hypothesis that individuals high in Conscientiousness will also demonstrate greater withdrawal motivation.

In an effort to elucidate this matter, Smits and Boeck (2006) had participants complete the BIS/BAS and the NEO-FFI. They hypothesized that since BAS-Fun Seeking is strongly related to impulsivity and Conscientiousness is negatively correlated with impulsivity, they would find a negative relationship between the two. Their results confirmed this, and in one of their two studies, they also found a positive correlation between BAS-Drive and Conscientiousness. Interestingly, in a model where all correlations among the Big Five variables were set to zero to reduce suppressor effects, BIS and Conscientiousness were positively correlated. Segarra et al. (2014) also found that Conscientiousness positively correlated with BAS-Reward Responsiveness and negatively correlated with BAS-Fun Seeking. They, too, identified a positive relationship between Conscientiousness and the BIS, although they also noted that the FFFS was negatively correlated with Conscientiousness.

Mitchell et al. (2007) uncovered a positive relationship between Conscientiousness and Sensitivity to Punishment. However, their results diverged from those of Smits and Boeck and Segarra et al. since Mitchell et al. reported a negative relationship between Conscientiousness and Sensitivity to Reward. In a replication and extension of the Mitchell et al. and Smits and Boeck studies, Keiser and Ross (2011) discovered that two NEO-PI-R Conscientiousness facets were positive predictors of BIS scores (Deliberation and Order) while two others negatively predicted BIS scores (Self-Discipline and Competence). However, they found no significant correlations between overall Conscientiousness and the BAS, although a few facets exhibited positive or negative correlations. It is possible that the lack of a significant correlation between the BAS and Conscientiousness was due to Conscientiousness' opposing relationships with BAS subscales, but this cannot be confirmed as Keiser and Ross omitted the subscales in their analyses.

Conscientiousness, then, does not seem to have an explicit connection to either approach or withdrawal motivation but appears to be some combination of the two. Additional research is needed to clarify the contributions of each type of motivation. DeYoung (2013) describes Conscientiousness as a trait that enables top-down, effortful control of behavior, allowing one to pursue far-off goals instead of giving in to instant gratification. When viewed through this lens, one could see how both approach and withdrawal motivations interact to produce Conscientious behavior: The pursuit of far-off goals requires approach motivation, while the effortful control of behavior inhibits impulses and sensitizes the individual to the potential consequences of succumbing to immediate desires. As before, examining the two BFAS aspects of Conscientiousness, termed Industriousness and Orderliness, could furnish additional insights into the motivational structure of Conscientiousness. Evidence from DeYoung (2013) even suggests that Industriousness has a large Plasticity component, which could result in a stronger correlation with approach motivation. Orderliness, however, seems likely to depend on withdrawal motivation, since the two similar NEO-PI-R facets of Deliberation and Order positively correlate with the BIS (Keiser & Ross, 2011). Quilty et al.'s (2014) results provide some initial evidence in favor of this possibility. In two samples, the approach factors of assertiveness and enthusiasm positively correlated with the Industriousness aspect. However, the Orderliness aspect only demonstrated a positive correlation with the assertiveness and enthusiasm factors in one of the three samples, indicating a somewhat weaker and more inconsistent relationship between the constructs. Orderliness and overall Conscientiousness also exhibited negative correlations with the sensation seeking factor, whereas Industriousness only showed a weaker negative correlation with that factor in one study. Additional studies are needed to test whether these results generalize to other samples as well as to other measures of approach and withdrawal beyond the BIS/BAS.

Agreeableness. Agreeableness is another personality domain that seems to combine elements of approach and withdrawal motivation. When Smits and Boeck first published a paper on the Big Five and the BIS/BAS in 2006, they explained that they could not make a priori predictions about Agreeableness as no other studies on the topic had been conducted. Their results from two models showed a positive correlation between Agreeableness and BIS and a negative correlation with BAS-Drive. In one model that allowed for correlations among the Big Five, they also found a negative correlation between BAS-Fun Seeking and Agreeableness but added that this finding should be considered less reliable. Their post hoc explanation was that BIS increases Agreeableness by preventing socially undesirable behaviors so that one is not punished, while people higher in BAS-D actively pursue their own goals, likely at the expense of others' goals, and are therefore less agreeable. Shortly after Smits and Boeck reported their findings, Mitchell et al. (2007) published similar results that showed Agreeableness related negatively to SR and positively to SP. Keiser and Ross (2011) also found that Agreeableness correlated positively with the BIS and negatively with the BAS, while Segarra et al.'s (2014) results showed a positive association with the BIS and a negative association with the Drive and Fun Seeking BAS subscales. Bipp et al. (2008) also reported that two subfacets of Agreeableness on the NEO-PI-R correlated negatively with approach goals, while Robinson (2007) noted that Agreeableness was highly correlated with measures of self-regulation. These studies suggest a link between Agreeableness and withdrawal motivation, but other findings on academic achievement and goals make this association somewhat murkier.

Komarraju et al. (2009) discovered that Agreeableness was negatively associated with amotivation, meaning that agreeable individuals were more likely to be academically motivated and to stay engaged in their work. Moreover, Straightforwardness, a facet of Agreeableness, was negatively related to measures of work avoidance (Bipp et al., 2008). De Feyter et al. (2012) also reported a positive association between academic achievement and Agreeableness. However, this association did not extend to academic motivation, leading De Feyter et al. to hypothesize that agreeable individuals succeed in school by using their cooperative and prosocial talents, not by working harder or displaying more goal-driven behavior. Finally, Poropat's (2009) meta-analysis showed a small but significant positive relationship between Agreeableness and academic performance, although the effect was largest in primary-school students and waned substantially as they aged.

There is a strong possibility that separating Agreeableness into its two BFAS aspects of Compassion and Politeness could account for some of the variability in these findings. Compassion, which consists of a strong interpersonal orientation and a tendency to display empathy, could be considered more of an approach-motivated aspect, while politeness, with its accompanying emphasis on adhering to social norms, could be considered a withdrawal-oriented aspect (Hirsh, DeYoung, Xu, & Peterson, 2010). Additionally, the negative association between high Agreeableness and increased anger and aggression (approach-oriented emotions) could be complicating the findings. Again, findings from Quilty et al. (2014) support this interpretation of the complex relationship between motivation and Agreeableness. Compassion was found to positively correlate with the enthusiasm approach factor, as was overall Agreeableness, and it was also correlated with the assertiveness factor, albeit less strongly. Politeness, on the other hand, was negatively correlated with both sensation seeking and assertiveness, as would be expected due to its conceptual associations with avoidance and withdrawal. It is necessary to confirm these findings using new samples and measures in order to identify the various motivational factors driving this split domain and to explore its relationship with other key systems such as the FFFS.

Openness/Intellect. The final domain, Openness to Experience or Openness/Intellect, falls under the Plasticity umbrella and so, like Extraversion, could theoretically be an approach-oriented domain. Smits and Boeck (2006), who again commented on the lack of prior research on the BIS/BAS and Openness/Intellect, found a positive correlation between Openness/Intellect and BAS-Fun Seeking. McGeown et al. (2014) and Komarraju et al. (2009) also found positive associations between Openness/Intellect and intrinsic academic motivation, further supporting the hypothesis that Openness/Intellect and approach motivation are interconnected. Similarly, Bipp et al. (2008) found that the majority of NEO-PI-R Openness/Intellect facets were correlated with approach-related learning goals (although the Values subfacet was negatively correlated). According to Quilty et al. (2014), the enthusiasm and assertiveness factors were positively correlated not just with the overall Openness/Intellect domain but with both individual aspects (Openness and Intellect) as well. Furthermore, the Openness/Intellect domain and aspects also showed positive associations with sensation seeking, making it the domain most strongly related to overall approach motivation besides Extraversion. There is also evidence that Openness/Intellect is negatively correlated with avoidance and withdrawal motivation. Deal et al. (2005) found that children who were initially rated as more inhibited by their teachers were rated as lower in openness by their parents later in life.

Although this pattern of findings is convincing, some results are inconsistent with this general consensus. For example, De Feyter et al. (2012) noted that participants high in Openness/Intellect did not show any corresponding increase in academic motivation or performance, but were instead slightly more likely to exhibit reduced academic motivation. However, De Feyter et al.'s results were from a single longitudinal study and they disagree with Poropat's (2009) meta-analysis, which found a moderately sized positive correlation between Openness and academic performance. It is also possible that Openness/Intellect is related to withdrawal motivation due to a shared association with uncertainty. Since the BIS is thought to handle conflict monitoring and choosing between multiple response options, it could positively relate to Openness/Intellect due to the domain's connections to in-depth cognitive processing and openness to alternatives. Evidence for such a relationship is lacking in the literature, however.

Dopamine's prominent role in Openness/Intellect provides additional support for the hypothesis that this domain is coupled with approach motivation more than withdrawal motivation. First, dopamine is responsible for reward-driven, exploratory approach behaviors. Furthermore, Intellect is positively associated with working memory capacity (DeYoung, Shamosh, Green, Braver, & Gray, 2009) which in turn is associated with prefrontal areas, and two genes that contribute to dopamine activity in the prefrontal cortex have been directly linked to individual levels of Openness/Intellect (DeYoung et al., 2011). This is important as the majority of hemispheric motivational asymmetry studies reviewed here focus on prefrontal areas. Studies such as this one could therefore help explain in more detail why prefrontal areas are so frequently implicated in motivational processing. DeYoung (2013) also posits that two separable dopaminergic systems are responsible for Extraversion and Openness/Intellect: one strongly activates motivation and reward areas, and one strongly activates higher cognitive areas. In contrast to value coding neurons, which typically activate reward-related areas and are crucial for Extraversion, salience coding neurons are more closely tied to Openness/Intellect and higher cognitive processes (DeYoung, 2013). These salience coding neurons fire in response to any increase in uncertainty that is generated by unexpected punishment, unexpected reward, or any unexpected stimulus. An upswing in uncertainty serves as a signal that new information is available and could have value. This in turn leads to searches for additional information and further cognitive exploration, all of which are highly reminiscent of approach-motivated behavior. However, paying attention to the aspect level is once again important in this case. Intellect is hypothesized to be more highly correlated with Plasticity and increased dopamine levels than Openness, with its stronger connections to aesthetics and the opiod system (DeYoung, 2013). This suggests that Intellect may have more approach-related components than Openness. It could be interesting to compare the two in real-life behavioral contexts involving decisions to approach or withdraw from a stimulus, as those types of situations are known to elicit more subtle distinctions than typical resting-state analyses or questionnaire measures.

In summary, each of the Big Five domains has demonstrable connections to approach and withdrawal motivation that can be detected through traditional questionnaires but are also apparent in various real-world circumstances: in childhood, at school or the workplace, during working memory tasks, or when viewing someone else's face and gaze direction. However, some of these connections are still unclear or contradictory, while others require additional replication using new methods and samples. Most importantly, it is necessary to explore the "why" behind these associations. In other words, why does the BAS tend to correlate with measures of Extraversion and Openness, and the BIS with other domains such as Conscientiousness? Is this due to genetic influences, brain structure, or environmental factors? Does one lead to the other, do both develop as a result of some separate underlying cause, or does one account for variance in a relationship between the other and a third variable?

In order to test approach and withdrawal motivations as potential mediator variables linking handedness and cerebral hemispheric differences to scores on the Big Five domains, one must first determine the correlations between each domain and measures of approach and withdrawal. This review serves as an initial step toward this goal and gives rise to many possible questions worthy of further investigation. For instance, since research suggests that BFAS aspects such as Compassion and Industriousness have a strong approach component, do right-handers, who should exhibit a frontal left-hemisphere bias and potentially greater BAS activity, also score higher on those two aspects? The approach and withdrawal components of the Big Five reviewed here should serve as a basis for the formation and testing of informed hypotheses about these questions.

Maladaptive personality traits. Given that the Big Five exhibit correlations with approach and withdrawal motivation, a natural follow-up question is whether these correlations also appear in maladaptive personality traits. The Personality Inventory for the DSM-5 (PID-5; Krueger et al., 2012) has a five-factor structure like the Big Five, but instead measures pathological personality traits and can be used to diagnose clinical patients. Therefore, it provides a good opportunity to test whether approach/withdrawal motivations also contribute to maladaptive personality traits. The question is of particular relevance for this review, as many studies discussed in the first section associated handedness with measures of psychopathology. If approach and withdrawal motivations do mediate the relationship between handedness and personality, it is plausible that this model will also hold true when maladaptive personality is the criterion variable.

The PID-5 has a total of 25 maladaptive traits or facets that cluster into five overarching domains, each of which empirically aligns with a similar Big Five domain. Gore and Widiger (2013) found that Agreeableness was inversely correlated with Antagonism and Neuroticism was positively correlated with Negative Affectivity. Extraversion negatively related to Detachment, while Conscientiousness was negatively associated with Disinhibition. Openness/Intellect was also positively associated with Psychoticism, although this correlation was somewhat weaker. Thomas et al. (2012) reported similar findings, although they found only a weak correlation between Conscientiousness and Disinhibition. DeYoung, Carey, Krueger, and Ross (2016) found evidence that suggested this weaker association may be due to the disparate effects of the two Openness/Intellect aspects, as they reported that after partialling out shared variance with Intellect, Openness loaded on the same factor as PID-5 Psychoticism.

Just as Openness/Intellect should theoretically be more approach-driven because of its connection to the dopaminergic system, Psychoticism could show a similar association. A meta-analysis by Howes et al. (2012) concluded that presynaptic dopaminergic function is elevated in people with schizophrenia. The Psychoticism domain contains items that also describe positive schizophrenia, so it is likely that people who score highly on Psychoticism also exhibit high levels of dopamine. Since higher levels of dopamine indicate greater reward sensitivity and approach tendencies, it is possible that individuals scoring highly on Psychoticism would also exhibit greater approach motivation as measured by inventories such as the BIS/BAS. However, negative symptoms of schizophrenia, which include the inability to take pleasure in daily life and the inability to complete planned activities, are likely more related to withdrawal motivation and could complicate the relationship.

Other PID-5 domains, such as Detachment and Antagonism, have also been shown to relate to approach and withdrawal motivation. According to Papousek et al. (2018), participants high in Antagonism showed more left prefrontal EEG activation when they heard audio recordings of angry expressions, whereas participants high in Detachment showed more right prefrontal EEG activation during clips of individuals crying. Combining these findings with Gore and Widiger's and Thomas et al.'s evidence regarding the inverse relationship between Detachment and Extraversion, one could hypothesize that individuals who score high in Detachment will also have higher BIS and withdrawal scores and will be more likely to be left- or mixed-handed due to right hemisphere withdrawal biases. Antagonism could be hypothesized to show the opposite pattern due to its connection to approach motivation. Negative Affect could also be linked to withdrawal motivation and therefore left- or inconsistent-handedness given previous research on PANAS-NA and withdrawal motivation.

Hypotheses such as these can be formulated for each of the broad PID-5 domains, but some of the 25 facets may also be more likely than others to exhibit strong approach/withdrawal associations. For example, Withdrawal, Depressivity, and Restricted Affectivity appear at face value to be good candidates for withdrawal-oriented traits that would correlate with the BIS (although the PID-5 Withdrawal facet focuses more heavily on withdrawal from social interactions rather than broader anxiety). Other traits such as Impulsivity, Risk-Taking and Attention-Seeking could be more closely related to approach motivation and the BAS. Preliminary evidence for the Impulsivity-BAS relationship comes from Ross, Benning, Patrick, Thompson, and Thurston (2009), who found that a similar (non-PID-5) trait of impulsive antisociality was associated with higher BAS scores. However, most hypotheses regarding the PID-5, especially at the facet level, should be considered exploratory due to a paucity of research. The PID-5 was developed fairly recently which likely explains the lack of studies associating the PID-5 with the BIS/BAS. However, the similarity across the two five-factor models and the limited evidence to date suggests that the maladaptive PID-5 domains should relate to measures of approach and withdrawal motivation, making this a promising topic for future research.

Political Ideology and Approach/Withdrawal Motivation

Given personality's strong biological and genetic underpinnings, it makes sense to investigate whether specific brain structures and hemispheric asymmetries contribute to its development and expression. So far, the evidence summarized in this review suggests that approach and withdrawal motivations contribute to, or are at least associated with, individual differences in personality. Furthermore, there is reason to hypothesize that these contributions could be related to differential activation of frontal areas in the right and left hemispheres, and therefore differences in handedness. These same neural mechanisms that potentially contribute to the development of Big Five and PID-5 personality traits could theoretically aid in the development of other types of personality traits. Political ideology, for instance, is an excellent candidate variable that could also be affected by approach and withdrawal motivation and hemispheric asymmetries. Like the Big Five domains, it has a neural basis and high heritability (Alford, Funk & Hibbing, 2005; Koenig & Bouchard, 2006), and social-cognitive psychologists have examined its relation to approach and withdrawal motivation.

It is also quite plausible that any underlying motivational mechanisms driving the formation of political ideology would mirror those involved in the construction of Big Five personality traits, as some researchers consider political ideology to be either synonymous with personality or a subset of it. Some recent findings do align with the view that personality does not cause political ideology, but rather that the two share a common underlying genetic cause (Verhulst, Eaves, & Hatemi, 2012). Hatemi & Verhulst (2015), for example, found that changes in personality over a 10-year time span did not accompany significant changes in political ideology, as they should have if personality caused political ideology and there was no third variable masking shifts in the opposite direction. Others, such as Block and Block (2006), Perry and Sibley (2012) and Duckitt and Sibley (2010), have argued that the empirical evidence suggests political ideology arises from personality traits in a unidirectional fashion.

However, the direction of the causal arrow does not particularly matter in this specific case. If personality and political ideology both spring from the same genetic source, that makes it more likely that both constructs are influenced by the same hemispheric and motivational asymmetries. If political ideology is instead derived from personality, it should also be shaped by the same approach and withdrawal motivations that help form the Big Five (although the relationships may be weaker and more subject to influence by other factors). Either way, the high degree of overlap between political ideology and personality suggests that any Big Five findings relating to motivation could correspondingly apply to the political domain. Levels of approach and withdrawal motivation may predict whether someone is politically liberal or conservative, just as they may predict whether someone is extraverted or neurotic.

Associations between the Big Five and political ideology. Researchers have learned that certain Big Five domains are regularly associated with liberalism or conservatism, and these discoveries provide a good starting point for formulating hypotheses about approach and withdrawal motivation in relation to political ideology. One of the strongest and most consistent findings is that conservatism is negatively associated with Openness/Intellect, while liberalism is positively correlated with it (Hirsh et al., 2010; Gerber, Huber, Doherty, Dowling & Ha, 2010). Hirsh et al. and Gerber et al., along with numerous others, also found that Conscientiousness is higher in conservatives and is driven mainly by the Orderliness aspect (Hirsh et al., 2010). Carney, Jost, Gosling, and Potter (2008) reported that these differences even appeared when independent observers rated the bedroom décor of liberals and conservatives. Bedrooms belonging to liberals contained more books, music and colors, all of which are considered characteristics of Openness/Intellect. Conservatives' bedrooms, in line with their greater tendency toward Conscientiousness, were cleaner, brighter-lit and contained more organizational items such as sewing kits or calendars. These two personality traits may also drive changes in political attitudes over time. A longitudinal study by Ekstrom and Federico (2018) showed that individuals high in Conscientiousness became more conservative and identified more strongly as Republicans over the course of the 2008 presidential campaign, while high scores in Openness/Intellect predicted a greater tendency to identify as Democratic and liberal later in the campaign.

The remaining three Big Five domains do not show the same clear divisions along ideological lines. Neither Neuroticism nor Extraversion appears to consistently correlate with political ideology in the same way across different studies (Carney et al., 2008; Jost, 2006). Carney et al. analyzed personality and political inventories from six large samples of participants and discovered that conservatism was negatively correlated with Neuroticism in two samples but positively correlated with it in one sample. However, all the effects were small. Mondak (2010) and Gerber et al. (2010) provided stronger evidence for this claim, as both found significant positive correlations between Emotional Stability (reverse-scored Neuroticism) and conservatism. In Gerber et al.'s study, this correlation was strongest for economic conservatives.

Many other studies on the Big Five and political ideology have failed to find any such effects. This extends to the Extraversion domain as well, although there have been a few notable exceptions. Results from a study by Caprara, Barbaranelli, and Zimbardo (1999) indicated that conservative individuals tend to be more extraverted, and a follow-up study by Caprara, Barbaranelli, Consiglio, Picconi, and Zimbardo (2003) extended this finding to conservative politicians. In addition, Ekstrom and Federico's (2018) longitudinal research found that more extraverted individuals tended to become increasingly conservative over the course of the presidential campaign. Gerber et al. (2010) also found weak evidence for a positive association between conservatism and extraversion. On the other hand, Carney et al. (2008) found the same association in just one of six samples, rendering it effectively a null finding. Rentfrow, Jost, Gosling, and Potter (2009) also found that states with more extraverted populations tended to vote for more liberal candidates. Therefore, if Extraversion does correlate with ideology, the effect is smaller than the more reliable findings regarding Openness/Intellect and Conscientiousness.

The literature on Agreeableness and political ideology has been similarly muddled, but this is likely because the two halves of the Agreeableness domain show different associations with political ideology. Liberals score higher on the BFAS Compassion aspect of Agreeableness, but conservatives exhibit greater levels of Politeness (Hirsh et al., 2010; Osborne, Wootton, & Sibley, 2013). This finding confirms the importance of using aspect scales, since many earlier studies failed to detect any significant correlation between Agreeableness and ideology (e.g., Carney et al., 2008; Kossowska & Van Hiel, 1999; Gosling, Rentfrow, & Swann, 2003). Other researchers had to split conservatism into its social and economic components before uncovering any significant associations with Agreeableness. After doing so, Gerber et al. (2010) discovered that individuals high in Agreeableness also tended to be more economically liberal and socially conservative.

This use of more nuanced measures of political ideology in lieu of a global measure of conservatism or liberalism is also popular among researchers who subscribe to Duckitt's dual-process motivational model (Duckitt & Sibley, 2010). According to this model, individuals vary in their levels of Right-wing Authoritarianism (RWA; Altemeyer, 1996) and Social Dominance Orientation (SDO; Pratto, Sidanius, Stallworth & Malle, 1994). RWA measures one's desire to obey authorities and to live in an orderly, stable society, and people high on this trait tend to view the world as a dangerous, threatening place. It consists of three subscales: Conservatism, Authoritarianism and Traditionalism. People high in SDO see the world as competitive and Machiavellian and want high-status groups to hold power and dominate over others. SDO is divided into Dominance and Anti-Egalitarianism subscales and, just like RWA, is associated with higher levels of prejudice against outgroups. Both of these constructs are positively correlated with measures of global conservatism and with each other. SDO correlates about .30 with political conservatism (Jost, Glaser, Kruglanski, & Sulloway, 2003) while RWA has demonstrated correlations of up to .72 with commonly used measures of political conservatism (e.g., Bouchard et al., 2003). Correlations between SDO and RWA range from .14 (Pratto, Sidanius, Stallworth, & Malle, 1994) to .22 (Altemeyer, 1998) up to .38 (Heaven & Bucci, 2001), and tend to be even higher outside of the United States and Canada. However, although these constructs are clearly interrelated, they still independently predict a variety of outcomes and also relate to the Big Five domains in different ways than measures of global conservatism. Importantly for the purposes of this review, RWA and SDO also deserve further investigation because some research suggests they have unique associations with approach/withdrawal motivation.

Just as Openness/Intellect is strongly related to global conservatism and liberalism, it also demonstrates consistent but slightly different relationships with RWA and SDO. Both constructs are negatively correlated with Openness/Intellect (Hotchin & West, 2018; Perry & Sibley, 2012; Heaven & Bucci, 2001; Nicol & DeFrance, 2016), although the RWA-Openness/Intellect correlation is stronger and some researchers have found that the SDO-Openness correlation disappears after controlling for RWA (Sibley & Duckitt, 2008; Corr, Hargreaves-Heap, Tsutsui, Russell, & Seger, 2013). Results for Conscientiousness also differ somewhat when examining SDO and RWA in particular instead of global measures of conservatism. Although the majority of studies do not report any relationship between SDO and Conscientiousness, measures of RWA exhibit weak to moderate positive correlations with it (Sibley & Duckitt, 2008; Heaven & Bucci, 2001; Nicol & DeFrance, 2016; Corr et al., 2013). This pattern could potentially indicate that the previously observed relationship between general conservatism and Conscientiousness is being driven more by traits related to RWA than to SDO, and it also introduces questions related to approach/withdrawal motivation that will subsequently be discussed in more detail.

Agreeableness exhibits just as complex a relationship with these two attitudinal constructs as it does with global conservatism. While Corr et al. (2013) showed that individuals high in RWA also tended to be lower in Agreeableness, other researchers found that Agreeableness was positively correlated with RWA (in particular with the Traditionalism facet of RWA; Nicol & DeFrance, 2016). A number of studies in this area, however, report consistent negative relationships between SDO and Agreeableness but not between RWA and Agreeableness (e.g., Sibley & Duckitt, 2008; Heaven &

Bucci, 2001). In fact, low Agreeableness has been described as one of the core features of SDO and is thought to reinforce the Machiavellian, dominant worldview espoused by those high in SDO. Perry and Sibley's (2012) and Sibley and Duckitt's (2013) cross-lagged designs demonstrated that people who were low in Agreeableness tended to become higher in SDO over time, suggesting a unidirectional and potentially causal relationship between the two variables. As for the two remaining Big Five traits, research in this area has failed to find any reliable associations between RWA or SDO and Neuroticism. A few studies have shown, however, that Extraversion positively correlates with both RWA and SDO, and in particular the Dominance facet of SDO (Nicol & DeFrance, 2016; Corr et al., 2013). This association between Extraversion, an approach-related trait, and RWA and SDO somewhat mirrors the relationship between Extraversion and global conservatism, and has implications for hypotheses related to political ideology and approach/withdrawal motivation.

Predicting the effects of motivation on political ideology. Although the studies reviewed here all demonstrate connections between the Big Five and political ideology, there is some disagreement among researchers as to what factors might underpin these connections. Two cognitive biases, Need for Cognition and Need for Closure, have frequently been used to explain why conservatives and liberals tend to differ on traits such as Openness/Intellect. Others have suggested that variables as diverse as socioeconomic status, social network size, prejudice, happiness level, IQ and political exposure may affect correlations between Big Five domains and political ideology. However, the existence of broad individual tendencies toward approach and withdrawal motivation provides a plausible but often overlooked explanation for many of these findings. Approach/withdrawal motivation may separately influence both the development of personality traits as well as a bias toward a specific political ideology, resulting in the observed correlations.

Openness/Intellect, with its behaviors relating to novelty and exploration, could be associated with liberalism due to shared influence from an underlying predisposition toward approach motivation. In a parallel way, Conscientiousness and its accompanying need for order and stability could be correlated with conservatism because both traits are driven by increased levels of withdrawal motivation. These hypotheses are further supported by evidence that these associations extend far back into childhood. Block and Block (2006) collected multiple independent personality ratings of three-year-olds while they were in nursery school, and then collected political ideology ratings from those same students 20 years later. They found that the children who grew up to be liberals were more likely to be self-reliant, resilient, energetic, impulsive and somewhat dominating—all approach-related traits. The future conservatives, on the other hand, were more likely to be fearful, self-controlled, indecisive and inhibited, a constellation of traits that could be caused by a greater tendency toward withdrawal motivation.

Hypotheses regarding domains such as Openness/Intellect and Conscientiousness are more easily supported due to the wealth of evidence connecting those two domains to both approach/withdrawal motivation and global political ideology. Formulating more nuanced predictions about the approach/withdrawal components of global political ideology, RWA, and SDO using information from the other Big Five domains is a more complicated process. As an example, the Politeness aspect of Agreeableness has been positively correlated with both withdrawal motivation (Quilty et al.) and global political conservatism (Hirsh et al., 2010) while the Compassion aspect shows the opposite pattern of results (Quilty et al., 2014; Hirsh et al., 2010). Overall Agreeableness, on the other hand, is negatively correlated with SDO (Sibley & Duckitt, 2008). Does this indicate that SDO is more strongly associated with approach motivation, or does it suggest an interaction between SDO, RWA, and the two aspects of Agreeableness that is obscured when measures of global conservatism are used instead?

Without data consisting of both the BFAS aspects and the RWA and SDO scales in addition to measures of global conservatism and approach/withdrawal motivation, it is difficult to say for sure what these relationships with Agreeableness might be telling us about the effects of approach/withdrawal motivation on political ideology. In addition, while information about the motivational associations of the Big Five domains may be helpful to guide initial hypotheses about relationships between handedness, hemispheric asymmetries, approach/withdrawal motivation and political ideology, ultimately it is more informative to have empirical data directly linking approach/withdrawal motivation to political ideology.

To the best of my knowledge, only one recent study has attempted to specifically address that gap in the literature by combining measures of Big Five traits, RWA and SDO, and approach/withdrawal motivation in one study. Although Corr et al. (2013) also provided useful information about relationships between the Big Five and SDO and RWA that has already been discussed, their overarching goal was to determine whether social attitudinal measures of authoritarianism and social dominance were driven more strongly by approach or withdrawal/avoidance motivation. Their measures included a Big Five measure, the Carver and White BIS/BAS questionnaire, the RST-PQ and measures of RWA and SDO. Corr et al. (2013) found that SDO was positively correlated with one version of the BAS Drive subscale as well as the RST-PQ subscales of Fight and BAS Reward Interest. However, SDO failed to correlate with the FFFS or either versions of the BIS. RWA, on the other hand, exhibited a positive correlation with the FFFS and even stronger correlations with the RST-PQ Fight subscale and all of the RST-PQ BAS measures. Interestingly, though, it was only correlated with the BAS Drive subscale and not the other two scales of BAS Reward Responsivity or BAS Fun-Seeking.

Corr et al. (2013) interpreted these results as evidence for their hypothesis that RWA and SDO are strongly approach-driven constructs, especially given both scales' positive relationships in their study to Extraversion, a prototypical approach-related domain. They contrasted this novel finding with the vast majority of other literature in the field that supports the theory of conservatism as withdrawal-oriented, a theory that will be discussed in more detail shortly. The authors struggled to explain how the correlation between the FFFS and RWA fits into this picture, as their description of the FFFS places it in the same avoidance-motivation category as the BIS. However, this finding makes more sense in light of discoveries about the FFFS' role in active avoidance, its potential left-lateralization, and that it may be more related to approach than withdrawal motivation (e.g., Wacker et al., 2008). These associations with fear and anger (and with approach motivation, as shown by Harmon-Jones et al. (2003) and others) are also supported by findings from Kossowska, Bukowski, and Van Hiel (2008). Kossowska et al. found that evoking anger in high-RWA participants and evoking fear in high-SDO participants led them to be more prejudiced against a low-status group. These results demonstrate that fear and anger may serve to amplify the effects of RWA and SDO on behavior, and may also point to a stronger connection between those types of negative emotions and the two attitudinal constructs.

As intriguing as these findings are, and although they provide evidence of a direct link between approach/withdrawal motivation and political ideology, questions remain. First, do these results tying approach motivation to RWA and SDO also extend to global conservatism? As noted earlier the two scales, although correlated with broader conservatism, are still distinct from it and tap into different constructs. It is quite possible that even if approach motivation is a core component of RWA and SDO, it may be less prominent in conservatism as a whole. Corr et al. (2013) did not include a measure of global conservatism in their study so this question requires further investigation. Secondly, how can these results be assimilated with the extensive literature on conservatism as withdrawal-oriented and threat-focused? Corr et al.'s and Kossowska et al.'s results relating to fear and anger may provide one avenue for doing so, but additional research is necessary to determine which of the two competing accounts provides a more accurate depiction of the motivational forces shaping liberalism and conservatism. Lastly, do these results extend beyond variations of the BIS/BAS to other questionnaire and behavioral measures of approach/withdrawal motivation? Even within Corr et al.'s study, SDO and RWA each displayed different associations with the RST-PQ and Carver and White scales. Answering these questions will help inform the design and testing of a path model linking handedness (as a proxy for hemispheric asymmetries) to approach/withdrawal motivation and finally to personality and political ideology, which is ultimately the chief goal of the current study.

Social and cognitive explanations of approach and withdrawal behavior in liberals and conservatives. The majority of findings linking personality and political ideology suggest that liberals tend to exhibit more approach-related personality traits, while conservatives are more likely to demonstrate withdrawal-related personality traits. Many researchers hypothesize that this is reflective of a deeper underlying connection between liberalism and approach motivation on the one hand, and conservatism and withdrawal motivation on the other. Janoff-Bulman (2009) argues that liberalism is approach-based because it involves a desire to provide for others through beneficial public policies and a preference for interventions that better the lives of other members of society. Conservatism, in contrast, is withdrawal-based because it stems from a motivation to protect society from threats and a desire to avert societal catastrophes. This explanation aligns neatly with the Big Five political literature, including the finding that Politeness is associated with conservatism and Compassion with liberalism. Individuals use politeness to defuse potentially problematic social situations, while high levels of Compassion motivate people to improve the lives of others.

This approach/withdrawal distinction can also be combined with a self-other distinction to create four general “moral motives” that govern individuals’ political behavior. Janoff-Bulman, Sheikh, and Baldacci (2008) found that Self-Restraint, a withdrawal motivation that involves resisting temptations to the self, and Social Order, another withdrawal motivation that focuses on fending off threats to the group’s physical and psychological survival, were both positively correlated with political conservatism and RWA. The moral motive of Social Justice, which emphasizes caring for the worst-off in a community and is considered approach-motivated, was positively correlated with liberalism. Self-reliance, a self-oriented approach motivation that highlights the importance of individual industriousness, did not correlate with either ideology. However, SDO was negatively correlated with both approach motivations (Janoff-Bulman et al., 2008). These results suggest that liberals and conservatives employ different types of motivation when judging what moral systems should be upheld in a society, and that these moral differences are intertwined with approach and withdrawal motivations.

Other researchers have used an individualizing versus binding distinction when describing moral systems (Graham, Haidt, & Nosek, 2009; Graham et al., 2011). In a sample of more than 34,000 individuals from multiple countries, liberals tended to endorse moral systems that focused on the individual, such as the moral virtues of Fairness/reciprocity and Harm/care (Graham et al., 2011). Conservatives, however, more strongly endorsed moral systems that emphasized binding groups together such as Ingroup/loyalty, Authority/respect, and Purity/sanctity. Although the researchers did not explicitly discuss whether these moral foundations had strong approach or withdrawal components, the parallels are evident. The binding moral virtues relate to preventing issues within the group and avoiding external threats, while the individualizing moral virtues are associated with providing care and actively intervening to ensure systems remain fair for disadvantaged individuals. Therefore, this line of research also seems to suggest that liberals prefer approach-oriented moral systems while conservatives more readily support withdrawal-oriented ones.

Liberals' and conservatives' preferences for different moral systems partially explain why they are motivated to behave in dissimilar ways. Another crucial piece of the puzzle comes from research on their disparate attributional styles. Conservatives frequently employ dispositional attributions, while liberals are more likely to select situational attributions, at least under normal levels of cognitive load (Morgan, Mullen & Skitka, 2010; Skitka, Mullen, Griffin, Hutchinson, & Chamberlin, 2002; Weiner, Osborne, & Rudolph, 2011). When providing explanations for why individuals are in poverty, for example, conservatives are more likely to blame the person for their present circumstances, but liberals blame outside circumstances beyond the person's control. These attitudes then translate into observable approach or withdrawal behaviors. Liberals who provide situational attributions for individuals in bad situations are also significantly more likely to agree that those individuals should be helped and supported by societal programs (Morgan et al., 2010; Weiner et al., 2011). This holds true even when the individual "brought on" his or her bad situation by doing drugs, failing to follow a doctor's orders, or refusing to buy flood insurance when living in a flood zone (Skitka et al., 2002). Conservatives, however, are more prone to withhold help and punish the individual, since they view the individual's failure as dispositionally based.

Endorsing withdrawal-oriented moral systems, employing dispositional attributions, and punishing those who destabilize society are just some of the tools conservatives use to counteract a threatening world. Jost et al.'s (2003) seminal meta-analysis on conservatism as motivated social cognition found that various measures of conservatism were positively correlated with a number of psychological variables: dogmatism, intolerance of ambiguity, inflexibility, need for cognitive closure, fear of death and mortality salience. Based on these results, Jost et al. proposed that conservatives are motivated by fear and use a variety of cognitive techniques to withdraw from threat, deal with uncertainty, and avoid change. Interestingly, it appears that this enhanced response to threat has a physiological basis. In general, conservatives rate ambiguous faces as more threatening than liberals do (Vigil, 2010) and they show increased skin conductance and startle eye blink responses to threatening pictures (Oxley et al., 2008). These results support a link between withdrawal motivation and conservatism, as the previously discussed study by Peterson et al. (2008) reported that individuals high in BIS and withdrawal motivation also showed an increased startle response to threatening, negative images.

Conservatives also allocate more attention to negative stimuli and are more distracted by negative words than liberals, as shown by their performance on a modified Stroop task and a dot-probe task (Carraro, Castelli & Macchiella, 2011). This increased weighting of negative stimuli also extends to group judgments. When reading descriptions of the behaviors of two different-sized groups, conservatives were more likely than liberals to attribute a greater number of negative behaviors to the smaller group, even when the two groups' ratios of positive to negative behavior were held constant (Castelli & Carraro, 2011). This is likely because conservatives found the negative behaviors among members of the smaller group more salient and memorable. Such illusory correlations are often responsible for the formation of negative stereotypes about members of a minority group. Conservatives' inclination to pay more attention to threatening, negative information may even affect their emotional expression. Those scoring high on RWA measures exhibit fewer positive emotions, while those high in SDO express fewer positive and negative emotions in general (Van Hiel & Kossowska, 2006). Again, this supports the existence of an association between withdrawal motivation and conservatism, as those high in withdrawal motivation also pay more attention to negative events in their daily lives and experience stronger reactions to adverse events (Gable et al., 2000). These findings are somewhat complicated by the fact that multiple authors have also reported positive correlations between global conservatism and happiness. One explanation for this comes from an analysis by Napier and Jost (2008) that found happiness level was tied to growing economic inequality and rationalizations of it. Conservatives' propensity to be more accepting of the economic status quo means they are therefore less affected by and better able to justify stark differences in individuals' economic status, leading them to be happier overall (Napier & Jost, 2008). However, this tendency for conservatives to be happier could still have interesting theoretical implications in light of Corr et al.'s (2013) findings and prior research relating positive emotions such as happiness to approach motivation.

The tendency to withdraw from disgusting stimuli also appears to be a hallmark of conservatism. Along with their endorsement of the Purity/sanctity moral domain and their stronger rejection of morally "impure" behaviors such as homosexuality and abortion, conservatives exhibit greater overall disgust sensitivity (Inbar, Pizarro, & Bloom, 2008; Feinberg, Antonenko, Willer, Horberg, & John, 2013). Feinberg et al. (2013) also found that, after watching videos intended to elicit disgust, liberals were more likely than conservatives to reappraise their initial disgust reactions. These findings provide further support for the hypothesis that conservatism springs from a broad tendency to withdraw from threatening, disgusting and fearful stimuli, and therefore should correlate with increased levels of overall withdrawal motivation.

Research has been somewhat more limited on liberalism and the physiological and cognitive motivations driving it. Nonetheless, empirical evidence suggests that just as conservatives preferentially engage in withdrawal-motivated processes, liberals preferentially employ approach-motivated tactics when encountering novel stimuli. Shook and Fazio (2009) created a game called BeanFest to investigate whether liberals deal with potential gains and losses differently than conservatives. In BeanFest, players must accept "good" beans that increase their point totals and reject "bad" beans that decrease point totals. Although liberals and conservatives used equally successful strategies that netted them an equivalent amount of points, liberals used an approach strategy and conservatives used a withdrawal one. Conservative participants in BeanFest learned which beans were negative at a higher rate than liberal participants, and also rejected more beans than the liberals. They tended to miscategorize "good" beans as bad because of their more avoidant strategy. Liberal participants, on the other hand, adopted an exploratory approach, accepting more beans than the conservatives overall and not exhibiting any skew toward the negative beans.

It is also possible to nudge someone who typically employs a more liberal approach-motivated style of social cognition toward the withdrawal end of the spectrum. Nail, McGregor, Drinkwater, Steele, and Thompson (2009) tested a number of the hypotheses outlined in the Jost et al. (2003) article relating to conservatism and threat. In their first experiment, the researchers induced an injustice threat by having some participants read an article describing how an Enron executive would get away with his crimes because of a technicality. Participants in the control condition read a different version in which the executive faced legal punishment. Next, the participants rated the quality of anti-American and pro-American essays, purportedly written by foreign students. Liberals in the injustice threat condition showed significantly greater ingroup favoritism, which was defined as the difference in quality ratings between the pro-American and anti-American essay ratings. In two additional studies, Nail et al. (2009) found that inducing mortality salience caused politically liberal participants to endorse more conservative attitudes and policies. After dwelling on their feelings about their future death, liberal participants showed significant increases in anti-gay sentiment and preference for cognitive closure. Interestingly, although these manipulations shifted liberal participants' ideological views in a conservative, threat-sensitive direction, they had no significant effect on conservatives. One potential explanation is that conservatives' thoughts were already more focused on mortality salience and threat and therefore the priming manipulation had little effect on them.

Shifting participants' attitudes in an approach-oriented direction is also feasible. In a series of experiments, Mikulincer and Shaver (2001) manipulated participants' feelings by priming them with words related to secure attachment (love, support, etc.), having them visualize a social situation that made them feel safe, or instructing them to think about a close relationship with a loved one. The researchers found that making participants feel more socially comfortable and less fearful caused them to display more liberal attitudes, such as a reduction in negative stances toward outgroups. Overall, the evidence reviewed here indicates that experimental inductions of approach or withdrawal orientation can shift ideological beliefs in a liberal or conservative direction, respectively. This further reinforces the hypothesis that approach motivation is positively associated with liberalism, and withdrawal motivation is positively associated with conservatism.

Nevertheless, it is important to note that the experiments summarized in this section all used behavioral approximations of approach/withdrawal motivation or measured different yet related constructs such as disgust sensitivity, moral virtues, or threats of injustice. None included any questionnaire measures of approach/withdrawal motivation, which makes it difficult to directly compare them to Corr et al.'s (2013) study that used only questionnaires and no behavioral measures. Studies from the field of political neuroscience provide one method of arbitrating between these two models.

Cognitive neuroscience-based explanations of liberal/conservative differences in approach and withdrawal behavior. Neuroscientific findings provide some preliminary support for the theory that liberals preferentially engage in approach-motivated social cognition, and conservatives engage in withdrawal-motivated social cognition. However, additional replications and extensions are required to eliminate methodological issues and conflicting results, and there is some evidence for the opposing theory as well. Kanai, Feilden, Firth, and Rees (2011) found that greater ACC volume was correlated with greater liberalism in a population of young adults, while greater right amygdala volume was correlated with greater conservatism. Amodio, Jost, Master, and Yee (2007) had participants perform a Go/No-Go task while recording electroencephalographs. They too found greater ACC activation for liberal participants, and liberal participants were also more accurate on No-Go trials that involved response conflict.

The authors of these studies explained the liberalism-ACC association as due to liberals' greater sensitivity to response conflict and their tendency to analyze multiple possible options or response choices. These characteristics associated with the ACC are similar to those responsibilities typically assigned to the BIS: conflict detection, deciding between multiple possibilities when responding to a threat, etc. In Gray et al.'s (2005) study, participants who scored higher on the BIS also showed greater overall ACC activation. Those results could be interpreted as support for an association between liberalism and the BIS given the greater ACC activation in liberals reported by Kanai et al. (2011) and Amodio et al. (2007). As for the amygdala-conservatism association found in their study, Kanai et al. (2011) hypothesized that since that brain structure is involved in threat processing and fear regulation, it would be larger among conservatives who more frequently engage in that kind of processing. However, any conclusions from studies such as these are limited, as every brain area is implicated in many different processes. For example, the amygdala is important for threat processing but also plays a role in responses to pleasurable stimuli and emotional learning.

A study by Hart et al. (2000) provided additional support for a potential link between conservative attitudes toward outgroups and the amygdala. This association would also theoretically be due to the amygdala's aforementioned role in threat processing and fear regulation. The researchers found that participants presented with outgroup faces showed increased amygdala activation when viewing those faces compared to ingroup faces. Although Hart et al. did not examine political ideology's role in this interaction, the findings suggest that the amygdala's previously established role in threat processing could extend to threats related to outgroups. One study that did account for political ideology provides some evidence that brain activity is fundamentally different between liberals and conservatives when engaged in risk-taking (Schreiber et al., 2013). Participants in the study performed a risk-taking task with monetary rewards while in an fMRI scanner. The task was chosen because the brain areas activated during this risk-taking task, such as the amygdala and ACC, were those activated in the Kanai et al. (2011) study. Although Republicans and Democrats performed equally well on the task, and no behavioral differences were noted, some neural differences were significant. During the risk-taking task, Republicans showed greater right amygdala activation, while Democrats showed greater left posterior insula activity. The researchers hypothesized that the greater amygdala activation of the Republicans indicated they were more fearful during the risk-taking task, and the insula activation signified more thoughtful cognitive processing by the Democrats (Schreiber et al., 2013).

However, any speculation such as this is considered a reverse inference due to the multiple functions of any given brain area. Stating that a participant is experiencing fear because of amygdala activation would be considered a reverse inference because the amygdala has also been implicated in other emotions and processes. An additional problem is that Schreiber et al. originally defined their regions of interest (ROIs) as identical to those in the Kanai et al. study. They subsequently included a finding of significant insula activation in their final analyses, a brain area that was not found to significantly differ in the Kanai et al. study. This was only discovered after Schreiber et al. expanded their ROIs and included areas that were activated in their study (which could have occurred simply by chance). These areas had not been found in previous studies of liberal-conservative differences, and so had no a priori reason to be included in their analyses.

Political neuroscience is a relatively new area of inquiry, so although many of the findings have provided interesting insights, numerous questions remain. Most of the studies have been of an exploratory nature or have focused on specific ROIs that were also found in a previous study. To the best of my knowledge, researchers have not directly investigated whether liberals and conservatives show different patterns of frontal hemispheric activity due to hypothesized differences in approach and withdrawal motivation. The closest is by Zamboni et al. (2009) who addressed a related question with fMRI and found that reading conservative political statements, as opposed to reading liberal individualistic statements, was associated with increased activity in the right dorsolateral prefrontal cortex (dlPFC). In previous studies, activation of this brain area has been associated with response inhibition, negative affect, and withdrawal motivation (Harmon-Jones, 2003b). However, it has also been associated with decision making and choosing to accept or reject unfair offers (Zamboni et al., 2009), so as is typically the case in studies of this nature, one cannot assume that activation of the dlPFC means conservative-type withdrawal processes were engaged. Unfortunately, the authors did not report whether this activity differed depending on the participants' political orientation, so the finding simply links the processing of conservative statements to the right prefrontal cortex. It provides an intriguing starting point for future investigations of this topic, however.

The empirical evidence to date points to a connection between political ideology and approach/withdrawal motivations, just as evidence from the personality literature suggests that each of the Big Five domains is differentially related to approach/withdrawal motivation. Given the converging research streams linking conservatism to withdrawal and liberalism to approach, one hypothesis would be that conservatives should display greater right-hemisphere activation while liberals should display greater left-hemisphere activation. Examining the contradictory evidence from authors such as Corr et al., the studies linking liberalism to the ACC, and the findings that will be discussed shortly related to handedness and political ideology, however, leads to an alternate prediction. According to this hypothesis, conservatives (especially those high in RWA and SDO) should be higher in approach motivation and therefore exhibit greater left-hemisphere activation than liberals, who should show greater right-hemisphere activation. Pitting these two competing hypotheses against one another requires a study design that incorporates various measures of political ideology and approach/withdrawal along with a measure of handedness that can serve as a proxy for hemispheric asymmetries.

Evidence for Links Between Handedness and Personality and Political Variables

Current research on handedness and political ideology. To date, there has been very little research about how handedness interacts with the Big Five domains or whether it predicts political ideology. Some political studies screen for handedness using the EHQ, such as an fMRI study by Knutson et al. (2006) that examined prefrontal activation and emotional processing in participants while they looked at pictures of politicians. However, this is done to eliminate any left-handers so only right-handers are included in the study. Researchers worry that left-handers' differences in hemispheric activation and occasional reversed lateralities will make it harder to detect significant brain activation differences in between-subjects analyses (Willems, Van der Haegen, Fisher, & Francks, 2014). Thus, as seen in earlier studies of hemispheric asymmetry and approach/withdrawal motivation, many prefer to use an exclusively right-handed sample to promote greater homogeneity and reduced statistical noise. Unfortunately, this means that very few studies directly compare left- and right-handers or consistent- and inconsistent-handers.

Oppenheimer and Trail (2010) came close to addressing the question of whether handedness relates to political ideology, although they did not directly assess the handedness of their participants in two out of three of the experiments they conducted. In the first experiment, they had participants squeeze a ball in either their right or left hand while rating their agreement with political statements. In the second experiment, a different group of participants sat on a chair that leaned to either the left or the right while completing the ratings and in the third experiment, participants used a computer mouse to click on an image appearing on the left or right half of the screen. Oppenheimer and Trail found that when participants squeezed the ball with their left hand, sat in the left-leaning chair, or were oriented to the left side of the screen, they subsequently agreed more strongly with Democratic, liberal statements. The same was not equally true for Republican statements: there was a slight but nonsignificant trend for participants on the right-leaning chair to agree more strongly with conservative opinions, while squeezing the ball in the right hand or clicking on the right half of the screen had no effect whatsoever. These results agree with those from another study by Dijikstra, Eerland, Zijlmans, and Post (2012) who used a Wii balance board to subtly tilt participants to either the left or right when they thought they were standing straight. When participants were tilted to the left, they assigned a greater number of general political statements to left-leaning parties in the Dutch House of Representatives, but when they were leaning right they attributed more of those same broad statements to right-wing parties. These results were unaffected by the participants' political affiliation, just as in Oppenheimer and Trail's (2010) study.

However, there are a number of significant confounds in Oppenheimer and Trail's series of experiments that could affect their reliability. First, two out of three of the researchers' samples were predominantly Democratic and the third sample leaned Democratic, making it difficult to accurately predict whether Republican-heavy samples would be similarly affected by these spatial metaphors. The participants were also told in the first experiment that the study was about political attitudes, potentially priming them to be more conscious of the left-right political metaphor. Even more importantly for purposes of this review, the interpretability of the results is very limited since Oppenheimer and Trail failed to measure the participants' handedness entirely in the first two experiments due to a logistical error. They measured handedness in the third experiment using participants recruited from Amazon's Mechanical Turk, but since they only had nine left-handed and seven mixed-handed participants, they removed them from the main analyses so as not to contaminate the data. Although they did include the removed participants later in a secondary analysis and reported a similar but weaker pattern of results, they did not include handedness as a variable in any of their analyses and so were unable to report any handedness interactions. Dijikstra et al. (2012) also failed to include any handedness measure in their study design. Therefore, neither of these studies provides clues about any approach/withdrawal motivational biases or hemispheric asymmetries that could be involved in this process because handedness could not be analyzed as a proxy for hemispheric lateralization. This is methodologically unfortunate for other reasons as well since handedness may have altered participants' typical right-left political schemas. Studies such as those discussed earlier by Casasanto et al. (2009) and Casasanto and Jasmin (2010) showed that right- and left-handers differ in how they associate the concepts of "good" and "bad" with either the right or left side of space. Oversights such as these emphasize the need for additional research on handedness and its relationship to political ideology as mediated by approach/withdrawal motivation.

A handful of recent studies have started to examine this question in more detail, although none have included measures of approach or withdrawal/inhibition. Christman (2014) found that along with decreased levels of sensation-seeking and increased levels of disgust, consistent-handers also scored higher on RWA. These results mirror those of Lyle and Grillo (2014) who found consistent-handers scored higher on a measure of submission to authority and were also more likely to identify as Republican. Chan (2018) found that RWA mediates the positive association between consistent-handedness and religiosity, providing additional support for a connection between RWA and consistent-handedness. Chan (2018) also argued that these results show that authoritarianism underlies the association between consistent-handedness and religiosity instead of differences in belief updating, as other researchers had proposed.

Nonetheless, there are a few limitations to these findings. Although Chan used a continuous measure of degree of handedness, Christman (2014) analyzed the data dichotomously instead of continuously, an approach that is not recommended by other researchers (e.g., Hardie & Wright, 2014: Beaton et al., 2015). Furthermore, neither Chan nor Christman analyzed handedness direction. As seen throughout this review, many studies have found differing results depending on direction or degree of handedness, so including both types of analyses is crucial for a complete understanding of whatever phenomenon is being investigated. Additionally, it is important to remember that the category of "consistent handers" is often made up almost exclusively of right-handers. In Christman's (2014) study, the first sample of 102 consistent-handed participants contained just two left-handers, the second sample of 47 consistent-handers contained no left-handers at all, and the third sample of 49 consistent-handers included just three left-handers. Any interpretation of results that depends on degree or direction of handedness needs to account for these imbalances. Lyle and Grillo (2014) analyzed their data using both continuous and dichotomous approaches, so their findings may be more reliable, although they did use a different measure of authoritarianism than the RWA. They also noted that they had too few left-handers in their study to test whether direction of handedness influenced the results, so they relied on descriptive statistics to make those comparisons. Although they found using that approach that left consistent-handers and right consistent-handers were still more likely to identify as Republicans than inconsistent-handers, further replications with larger left-handed populations are needed to accurately test whether these results extend to handedness direction as well as degree.

A final concern that should be addressed in future research of this kind is the lack of other measures of political ideology beyond RWA. Christman (2014) and Chan (2018) only used the RWA scale, not the SDO scale or any other measure of global conservatism. Only Lyle and Grillo (2014) included measures of global political ideology in addition to the RWA, and those measures showed conflicting results. They found that consistent-handers were more likely to be Republican, but this analysis was based on a single yes-or-no question. They also had participants report their ideology on a 7-point scale and give “thermometer ratings” for a variety of political candidates for both parties, but neither of those measures correlated with handedness. This discrepancy should be explored further, as it is possible that results for global conservatism, global liberalism, or even SDO might show different associations with handedness than RWA. It is also plausible that those differences could be due to varying levels of approach/withdrawal orientation driving each political construct, given the potential associations between RWA and the approach-related emotion of anger.

Answering these questions may help to resolve a number of implicit discrepancies in the current literature. For instance, previous research suggests that left-handers and mixed-handers have increased interhemispheric activity and greater right-frontal activation (e.g., Propper et al., 2012). Therefore, they should also show greater loss aversion and sensitivity to risks as both have been linked to greater right frontal activation (e.g., Gonzalez et al., 2005). Other studies connect left-handedness to anxiety and higher scores on the BIS (Hardie & Wright, 2014). At the same time, a large body of work on conservatism suggests that it is associated with related concepts such as loss aversion, threat sensitivity, mortality salience, etc. (e.g., Jost et al., 2003). How, then, to explain the finding that conservatives are more likely to be right- or consistent-handed? A more detailed exploration of the relative contributions of approach and withdrawal to these political constructs, especially one that takes into account more nuanced components such as the FFFS, RWA and SDO, should help untangle these complex and sometimes contradictory results.

Current research on handedness and the Big Five. Research on handedness and the Big Five is also fairly limited, although studies have been conducted using non-Big

Five personality inventories (e.g., Killgore et al., 1999; Coren, 1994). Spere, Schmidt, Riniolo, and Fox (2005) found that people who scored high on measures of both shyness (feeling socially inhibited) and sociability (preferring to be around others) were also significantly more likely to be mixed-handed. Spere et al. (2005) used the Cheek and Buss Shyness and Sociability Scale instead of a typical Big Five measure of Extraversion; moreover, the results could also be explained by factors unrelated to personality such as a greater yea-saying bias in mixed-handers. A few studies have examined the relationship between handedness and personality measures that are loosely related to approach/withdrawal motivation. For example, Christman (2013) found that mixed-handed participants were more likely to say they liked unpopular music genres than consistent-handers, regardless of how familiar they were with the music. Christman's explanation for this result was that mixed-handers, with their greater interhemispheric flexibility, are more open to novel experiences.

Some caveats should be considered, however: four strong left-handers were excluded from the analyses, only handedness degree and not direction was analyzed, and handedness was analyzed in a dichotomous rather than a continuous fashion. An additional explanation for findings such as this one that link greater openness to mixed-handedness is that instead of mixed-handedness leading to greater openness, the causal arrow actually points in the opposite direction. According to this hypothesis, people who are higher on openness tend to also be more open to saying they use their non-dominant hand in various ways, regardless of whether they actually use it for those tasks in daily life, which leads to a false association between openness and mixed-handedness (Grimshaw, Yelle, Schoger, & Bright, 2008). This hypothesis has also been employed to explain the previously discussed finding that questionnaire but not behavioral measures of handedness show an association between magical ideation/openness and mixed-handedness (Bryson et al., 2009; Badzakova-Trajkov et al., 2011).

To the best of my knowledge, Grimshaw and Wilson (2013) have been the only researchers to publish a study that associates Big Five personality ratings with a continuous measure of handedness. By analyzing handedness as a continuous variable, they also avoided the methodological flaw of dichotomizing a continuous variable that was common in previous personality-handedness studies. Grimshaw and Wilson had 662 undergraduate students complete Goldberg's (1999) 50-item IPIP, which includes 10 items that describe each Big Five trait. They chose the Annett Handedness Questionnaire to measure handedness, which is similar in format to the EHI. Grimshaw and Wilson then used a three-step regression to determine whether handedness predicted scores on any of the Big Five traits, and they included both linear and quadratic measures of handedness. Linear effects would indicate that left- and right-handers differed on that personality domain, while significant quadratic effects would differentiate strong-handers from mixed-handers. Surprisingly, the only significant finding was in the Extraversion domain. Mixed-handers scored lower on Extraversion than either strong-left or strong-right handers, resulting in a curvilinear relationship. There was no linear effect, and after controlling for sex because of gender differences in handedness rates, handedness only accounted for 1.4% of the variance in Extraversion (Grimshaw & Wilson, 2013).

Although the results are interesting, the researchers offered no a priori hypotheses about the direction of any handedness-Big Five interactions. Their speculative explanation of the Extraversion-handedness link was that since mixed-handers typically score high on Schizotypy, they should also score higher on Introversion. They did briefly mention the right and left hemispheres' withdrawal and approach biases in their literature review but did not apply this concept to their study's findings. Finally, their Big Five measure did not separate each of the domains into its two aspects, as the BFAS does, so any aspect-level differences were overlooked. Future studies on the Big Five and handedness should test for the presence of a mediator variable, such as approach/withdrawal motivation, and should employ aspect-level or facet-level Big Five measures to account for more nuanced relationships. In addition, future research in this area should propose hypotheses about the direction of any handedness-personality interactions and sample from a wider variety of populations. In the next section I will describe my pilot study and current study, both of which were designed to address these and other issues discussed throughout this review.

Preliminary Findings of Associations Between Handedness, Approach/Withdrawal Motivation, Personality, and Political Ideology

Researchers have investigated many combinations of the variables discussed in this review, such as the relationships between personality and handedness, political ideology and approach/withdrawal motivation, and hemispheric asymmetries and handedness. However, no theory or model to date has explicitly linked all these variables to one another. In this section, I will report preliminary findings regarding handedness, personality and political ideology, propose new hypotheses based on the literature reviewed here, and outline a new study design to test these hypotheses.

The pilot study I designed to test aspects of this model included two general hypotheses. The first hypothesis was that handedness would relate to motivational biases in a predictable way: Right-handers and consistent-handers would score higher on measures of approach motivation as a consequence of their left-hemisphere biases, while left-handers and inconsistent-handers would score higher on measures of withdrawal motivation due to their increased right-hemisphere activation. Since very few researchers have analyzed handedness in a continuous fashion, no specific hypotheses were formed regarding whether the left/right or consistent/inconsistent distinction would be more important. The second hypothesis was that these differences in approach and withdrawal motivation would relate to both handedness and the two criterion variables of Big Five personality and political ideology. More specifically, I hypothesized that right- and consistent-handers would be more politically liberal and would score higher on BFAS aspects related to approach (both facets of Extraversion, both facets of Openness/Intellect, the Compassion aspect of Agreeableness, the Industriousness aspect of Conscientiousness, and the Volatility aspect of Neuroticism). Conversely, left- and inconsistent-handers were hypothesized to score higher on BFAS aspects related to withdrawal (the Politeness aspect of Agreeableness, the Orderliness aspect of Conscientiousness, and the Withdrawal aspect of Neuroticism) and to be more politically conservative. Given the scarcity of research on the PID-5, no a priori hypotheses were formed.

Measures to test these hypotheses were included at the end of an unrelated study about handedness and personality ratings of likeable and unlikeable traits. Since time was limited and collecting these data was not the main purpose of the study, the number of measures that could be included was somewhat restricted. In total, participants completed the BFAS, the PANAS, the EHI, the BIS/BAS and a simple measure of political ideology that required participants to rate their political affiliation on a scale from 1 to 100, with 1 being extremely liberal and 100 being extremely conservative. Single-item measures of political ideology have been shown to be reliable and exhibit good predictive validity of party identification and voting behavior (e.g., Jost, 2006; Carney et al., 2008) although are less ideal than longer measures. Participants also completed the Society Works Best index (SWB; Smith, Oxley, Hibbing, Alford & Hibbing, 2011), a forced-choice measure of political ideology that has good reliability and external validity. The BIS/BAS was broken down into its three main components for scoring: the BAS, the BIS, and the FFFS. Scores for the three BAS subscales were also calculated.

A total of 258 participants took part in the main portion of the study but only the 216 participants who completed all of the surveys were included in analyses. These participants (122 females, 94 males) were all from the United States and completed the surveys on Amazon's Mechanical Turk. A separate dataset consisting of 398 Mechanical Turk participants was analyzed as well. These participants completed the EHI, the BFAS, and the PID-5, along with other measures that were not relevant to the current study and so were not analyzed. No political ideology measures or measures of approach/withdrawal were included in this second dataset.

The first hypothesis—that right- or consistent-handedness would be positively correlated with approach motivation and left- or inconsistent-handedness would be positively correlated with withdrawal motivation—was only partially supported. In the first study, there were no significant correlations between handedness and the BIS, the BAS, or the FFFS. However, regressing the PANAS onto handedness scores in the first study indicated that left-handers and inconsistent-handers falling on the left end of the handedness spectrum scored higher on negative affect than right-handers and consistent-handers falling on the right end of the spectrum. Adding a quadratic term resulted in a better fit than the linear term alone. This provided some support for the hypothesis that left-handers and inconsistent-handers should show greater withdrawal motivation, since negative affect on the PANAS has been positively correlated with BIS scores and right-hemisphere asymmetries. The two scales are not perfectly correlated, however, so further investigation is needed to determine if other withdrawal measures also relate to left-handedness. The second sample did not include a measure of approach/withdrawal, so the first hypothesis could not be tested in that sample.

Only one of the BFAS facets was significantly predicted by handedness, but the finding replicated across both samples. Right-handers and mixed-handers on the right end of the handedness spectrum scored significantly higher on Extraversion-Enthusiasm than their left-handed counterparts. These results support the hypothesis that Extraversion, as an approach-related trait, should positively correlate with right-handedness. Although the first sample did not include the PID-5, in the second sample left- and mixed-handedness was associated with significantly higher scores on the two domains of Psychoticism and Antagonism. In addition, there was a trend towards significance in the Detachment domain, with left-handers scoring higher than right-handers. Nine of the 25 facets showed positive correlations with left- and/or mixed-handedness, and three additional facets trended in the same direction. The only facet to show a positive relationship with right-handedness was Submissiveness. Overall, it appears that previous findings regarding non-right-handedness and psychopathology were reinforced, although replication is obviously needed since this was the first study to look at the PID-5 traits and handedness and only one of the two samples included the PID-5.

Finally, political ideology was also associated with handedness in the predicted direction. Although scores on the single-item political inventory in the first 216-participant sample did not show any associations with handedness, SWB scores did. In line with the hypothesis outlined earlier, liberalism was positively associated with right-handedness.

However, there were also a number of surprising findings that were difficult to interpret in light of the previous literature. For example, BIS scores positively correlated with Extraversion, while BAS scores negatively correlated with Extraversion. This was unexpected, as the other studies reviewed in this paper all found moderate to high positive correlations between Extraversion and the BAS. Given the consistency of contrary findings, simple sampling error may explain the problem. More research is needed to explain these findings, since they are incongruent with previous research on the BIS/BAS.

The current study addresses these questions and other remaining ones, such as why the Extraversion-Enthusiasm findings from my two pilot samples differed from those of Grimshaw and Wilson (2013). They reported that mixed-handers in the middle of the spectrum scored the lowest on Extraversion, while strong-handers on the left and right ends of the spectrum scored the highest, but they did not find any linear effects related to direction of handedness. These differences could be due to the fact that Grimshaw and Wilson did not split Extraversion into its facets or to a difference in the sample populations.

Present Study: Design and Hypotheses

These exploratory findings were a start to answering the two broad hypotheses outlined above, but due to a number of constraints, a more in-depth study was needed. The present study expanded on the pilot study by adding the PID-5, additional political measures, and other measures of approach/withdrawal motivation. Eliot and Thrash's (2010) measure of approach and withdrawal motivation was included along with the BIS/BAS to compensate for any problems relating to the design of the BIS/BAS. Participants also completed a computerized task designed to simulate a real-world approach/withdrawal situation, in which they had to select "good" mushrooms and avoid "bad" mushrooms. This addition was particularly vital given the research on the Capability Model and the inconsistent results from many questionnaire-only studies of approach and withdrawal motivation. A similar approach was taken with political inventories. Although the SWB is well-constructed, it is a unidimensional measure of ideology, and some evidence suggests that multidimensional models are preferable (Smith et al., 2011). In addition, since most single-item measures of political ideology use a 5- or 7-point Likert scale, the 1-100 scale included in the pilot study may not be as reliable or valid, so a 5-point Likert scale of political party identification was added alongside the 1-100 measure. The frequently used SDO and RWA scales were also included in the present study, which allowed for direct comparisons with the studies reviewed earlier and provided more detailed, multidimensional information about an individual's political attitudes. Finally, various measures related to moral psychology were added to the study. The Moral Motives (MM) scale developed by Janoff-Bulman (2008) measures approach/withdrawal motivation from a more political perspective and so is ideal for use in this line of research. The Moral Foundations Questionnaire (MFQ) by Graham et al. (2011) also explores the relationship between morality and political ideology and therefore captures a different aspect of political ideology than the other political measures, hence its inclusion in the study.

These additions were designed to allow for replication of the preliminary findings while exploring connections between new measures. The two primary research questions for this study are as follows:

> Research Question 1: Do approach and withdrawal motivation influence the relationship between handedness and personality and political ideology, and if so, what is the form of that influence?

> Research Question 2: How does handedness relate to the variables of approach/withdrawal motivation, personality, and political ideology?

More specifically, this study tests a model in which approach/withdrawal motivation mediates the relationship between handedness (serving as a proxy variable for hemispheric asymmetries) and the criterion variables of personality and political ideology. For this model to be correct, a number of hypotheses have to be supported, beginning with

Hypothesis 1: Right-handers and/or consistent-handers will score higher on measures of approach motivation, while left-handers and/or inconsistent-handers will score higher on measures of withdrawal motivation.

Research on hemispheric asymmetries suggests that using one's right hand activates left frontal areas of the brain. In addition, right-handers and consistent-handers exhibit higher levels of left-hemisphere dominance. Conversely, using one's left hand or being inconsistent-handed is associated with activation of right frontal areas, and left-handers' and inconsistent-handers' higher levels of interhemispheric communication should also result in relatively greater right hemisphere activity. These findings, combined with the research connecting left-frontal areas and approach motivation and right-frontal areas and withdrawal motivation, underpin the predictions outlined in Hypothesis 1. Since research directly comparing the degree and direction models of handedness is limited, both models of handedness will be tested here as well as in all subsequent hypotheses. Although preliminary results only supported a relationship between the PANAS and handedness, the issues with the BIS/BAS in the preliminary study and the inclusion of additional measures of approach/withdrawal motivation (including a behavioral measure and measures of moral motives) in the current study make it possible that this hypothesis will still be supported. If this hypothesis is supported and an association is uncovered between handedness and any of the approach/withdrawal measures included in this study, the next step involves testing the relationship between handedness and the criterion variables of Big Five personality, maladaptive personality, and political ideology. To that end, I propose that

> Hypothesis 2: Right- and/or consistent-handers will score higher on approach-related Big Five aspects, including both aspects of Extraversion, both aspects of Openness/Intellect, the Industriousness aspect of Conscientiousness, the Volatility aspect of Neuroticism, and the Compassion aspect of Agreeableness, while left- and/or inconsistent-handers will score higher on withdrawal-related Big Five aspects including the Orderliness aspect of Conscientiousness, the Withdrawal aspect of Neuroticism, and the Politeness aspect of Agreeableness.

Although my pilot study results indicated PID-5 Antagonism was associated with left- and inconsistent-handedness, Papousek et al. (2018) had previously found a relationship between this domain and greater left frontal EEG activation. The present study will help address this discrepancy by testing Antagonism's relationship to various measures of approach and withdrawal so as to better determine if approach or withdrawal motivation explain its link to either left/inconsistent or right/consistent handedness. Hypotheses regarding Detachment and Negative Affect are also somewhat speculative but grounded in previous research. Since negative affect as measured by the PANAS has been associated with right hemispheric asymmetries and BIS scores (e.g., Gable et al., 2000), I hypothesized that the Negative Affect domain of the PID-5 will be associated with left- and/or inconsistent handedness. Detachment should demonstrate similar associations, as Papousek et al. (2018) found Detachment-right hemisphere connections while Gore and Widiger (2013) and Thomas et al. (2012) confirmed a negative relationship between Detachment and Extraversion, making it less likely to be a strongly approach-driven domain. Conversely, the PID-5 domain of Disinhibition, which Gore and Widiger (2013) found to be negatively correlated with Conscientiousness, was more difficult to assess. Although it seems at face value to be a more approach-related domain and contains items such as, “I feel like I act totally on impulse,” it also measures an individual’s willingness to avoid undesirable situations with statements such as, “I've skipped town to avoid responsibilities.” Psychoticism was likewise hypothesized to exhibit complicated relationships with handedness. Although DeYoung et al. (2016) reported that Psychoticism loaded on the same factor as Openness, it positively correlated with left- and inconsistent-handedness in my pilot study. In addition, schizophrenia and other mental illnesses have been linked to left- and inconsistent-handedness in past research. This weak but persistent connection between mental illness and left/inconsistent handedness was also why I predicted that more left- and inconsistent-handers will score higher on PID-5 facets overall. Psychoticism and Disinhibition’s relationships with approach and withdrawal motivation will be probed at a more in-depth level in the current study; therefore, just as with Antagonism, I refrained from any a priori directional hypotheses about Psychoticism and Disinhibition beyond predicting that they will demonstrate significant associations with handedness. Regarding the other two domains and the facets,

> Hypothesis 3: Left- and/or inconsistent-handers will score higher on the Detachment and Negative Affect domains of the PID-5 than right- and/or consistent-handers, in addition to scoring higher on a greater number of PID-5 facets.

Given the complex and contradictory nature of the research involving political ideology, handedness, and approach/withdrawal motivation, the goal of the following political hypotheses was to test between two competing accounts: one that suggests conservatism should be associated with right- and/or consistent-handedness and, by extension, approach motivation, and one that suggests conservatism should be associated with withdrawal motivation and, by extension, left- and/or inconsistent-handedness. Furthermore, although I found tentative connections between liberalism and right-handedness in my pilot study, the evidence that has accumulated since then regarding handedness and political ideology contradicts that finding. Accordingly, this non-directional hypothesis only states that

> Hypothesis 4: Conservative political ideology will be significantly associated with handedness and liberal political ideology will be significantly associated with handedness.

One requirement of any proposed mediation model is that measures of approach/withdrawal motivation and the various criterion variables have to exhibit significant relationships. Any other incidental findings, such as correlations between political ideology measures and the PID-5, are considered exploratory and are not assigned a priori hypotheses. Therefore I predict that

Hypothesis 5: Measures of approach motivation will positively correlate with approach-related Big Five aspects, including both aspects of Extraversion, both aspects of Openness/Intellect, the Industriousness aspect of Conscientiousness, the Volatility aspect of Neuroticism, and the Compassion aspect of Agreeableness, whereas measures of withdrawal motivation will positively correlate with the various withdrawal-related Big Five aspects including the Orderliness aspect of Conscientiousness, the Withdrawal aspect of Neuroticism, and the Politeness aspect of Agreeableness.

Hypothesis 6: Measures of withdrawal motivation will positively correlate with the PID-5 domains of Negative Affect and Detachment. Additionally, a greater number of PID-5 facet scales will be associated with measures of withdrawal motivation than with approach motivation.

Hypothesis 7: Measures of approach and withdrawal motivation will significantly correlate with measures of political ideology.

Finally, the last phase of the study examined whether approach/withdrawal motivation explained part of the relationship between handedness and personality and political ideology. Although approach/withdrawal motivation is one possible mediator variable, a wider examination of the literature shows there are other candidate variables that may also theoretically mediate the relationship between handedness and personality/political ideology. For example, a few studies report that inconsistent-handers tend to show greater cognitive flexibility and belief updating than consistent-handers (e.g., Jasper et al., 2014), two traits that are less common among those high in authoritarianism. Due to the potential for other mediator variables, I hypothesize that

> Hypothesis 8: Measures of approach/withdrawal motivation will partially mediate the relationship between handedness and the criterion variables of Big Five personality, the PID-5, and measures of political ideology.

If these hypotheses are supported at each step and mediation analyses confirm the proposed model, this would have significant theoretical implications for disparate fields of study. Even if only some parts of the model are supported, the results should still provide a wealth of new information about the connections between handedness, hemispheric motivational asymmetries, and the criterion variables of personality and political ideology. For example, information about how measures such as the BIS/BAS relate to less commonly used measures of approach and withdrawal would be invaluable for researchers seeking to understand this multifaceted and complex area of study. A better understanding of how handedness relates to personality and political ideology would additionally benefit individual differences and political psychologists, since handedness is an often-overlooked variable in these domains. Lastly, testing for possible mediators of this relationship would help to clarify a number of previous findings. If approach and withdrawal motivations do mediate the relationship between handedness/hemispheric asymmetries and personality outcomes, these results will also be of use to researchers who use neuroimaging in their work. Examining this complex relationship could lead them to a more thorough understanding of the role hemispheric asymmetries play in personality and political ideology.

This increased level of understanding can only be reached if researchers couple their empirical findings with equally rigorous theories. In the few studies that found significant relationships between handedness and personality, the researchers reported the results in a stand-alone fashion and failed to offer compelling, cohesive explanations as to why the associations exist. For research in this area to progress, more detailed theories need to be proposed and tested. Developing an overarching model that explains why handedness differences result in personality and political ideology differences should be of service to the field. Even if these hypotheses are not ultimately supported, the present study is a good first step toward integrating handedness and cerebral hemispheric research with research in other domains. There has been little overlap in the past, and therefore many potentially interesting connections have likely been overlooked. Exploratory studies such as this one help uncover those connections by showing how individual differences in neural processes can subsequently lead to readily observable individual differences.

Method

Participants

Participants were recruited both from the University of Minnesota psychology department's Research Experience Program (REP) and from Amazon's Mechanical Turk (MTurk). I decided to recruit participants from these two sources in order to increase the sample size, diversity, and representativeness of the study. Workers on MTurk are compensated for completing human intelligence tasks (HITs) online that are posted by requestors, and in recent years, researchers in the academic community have started relying on MTurk as an effective yet lower-cost alternative to traditional laboratory experiments. One significant benefit of this approach is that MTurk samples have been shown to be more representative of the general population than community-based samples, college student samples, or other online samples, although they still lag behind online probability samples that use truly random sampling techniques (Berinsky, Huber, & Lenz, 2012; Huff & Tingley, 2015; Casler, Bickel, & Hackett, 2013). An additional benefit is that researchers are able to recruit from a larger pool of participants than that available in a typical university psychology department, with Stewart et al. (2015) estimating that one research laboratory could access as many as 7,300 participants on MTurk. Test-retest reliabilities on MTurk are actually higher than those found in other samples (Buhrmester, Kwang, & Gosling, 2011) and many researchers have replicated results of laboratory experiments with MTurk samples (Casler et al., 2013; Berinsky et al., 2012).

Although these findings demonstrate that MTurk results can be trusted, workers on MTurk do differ from college students and the general population in a few ways. According to a review of the quickly-growing MTurk literature by Chandler and Shapiro (2016), MTurk workers tend to be younger, more educated, and less religious than the general population and are more likely to be under- or unemployed. Some other differences relate to variables that are of interest in the present study. For example, MTurk workers tend to be slightly more liberal than the general population (Berinsky et al., 2012), although Huff and Tingley (2015) found that this difference only held for older individuals, not younger ones. Goodman, Cryder, and Cheema (2013) discovered that

MTurk workers were lower in Conscientiousness than college students and were also lower on Emotional Stability and Extraversion than college students and the general population. Regardless of these differences, however, it appears that the structure and factor loadings of the Big Five are the same in MTurk samples as they are elsewhere. Feitosa, Joseph, and Newman (2015) demonstrated measurement equivalence of the Big Five across an English-speaking MTurk sample, a college student sample, and a sample of employees at an organization.

Since the underlying structure and processes of personality are unchanged in MTurk workers, the aforementioned differences in personality traits should only improve the diversity and generalizability of the study. Any significant results would not be based exclusively on a sample of college students and would theoretically be less affected by atypical fluctuations in personality within one sample, making the findings more likely to hold true for a broader segment of the population. Furthermore, while MTurk workers differ from the general population on some personality and political ideology measures, they exhibit similarities on other measures relevant to the present study. For instance, they demonstrate typical biases regarding risk-aversion, risk-seeking, and sensitivity to gains and losses – all variables related to approach and withdrawal motivation. From a methodological standpoint, it also appears that MTurk workers' incentive structures are similar to those of college students. Their main motivation for accepting HITs is financial, and their attitudes about money are similar to those of college students (Goodman et al., 2013), but they also complete HITs for fun and to learn new skills (Chandler & Shapiro, 2016). In conclusion, although MTurk workers may differ from traditional college students in a few limited areas, including them in the current study is by no means a liability but an advantage, as it should result in superior generalizability and representativeness.

To qualify for the study, participants had to meet a number of criteria. First, all participants had to be current United States residents 18 years of age or older. I restricted the visibility of the MTurk HIT so only individuals in the U.S. would be able to view and accept it. Participants also had to be native speakers of English, as previous research has found different results when comparing native and non-native English speakers, especially on MTurk. Since this qualification was listed as a demographic question, however, individuals who answered no were not barred from the study but instead had their data removed later. In addition, I set the HIT approval rate for MTurk participants at 96 percent. This meant that in order to accept my study, an MTurk worker's previous HIT submissions had to have been accepted by requestors at least 96 percent of the time. Research by Peer, Vosgerau, and Acquisti (2014) found that setting the prior HIT approval level to at least 95% resulted in high-quality data and workers who rarely failed attention checks, so I adhered to that guideline.

A total of 655 participants from both REP and MTurk gave their informed consent to participate in the study and answered at least one question. Data from 24 of those participants was discarded as they had already completed the study at an earlier time. An additional 77 participants' data was excluded from analyses because they did not complete some of the measures or stopped before finishing the study, 26 more participants were excluded because they did not meet the native English speaker qualification, and a final 29 participants had their data discarded because they failed more than one attention check. The use of attention checks is particularly recommended in online studies and with MTurk due to participants' greater distractibility and lack of researcher supervision (Goodman et al., 2013), although some researchers have found that MTurk workers pay better attention than other online samples (Berinsky et al., 2012). Eliminating these participants resulted in a total of 499 participants (152 from the MTurk sample and 347 from the REP sample) who completed all of the survey measures in the main study. Due to the online nature of the approach/withdrawal task at the end of the study and technical issues involving participants' computer browsers, only 432 of the 499 participants completed all the surveys as well as the approach/withdrawal task, and 429 participants completed all the surveys, the approach/withdrawal task, and a two-question posttest manipulation check.

All REP participants were compensated with three extra credit points for their psychology course and MTurk workers were paid $3 for their voluntary participation. Although some participants' data was excluded from analyses, they were still compensated for their time. Typically, workers on MTurk who withdraw early from a study or do not complete it fully are not approved or paid by requestors. This results in a lower HIT approval rate that can have negative ramifications for their future success on the site because lower approval rates disqualify workers from many studies. However, Gleibs (2017) and others have observed that this practice of withholding payment or punishing participants for declining to answer some questions is at odds with the ethical principles governing traditional laboratory research, which emphasize participants' autonomy and their right to drop out of a study at any time or leave questions unanswered. In accordance with this view, I decided to still approve and compensate participants with missing or incomplete data.

Seventy-six percent of the overall combined sample of MTurk and REP participants identified as White, 10% as Asian, 6% as Black, 4.4% as Hispanic, and .6% as Native American. Roughly 3% of participants chose not to respond to the ethnicity question. The MTurk (76% White) and REP (75% White) samples were almost identical in their distributions of ethnicities. Participants in the combined sample ranged in age from 18-77 years (M = 25.2), with participants in the MTurk sample (M = 36.2, range 22-77 years) showing a higher age distribution than participants in the REP sample (M = 20.38, range 18-43 years). Overall, 67% of the participants were female, but the MTurk sample was more evenly split (52% female) than the REP sample (73% female). Answers to a one-question demographic measure of handedness, a crucial variable for this study, were close to identical in the REP and MTurk populations. In the overall sample, 90.5% of participants identified as right-handed, 8.8% identified as left, and .6% chose not to answer (but were identified by later handedness analyses as mixed-handers). Roughly 90% and 8.5% of participants in the MTurk sample identified as right- and left-handed, respectively, while 90.7% of participants in the REP sample reported being right-handed and 8.9% reported being left-handed. These percentages closely mirror handedness levels in the general population (e.g., Coren, 1994).

Materials

All survey measures were presented to participants using the University of Minnesota's online version of Qualtrics. This software allows for detailed study design and the preservation of participants' anonymity and is compatible with multiple browsers. Participants responded to the majority of survey questions by selecting bubbles that corresponded to numbers on a Likert scale with labeled endpoints or bubbles that indicated their selected answer. The numerical scales with labeled endpoints were repeated at multiple points throughout each survey so participants would not forget the response labels. In a few instances, participants had to type a number or word in a text box instead. Each measure was preceded by instructional text that briefly described the types of questions the participant would be answering and the corresponding response scale. The timed approach/withdrawal task that was created for the present study was developed and administered using Millisecond's Inquisit program. Inquisit lets researchers program their own experiments and, importantly for the present study, also permits those researchers to collect reaction time data and present experimental stimuli in precisely timed intervals. Table 1 contains a list of all measures included in the current study and their hypothesized roles as predictor, mediator, or criterion variables.

Edinburgh Handedness Inventory. The EHI (Oldfield, 1971), which was discussed extensively earlier in this paper, contains 10 questions about which hand the participant uses to do common tasks. These questions refer to a number of tasks such as drawing, writing, and using a toothbrush, in addition to asking about which hand they would use to open the lid of a box or which hand they would place on the upper portion of a broom while sweeping (see Appendix A for the entire inventory). Participants were instructed to put a 1 in the left-handed or right-handed column if they typically used that hand to do the task, to put a 2 if they would never try to use the other hand unless they had to for that task, or to put a 1 in both columns if they were indifferent and would use either hand. The sum of numbers in the left column is subtracted from the sum of numbers in the right column, and then divided by the sum of marks in both columns, giving a total laterality quotient ranging from -1 to +1 which is then converted to -100 to

+100 to eliminate decimals. Negative numbers indicate a left-hand preference, positive numbers indicate a right-hand preference, and numbers around 0 indicate inconsistent-handedness.

This version of the EHI also contained an additional familial handedness survey. This was included as an additional measure of handedness since familial non-right handedness correlates with individual left-handedness but is also independently related to other measures. For instance, familial left-handedness has been linked to increased interhemispheric interaction (Gorynia & Egenter, 2000) and reduced left hemisphere lateralization among both right- and left-handers (Sommer et al., 2002), making it a variable of interest for the present study. In this measure, participants had to list how many relatives they had in each category (father's brothers, older sisters, etc.) and whether those relatives were right-handed, left-handed, ambidextrous, or if they did not know an individual's handedness preference. The total numbers of left-, right, and inconsistent-handed individuals in each family were then divided by the overall number of relatives to produce a percentage score indicating what percentage of the relatives were left-handed, right-handed, or inconsistent-handed. Many studies that employ measures of familial left-handedness do not differentiate between left- and inconsistent-handers, often categorizing them all as left-handers, so I opted to take a similar approach in my study. The percentages for left- and inconsistent-handed individuals were therefore combined to create a single variable, an overall percentage measure of familial non-right-handedness.

The BIS/BAS. Carver and White's (1994) version of the BIS/BAS was used to measure approach and withdrawal motivation and has also been discussed in detail in earlier sections of this paper. As the most frequently used measure of approach/withdrawal in this field of research, including it in the current study was necessary to both replicate and extend previous findings while testing new relationships. It contains 20 items originally designed to measure the BIS, the BAS and the three BAS subscales (Fun Seeking, Reward and Drive). In addition, three items previously attributed to the BIS were summed to provide an FFFS-Fear score in line with the empirically-based recommendations of Heym et al. (2008) and others. An example of an FFFS item is, "If I think something unpleasant is going to happen, I usually get pretty 'worked up.'" All items were scored on a 1-4 Likert scale, with 1 = strongly disagree and 4 = strongly agree. The BIS/BAS can be viewed in its entirety in Appendix B.

Approach-Avoidance Temperament Questionnaire. Developed by Eliot and Thrash (2010) as an alternative to measures such as the BIS/BAS, the Approach-Avoidance Temperament Questionnaire (ATQ) is designed to measure an individual's inclination to pursue rewarding experiences and avoid fearful or threatening ones. It includes 12 questions, six of which measure approach temperament and six avoidance temperament, and employs a seven-point rating scale anchored by strongly disagree and strongly agree options. The entire instrument can be seen in Appendix C, but one example item measuring avoidance temperament is, "It is easy for me to imagine bad things that might happen to me." Eliot and Thrash (2010) found in a series of studies that approach temperament was positively correlated, as expected, with Extraversion, the BAS, positive affect, and chronic promotion focus, while avoidance temperament was positively correlated with Neuroticism, the BIS, negative affect, and chronic prevention focus. They argue that the ATQ is different than the BIS/BAS because it measures reactions to a broader range of stimuli and is less constrained by specific structures and circumstances. As mentioned in earlier sections of this paper, the ATQ demonstrates good test-retest reliability and was included in this study because although it should correlate with the BIS/BAS, it should also provide an estimate of approach/withdrawal that potentially goes beyond that encapsulated by the BIS/BAS. Results from the ATQ, especially when considered in light of the other constructs measured in this study, could also inform ongoing debates about the structure, meaning, and reliability of the BIS/BAS.

The PANAS. The PANAS was included in this study as an alternative measure of approach/withdrawal motivation given its previously discussed associations with measures such as Extraversion, Neuroticism, and the BIS/BAS (e.g., Gable et al., 2000) and with right and left frontal hemispheric asymmetries (e.g., Davidson & Fox, 1989). The instrument includes a total of 20 items (10 measuring positive affect, 10 measuring negative) and asks participants to use a 1-5 scale to indicate how much they feel certain emotions on average (e.g., scared, proud, determined, upset, etc.; see Appendix D for all 20 items).

The MM scale. Janoff-Bulman's (2008) Moral Motives scale includes four subscales that measure Self-Restraint, Social Order, Self-Reliance and Social Justice (the entire measure can be seen in Appendix E). The first two subscales were designed to measure withdrawal/avoidance motivation and their scores are averaged to produce a total Avoidance score. The last two scales, Self-Reliance and Social Justice, are supposed to gauge approach motivation and are averaged together to produce an Approach score for each individual. As discussed earlier in this paper, the first two scales have been associated with political conservatism and RWA, while Social Justice has been found to correlate with liberalism. The scale itself contains a total of 20 items and includes statements such as “I demonstrate I’m a better person every time I exercise self- restraint rather than give in to my desires” that participants are asked to agree or disagree with using a seven-point scale. The MM scale’s previously established associations with political ideology and approach/withdrawal motivation make it a possible contender for a mediating variable between political ideology and handedness. It also demonstrates promise as an alternate measure of approach/withdrawal motivation and while it should theoretically correlate with measures such as the BIS/BAS and the ATQ, it may also help clarify how approach and withdrawal motivation play a role in moral decisions and political ideology, domains untouched by those other questionnaires.

The BFAS. The BFAS, designed by DeYoung et al. (2007) and discussed throughout the paper so far, was used as a measure of Big Five personality. Unlike other measures of the Big Five, the BFAS provides scores for not only the five domains, but for 10 lower-level aspects as well. It consists of 100 questions, with 10 questions devoted to each of the 10 aspects: Assertiveness, Enthusiasm, Politeness, Compassion, Orderliness, Industriousness, Openness, Intellect, Volatility, and Withdrawal. Participants used a 1-5 scale to indicate the extent to which they agreed or disagreed with an item describing their personality, such as “Am easily distracted” (reverse-scored Industriousness; see Appendix F for all 100 items).

The PID-5. This instrument was first discussed in the section on maladaptive personality traits. It was designed by Krueger et al. (2012) and can be thought of as a pathological version of the Big Five, with five domains roughly corresponding to the original Big Five domains: Detachment, Negative Affect, Antagonism, Disinhibition, and

Psychoticism. There are also 25 facets, such as Perseveration and Risk Taking, but not all 25 contribute to a domain. Instead, each domain score is calculated by averaging the scores of three facets that contribute to that domain. The PID-5 is a fairly long instrument, containing a total of 220 items, and is scored on a four-point scale. An example item is, "Things around me often feel unreal, or more real than usual." (Perceptual Dysregulation facet, Psychoticism domain; see Appendix G for the entire measure).

The MFQ. The Moral Foundations Questionnaire is similar in many ways to the MM scale and likewise measures individuals' moral inclinations and attitudes. Unlike the MM scale, however, Graham et al. (2011) did not explicitly design it to measure approach motivation or withdrawal/avoidance motivation and it has clearer connections to political ideology. The two subscales of fairness/reciprocity and harm/care have demonstrated correlations with liberal political ideology, while the three subscales of ingroup/loyalty, authority/respect, and purity/sanctity have all been associated with political conservatism (Graham et al., 2011). This questionnaire is particularly appropriate for inclusion as a criterion variable in the present study as items in the first two subscales appear to have approach-related components such as helping others beyond the self, taking action to redistribute money, or ensuring everyone has the same rights, while the last three subscales include statements that focus more heavily on in-group preservation, avoiding threats to society, and maintaining order in the face of chaos, all goals that seem to require greater withdrawal motivation. These evident connections to approach and withdrawal suggest that approach/withdrawal motivation could be a candidate mediator of any MFQ-handedness relationship. The MFQ uses a 0-5 response scale and includes 30 items in total, some of which require participants to indicate their agreement or disagreement with a statement and others that ask a participant to judge how relevant a specific factor is to them when deciding whether an action is right or wrong (see Appendix H for the questionnaire).

The RWA scale. The version used in the current study was Altemeyer's (2006) 22-item RWA scale. Participants were instructed to indicate how strongly they agreed or disagreed with a statement using a -4 to +4 scale, with a 0 indicating that they felt neutral about that statement. Higher scores on the scale are indicative of higher RWA levels. As discussed earlier in the literature review, RWA items are designed to measure an individual's desire for authoritarian leaders, traditional moral structures, and a stable society that reduces threats, and include statements such as, "The only way our country can get through the crisis ahead is to get back to our traditional values, put some tough leaders in power, and silence the troublemakers spreading bad ideas" (see Appendix I for the whole scale). Political psychology researchers have used various iterations of the RWA scale in the many years following its creation by Altemeyer, and although the scale positively correlates with political conservatism, it also provides different and more nuanced information about an individual's political attitudes than measures of partisan identification alone. The fact that it has also been used in recent studies investigating variables such as personality, handedness, and approach/withdrawal motivation further reinforces the need to include it in the current study.

The SDO scale. Closely related to RWA, this attitudinal measure also correlates with political conservatism. Like the RWA, it provides supplementary information; in this case, about an individual's preference for unequal hierarchical societies that allocate more power and resources to high-status groups that are viewed as superior. The version of the SDO employed in the present study was created by Pratto et al. (1994) and includes a total of 16 statements that participants are asked to disagree or agree with using a typical 7-point Likert scale. Higher scores indicate greater social dominance orientation. The entire scale can be found in Appendix J and contains items such as, "If certain groups of people stayed in their place, we would have fewer problems," and "In getting what your group wants, it is sometimes necessary to use force against other groups." As stated in prior sections of this paper, the SDO scale is commonly used alongside the RWA in political ideology research, but it is also incorporated in broader studies of personality and approach/withdrawal motivation due to its unique associations with those constructs. For example, SDO is associated with Agreeableness independently of RWA and overall conservatism (e.g., Sibley & Duckitt, 2008) and it exhibits different relationships with approach/withdrawal motivation than RWA does (e.g., Corr et al., 2013).

The SWB index. The Society Works Best index is comprised of 14 forced-choice items intended to measure participants' political ideology in a less immediately obvious way. By steering clear of any overt position statements or direct questions about partisan affiliation, Smith et al.'s (2011) goal was to reduce the number of participants who answer using response sets or in accordance with their chosen political party's platform. Therefore, although the SWB does correlate with other measures of political ideology, it should be thought of more as an implicit measure of how an individual believes society should be structured rather than an explicit measure of partisan identification or political ideology. It was included in the present study for these reasons as well as for its psychometric properties (e.g., good reliability). Additionally, the decision to use a forced-choice structure was consciously made in order to detect participants' true underlying predispositions rather than letting them pick neutral or socially desirable options. Each item asks participants to choose between two hypothetical societal outcomes, either of which most respondents would view as too extreme or lacking in nuance. For instance, participants are asked to indicate whether society works best when "Those who break the rules are punished" or when "Those who break the rules are forgiven." In another item, participants have to choose whether society works best when "People realize the world is dangerous" or when "People assume all those in faraway places are kindly" (see Appendix K for the complete SWB index). Although participants could likely marshal arguments as to why neither answer is fully correct or desirable, they are forced to select one, and by doing so they theoretically disclose their deep-seated political preferences. Higher positive scores indicate greater conservatism while more negative scores indicate greater liberalism.

Self-reported political ideology. Participants were asked an additional three questions about their political party affiliation and political ideology. These questions complemented the other political ideology measures in the study (SDO, RWA, and SWB) and served as direct confirmation of a participant's political attitudes. For the first two questions, participants indicated their agreement or disagreement with the following statements using a 1-5 Likert scale: "Politically, I favor the Democratic Party" and "Politically, I favor the Republican Party." These identical questions have been used in other studies involving personality and political ideology (e.g., Hirsh et al., 2010) and correlate with other (longer) measures of liberalism and conservatism. Finally, participants were asked to choose a number between 0 and 100 to indicate their ideological placement on the overall political spectrum, with a score of 0 indicating very liberal and 100 indicating very conservative. This question was used in the pilot study and has also been used in other studies as a simple marker of general political ideology.

Attention checks. Eleven attention check items were scattered throughout the survey portion of the study. Most survey measures contained one attention check, although some shorter ones such as the SWB did not contain any, while longer measures such as the PID-5 contained more than one. All attention checks were phrased in a similar way and asked participants to, for example, "Select "3" on this line" or "Select the 'Very False or Often False' response," depending on the response labels used for that particular survey. Participants were then supposed to click on the corresponding bubble. Participants who incorrectly answered more than one attention check had their data dropped from the study, as this was taken as an indication that they were answering randomly or were not carefully reading the questions.

Approach/avoidance task. The present study included a number of questionnaire-based measures of approach/withdrawal motivation such as the BIS/BAS, the ATQ, and the PANAS, as well as more novel measures with political overtones such as the MFQ and the MM scale. However, researchers such as Coan et al. (2006) posit that fundamental differences in approach and withdrawal motivation may not become apparent until they are tested in more realistic, motivating settings. According to Coan et al.'s aforementioned Capability Model, measures of approach/withdrawal motivation taken at rest may erroneously lead to null results and exhibit worse accuracy than measures obtained during or following a task that actively evokes approach and withdrawal motivation. This suggests that while questionnaires such as the BIS/BAS and ATQ may help elucidate relationships between handedness, approach/withdrawal motivation, and personality and political ideology, it is also possible that those relationships may appear nonexistent or weaker than they actually are due to the lack of any approach/withdrawal motivation on the part of the participants. Therefore, I created a timed approach/withdrawal task to better elicit participants' true motivational tendencies and rectify the oversights of previous researchers who relied solely on questionnaire measures.

Although relatively rare in this field of study, a few researchers have created computerized tasks intended to emulate real-world situations that involve approach and withdrawal motivation, and I used elements of these tasks as a starting point in the design process. Berkman and Lieberman (2010) designed one such experimental task to help investigate possible interactions between approach/avoidance motivation, positive and negative valence, and prefrontal hemispheric asymmetries. Specifically, they wanted to discover whether motivational direction alone was responsible for changes in fMRI measures of prefrontal asymmetry, or whether the valence of a stimulus (pleasant or unpleasant) was accountable for those differences. In the first stage of their experiment, Berkman and Lieberman had participants read a fake article about a newly discovered tribe of people, the Nochmani, who had rather atypical food preferences in some domains (they enjoyed eating insects but did not like meat) but more typical preferences in other areas (they disliked foods infested with fungi but liked eating desserts). Next, participants were scanned while viewing blocks of images from each of the four food categories (meat, insect, fungus, or dessert) and were instructed to press a key to indicate whether the Nochmani would or would not eat that item (the approach or avoid decision). The authors were particularly interested in trials where participants had to avoid eating a food with normally positive connotations such as meat and when they had to approach a typically unpleasant food such as insects, as these blocks of trials allowed them to distinguish between motivational direction and the valence of the stimulus being approached or avoided. Consistent with results discussed earlier in this paper, Berkman and Lieberman (2010) found that approach motivation, regardless of valence, predicted greater relative left-frontal activation than avoidance motivation. In addition, the level of approach motivation as measured by the BAS was positively correlated with increased left-frontal asymmetry during the task's approach conditions, although the BAS did not exhibit any such correlations during the baseline phase. This provides further evidence not only that their task succeeded in eliciting approach/withdrawal motivation, but that using the BIS/BAS unaccompanied by an active motivational task can lead to null results.

Although Berkman and Lieberman's task did effectively alter participants' motivational states, motivational direction was also crossed with valence, which is not of interest in the present study. A second concern is that although the action of deciding whether the Nochmani would eat a certain food or not does have motivational elements, it may not be as strongly motivating as a situation where the participants have to decide for themselves whether to approach or withdraw from a stimulus. Finally, although relying on single keyboard presses is acceptable in an fMRI study where participant responses should be physically restricted as much as possible to avoid movement artifacts, that constraint does not exist in non-fMRI studies. In those cases, it would instead be beneficial for the approach/withdrawal response to be as active as possible. In real-life situations outside the laboratory, people often move toward whatever stimulus they are approaching and physically retreat from a stimulus they are trying to avoid. Consequently, any design for an approach/withdrawal computerized task should try to mimic that physical process of approach/withdrawal as much as possible by using more active response methods than simple key presses.

One such method is gaining traction in recent years and has been used in studies of fear and addiction. Computerized Approach-Avoidance Tasks (AATs; Rinck & Becker, 2007) require the participant to pull a joystick towards them when approaching an image or push a joystick away from them when avoiding or withdrawing from an image. In this way, not only do the participants have to decide on a cognitive level whether to approach or withdraw, but they have to mirror that decision with their hand movements. Furthermore, the size of the image changes in response to the approach/avoid reaction: it grows to fill the screen for approach conditions as participants pull the joystick towards them, and shrinks during avoidance conditions as participants push the joystick away. This expansion or shrinking of the image lends an additional layer of realism to the task and reinforces the approach/avoidance aspect of every decision. In their first study using the computerized AAT, Rinck and Becker (2007) found results indicating that the task does reliably dissociate between participants who are inclined to avoid a specific stimulus and those who have no such prior motivation. Participants who were fearful of spiders, as measured by phobia questionnaires and actual approach distance to a harmless tarantula, displayed different patterns of results on a spider version of the AAT than participants who did not have arachnophobia. The participants who were frightened by spiders pushed images of spiders away faster than they pulled images of spiders towards them, pushed images of spiders away faster than images not containing spiders, and pushed spider images away faster than participants who were not afraid of spiders. The AAT results were also better predictors of participants' approach distance to the live tarantula than the phobia questionnaires. Rinck and Becker interpreted all of these results as strong evidence for the AAT's ability to accurately measure avoidance motivation in a population predisposed to avoid a specific stimulus.

Subsequent researchers have discovered that the AAT not only accurately measures approach and avoidance motivation, but can actually be used to alter those motivations. Wiers, Rinck, Dictus, and Van den Wildenberg (2009) created a version of the AAT to measure approach and avoidance motivation towards images of alcohol and then tested it with populations of individuals genetically predisposed to alcoholism. Men who were heavy drinkers and carriers of an allele previously linked to cravings for alcohol showed stronger approach motivation toward images of alcohol than heavy-drinking men who lacked the allele (Wiers et al., 2009). In one follow-up to this discovery, Wiers, Eberl, Rinck, Becker, and Lindenmeyer (2011) used the same alcohol AAT to train participants with alcoholism to avoid images of alcoholic beverages. Participants were assigned to one of two experimental conditions in which they were explicitly or implicitly trained to avoid images of alcohol using the AAT, or one of two control conditions in which they received either no training or sham training. During the AAT portion of the study, participants in the two experimental conditions learned to push images of alcoholic drinks away with the joystick but to pull images of nonalcoholic soft drinks towards them. After four consecutive days of AAT training, participants continued on to cognitive behavioral therapy. Post-hoc analyses of the data showed that the participants in the experimental conditions who had originally demonstrated an approach bias for images of alcohol instead showed the opposite bias, and the effects extended to other unrelated tasks involving categorization of alcohol-related words and concepts. Follow-up analyses one year after discharge from the clinic showed that the results were long-lasting: participants in the experimental conditions who had learned to associate images of alcohol with the action of pushing the joystick away were less likely to have relapsed.

These results suggest that the AAT is both an excellent imitation of a real-life approach/withdrawal task and a good barometer of an individual's level of approach/withdrawal motivation towards a stimulus category. Whereas these studies used the AAT to investigate reactions to specific addictive or fearful stimuli, however, I wanted my task to be a more generalizable measure of an individual's overall tendency to experience approach or withdrawal motivation. Since Wiers et al. (2009) had made a version of their alcohol-AAT publicly available for modification on Inquisit, I decided to use it as a template to build a version of the AAT that would measure an individual's levels of approach/withdrawal motivation during an image-categorization task. By the end of the design process, many of the parameters had been changed from the commonly used AAT versions described here; for example, the practice trials in the present study did not use horizontal versus vertical images as in previous studies, but were completely redesigned to give participants practice identifying mushroom images instead. In addition, since the study was conducted using online populations and not in the laboratory, participants used their computer's trackpad or mouse instead of a joystick, as

Wiers et al. (2009) also did in one experiment. However, the basic design of the task was kept roughly the same so that when participants chose to approach a stimulus, the image expanded to fill the screen, and when they chose to withdraw from a stimulus, the image shrank accordingly in size.

When choosing which task and images to use for my version of the AAT, I kept a number of requirements in mind. First, the images had to be fairly innocuous (i.e., not fear-inducing, not related to an addiction, not particularly arousing, pleasant, or unpleasant, etc.) so participants' predispositions to avoid or approach a specific or highly salient stimulus would not play a role in their responses. Second, while not evoking strong emotions or prior motivational desires, the images and the task still had to be motivating enough to induce approach and withdrawal motivation in the participants. Third, the images and task had to relate to an approach/avoid activity that could theoretically be conducted in the real world, but not one so common that participants would be well-practiced at it, resulting in ceiling effects, or one that was more popular among certain subsets of the population, resulting in faster and more accurate responses for those participants. Fourth, the images had to be of objects that were visually similar enough to avoid potential confounds due to unique or distinctive stimuli but different enough for participants to be able to learn to categorize them after a limited number of practice trials.

I eventually decided to use a mushroom-gathering task as the basis for my version of the AAT as it met all four criteria. Sorting edible from inedible mushrooms in the wild has an element of risk and uncertainty, so it should theoretically elicit approach and withdrawal motivation. However, the task is not so fear-inducing that participants should have previous phobias relating to it. Gathering mushrooms is also a real-world activity that people are familiar with, but it is also sufficiently uncommon in the general population that most participants should not have had previous experience with it. Finally, although many images of mushrooms look superficially similar and are identifiable as belonging to the same family of organisms, they also have notable differences in color, structure, and texture and consequently would lend themselves to relatively easy categorization. A mushroom identification task was also used in a study by Rich and Gureckis (2014), which provides additional evidence that such a task would work well in the present study. Although Rich and Gureckis focused on how uncertainty and base rates affect approach/avoid decision-making models instead of specifically measuring levels of approach/withdrawal motivation, their overall design was similar. Participants received feedback about which mushrooms were healthy or poisonous in a habitat and then had to use their knowledge of mushroom base rates and probabilities to decide whether to eat or avoid a particular mushroom. Importantly for the present study, they reported that participants were capable of learning which mushrooms belonged to the healthy or poisonous categories, thus indicating they should be able to do the same in a mushroom-gathering version of the AAT.

The mushroom AAT was programmed with and launched through Inquisit, and it employed 20 photos of mushrooms that I found through searches of Google free images (see Appendix L for example mushroom images). All photos were cropped so that the mushrooms took up approximately the same amount of visual space in each image, and mushrooms of a variety of colors, shapes, and types were chosen so participants would not be confused by species that looked too similar. For counterbalancing purposes, participants were first assigned to one of two conditions based on whether their randomly assigned participant number from Qualtrics was odd or even. Participants in the first condition only saw mushroom images 1-10, while participants in the second condition only saw mushroom images 11-20. This allowed for later testing to rule out possible confounds related to the images themselves. After being placed in one of two image conditions, participants were then randomly assigned to an additional experimental condition. Participants who had been assigned to the 1-10 images condition, for example, would then be assigned to one of two experimental conditions: in one condition, images 1-5 would be categorized as edible or “good” mushrooms and images 6-10 would be categorized as inedible or “bad” mushrooms, whereas in the other condition, images 1-5 would be “bad” and images 6-10 would be “good.” The “good” mushrooms were the ones participants were supposed to approach, while they were supposed to avoid the mushrooms categorized as “bad.” This same process was done for participants in both the 1-10 and 11-20 image conditions, resulting in a total of four experimental conditions partially counterbalanced based on images used and the good or bad designations of those images.

This additional counterbalancing was done to reduce potential confounds that could occur if the same mushroom images were always classified as good or bad across all conditions. For instance, if a certain mushroom color was classified as “bad” throughout the task, and the color also happened to be associated with dangerous mushrooms in the real world, participants may have exhibited higher error rates and slower reaction times when they had to approach it. Participants were also reminded before and after the AAT that any associations they learned about good and bad mushrooms in the task should not be applied to real-world encounters with mushrooms, so as to reduce the risk that a participant would mistakenly collect or eat a mushroom that was actually poisonous but had been randomly labeled as “good” in the study. This ethical concern was also the reason the terms “good” and “bad” were used throughout the AAT instead of other descriptors such as edible/inedible, poisonous/healthy, etc.

The AAT itself consisted of three blocks: a trial sequence generation block, a practice block, and a test block. The trial sequence generation block did not involve participants and its purpose was solely to determine the order of mushroom images that the participant would see in both the practice and test blocks. This sequence of images was generated semi-randomly with restrictions, in line with previous versions of the AAT. No individual mushroom image could be shown more than three consecutive times, and no category of mushroom image (good or bad) could be presented more than three consecutive times. These constraints were established to prevent participants from developing response sets or from being primed after seeing the same image multiple times in a row, leading to faster reaction times. After sequence generation the practice block, which consisted of a total of 40 trials, was launched. Before beginning the trials, participants first read a set of instructions and were asked to review each “good” mushroom image and each “bad” mushroom image one at a time to familiarize themselves with all 10 images, only pressing the space bar when they were ready to move on. Instructions for the practice and test blocks can be found in Appendix M.

Participants followed the identical format for the practice trials as for the actual test trials, with the only differences being that feedback was provided following each practice trial and there were 80 total test trials instead of 40. They were first told to click on an X in the center of the screen and leave the cursor there. The purpose of this instruction was to ensure the participant's cursor was in the center of the screen, ready to be moved up or down in response to the upcoming mushroom stimulus. A mushroom image would then appear in the center and fill 50% of the screen. Participants were told to decide as quickly and accurately as possible whether the mushroom was one of the "good" mushrooms or "bad" mushrooms they had seen earlier during the familiarization phase. If it was a good mushroom, they were supposed to approach it by moving the cursor (using their touchpad or mouse) down towards them until it reached the bottom of the screen, whereas bad mushrooms were supposed to be withdrawn from by pushing the cursor up and away from them until it reached the top of the screen. If the participant chose to move the cursor towards them to approach the mushroom, the image would correspondingly increase in size until it filled 100% of the computer screen. Conversely, if the participant chose to push the cursor away from them to avoid the mushroom, the image would shrink until it took up just 10% of the screen. Participants sometimes changed direction during the course of the trial if they realized they had made a mistake; however, although Inquisit still logged these changes in direction, a trial was only counted as correct if a participant did not change direction with the touchpad or mouse. Following a practice trial, participants saw a red X over the image if they had incorrectly chosen to approach a bad mushroom or avoid a good mushroom; if they correctly approached or avoided a mushroom, the word "Correct" was displayed instead. This feedback was absent during the test block. Finally, once participants finished with a trial by moving their cursor to the top or bottom of the screen, there was a 300-ms intertrial interval before the next trial began.

Self-reported opinions about mushrooms. Although mushroom identification and gathering is a fairly uncommon hobby, there is still a chance some participants may have had more expertise than others in this area, potentially affecting the validity of their results. Some participants may also have strongly liked or disliked mushrooms and consequently had stronger motivational biases to approach or withdraw from them, which could have biased their reaction times and error rates. Therefore, two posttest questions with Likert scale response options were included following the AAT to test for these potential confounds: "How much do you know about mushroom identification?" and "How much do you enjoy eating mushrooms?"

Procedure

Participants were recruited through the REP system and through multiple MTurk HITs. REP participants received the study link via email while MTurk participants were able to click directly on the link after signing up. After first reviewing the study's instructions and giving their informed consent, participants were allowed to proceed to the demographics section where they answered questions about their age, gender, ethnicity, handedness, and whether they were a native English speaker. They then completed all the surveys and measures discussed in the Materials section beginning with the predictor measure—the EHI—and then continuing on to the BIS/BAS. These two measures were placed at the start of the study due to their importance to the overall study design and the likelihood that participants would be less fatigued at this point, resulting in higher quality data. In addition, the questions in both instruments are relatively uncontroversial and therefore should not lead to social desirability issues later in the study or greatly influence subsequent measures.

Next, participants completed the BFAS and the PID-5. These criterion measures were placed earlier in the study in the hope that they would be less subject to contamination from any assumptions participants might make about the study's aims after they began answering questions related to political ideology. For instance, if a participant knew that political ideology was being specifically measured in the study, their partisan biases might lead them to answer personality questions in a socially desirable fashion so members of their political party would be seen in a more positive light. Following the PID-5, participants completed the ATQ and then the PANAS, which were placed later in the study instead of immediately following the BIS/BAS due to the measures' somewhat similar content and question wording. By placing the longer BFAS and PID-5 between the approach/withdrawal measures, participants should have had time to forget their exact answers to the BIS/BAS and so would be less likely to simply rely on their previous answers when responding to the ATQ or PANAS.

The remainder of the criterion measures were ordered according to how explicitly they asked about political content in order to reduce social desirability effects and other potential contamination effects. Participants first took the SWB and then completed the MM scale followed by the MFQ. Participants then completed the RWA and SDO scales before answering the direct, self-reported political ideology questions. They were then re-directed to Inquisit, which they had been asked to download before the study began. Participants were randomly assigned to an AAT image condition (mushroom photos 1-10 or mushroom photos 11-20) and then to a good/bad categorization condition (first five images categorized as good, last five as bad or vice versa). Next, participants completed the 40 practice trials that were described earlier in the Materials section before continuing to the 80 test trials. When they had finished the mushroom AAT, participants were re-directed back to Qualtrics where they answered the final two posttest questions about their knowledge and liking of mushrooms. Participants typically took from 45 minutes to an hour and a half to complete the study, with an average completion time of slightly more than one hour. MTurk participants completed the study more quickly than REP participants on average, likely due to their greater familiarity with online surveys. Upon completion of the study participants were thanked, debriefed, given contact information in case of additional questions, and compensated for their time.

Results

Data Scoring

Participants' data was first cleaned according to the steps outlined in the Participants section before data from the Inquisit and Qualtrics sections of the study was combined using a unique identifier. I used multiple platforms to conduct statistical analyses (SPSS 24, R and Excel) and employed pairwise deletion throughout the study for any comparisons involving measures with different *N*s. This was necessary as measures that came late in the study, such as the political inventories, tended to have slightly higher levels of non-responses, and the technical issues associated with the Inquisit mushroom AAT task resulted in missing data points for a number of participants. The REP and MTurk samples were analyzed independently as well as in a combined dataset for greater statistical power and sample diversity.

Measures were scored as described in the Materials section; additionally, a number of measures containing subscales, such as the MFQ, were transformed into one variable for clearer analysis. Participants' mean scores on the harm/care and fairness/reciprocity MFQ subscales were summed and then subtracted from their mean scores on the ingroup/loyalty, authority/respect, and purity/sanctity dimensions to form MFQ-Progressivism, in line with previous studies using the MFQ (e.g., van Leeuwen & Park, 2009). The BIS was separated into its FFFS and BIS-Anxiety (BIS-A) components and the BAS was split into BAS-Drive, BAS-Fun Seeking and BAS-Reward Responsiveness, all of which were analyzed alongside the original BIS and BAS scores. Participants' scores on the EHI, which were computed using the method described in the Materials section, were used to create a Laterality Quotient variable that allowed me to investigate differences in overall direction of handedness from strong right-handedness to strong left-handedness. I also took the absolute values of Laterality Quotient scores to create a Laterality Quotient – Absolute Value variable that measured degree (inconsistent versus consistent) of handedness instead of direction.

After creating new variables from the questionnaire measures, I converted the results from the mushroom AAT into two difference scores in order to better depict participants' push and pull patterns across numerous trials. Before doing so, I used independent-groups t-tests to compare average scores across the counterbalanced groups to ensure that image order and image category were not acting as confounds. There were no significant differences between groups, indicating that there were no order effects or similar issues. Only trials from the 80-trial test block were included in the two difference score variables; all 40 trials from the practice block were discarded. The reaction time (RT) measures spanned the entire time from when the participant first saw the mushroom image to when they began moving their cursor either towards or away from them. To calculate differences in RT between push trials (when participants were pushing the bad mushrooms away) and pull trials (when participants were pulling the mushrooms towards them), any error trials were first removed. Outliers were then eliminated by removing the 200 fastest and 200 slowest trials across all participants, which amounted to about one percent of the total trials. Participants' average reaction times in milliseconds (ms) on push and pull trials were calculated using the remaining trials and mean pull time was subtracted from mean push time. This resulted in a difference score where a positive score indicated faster relative performance on the pull (approach) trials and a negative score indicated faster performance on the push (avoid) trials. Using a difference score in this instance was also beneficial because the mean RT for push trials (M = 898.92 ms) was significantly faster than the mean RT for pull trials (M = 951.24 ms; $p < .001$) across all participants in the combined MTurk and REP datasets. As a result, a participant's relative speed on push versus pull trials provided a better measure of their approach/avoid motivation by accounting for individual differences in overall reaction time. A second difference score variable was also created to depict variations in error rates across push and pull trials using the same set of data with outliers removed. The overall average percentage of correct push and pull trials was calculated for each participant and the average percentage correct on push trials was subtracted from the average percentage correct on pull trials. The resulting variable depicted the difference in error rate percentage between the two types of trials and was interpretable in the same way as the first difference score: positive numbers indicated fewer errors and therefore better relative performance on pull (approach) trials while negative numbers indicated fewer errors on push (avoid) trials. Unlike the first difference score measure, percentages of correct pull trials (M = 82.57) did not significantly differ from percentages of correct push trials (M = 83.01, p = .62) in the overall combined sample. Finally, I used the two posttest questions about participants' liking of mushrooms and their familiarity with mushroom identification as manipulation checks. I correlated participants' answers to these questions with each difference score variable; however, none of the correlations were significant. This indicated that participants' liking of mushrooms and their prior knowledge of mushroom identification had no apparent effect on their approach/avoid scores.

Data Analysis

After all variables of interest were scored or created, Pearson product-moment correlations were calculated for the hypothesized predictors, mediators, and criteria in the REP, MTurk, and combined datasets. An alpha level of .01 was used throughout the study unless otherwise noted to reduce the familywise error rate due to the large number of correlational analyses conducted. By employing a smaller alpha level, I lessened the likelihood that I would decide to conduct additional mediation analyses based on spurious correlations. Only variables with correlations that were significant at the .01 alpha level were considered as candidates for mediation analyses. This approach aligns with recommendations from a number of researchers regarding mediation best practices. For instance, Baron and Kenny's (1986) causal steps mediation model, a still popular if somewhat outdated approach, initially requires a significant relationship between the predictor and criterion variables as justification for proceeding with a mediation analysis (i.e., the total effect or path c must be significant; see Figure 1 for a visual depiction of the relationships between variables in a simple mediation model). In addition, the predictor must demonstrate a significant relationship with the mediator (path a) and the mediator with the criterion when controlling for the predictor (path *b*) in order to continue on to the final steps in the test.

Not all researchers agree that a significant predictor-criterion relationship is a necessary precondition for mediation, however. MacKinnon, Krull, and Lockwood (2000), Hayes (2009), and Rucker, Preacher, Tormala, and Petty (2011), among others, have all argued that suppression effects can lead to nonsignificant predictor-criterion correlations, thus obscuring total or direct effects that might actually be significant. For example, if a direct effect is positive but an indirect effect is negative, or if one indirect effect is negative while the other indirect effect is positive, the paths with opposing signs can effectively cancel one another out, resulting in nonsignificant total effects. In cases of suppression or inconsistent mediation like these, a researcher may decide not to conduct a mediation analysis due to the lack of a significant correlation between the predictor and criterion, and thus mistakenly conclude there is no mediation present. Although overlooking a potential mediation is clearly undesirable, testing for mediation in the absence of a significant predictor-criterion relationship is more justifiable in an exploratory context or when a priori hypotheses posit inconsistent mediation. A number of researchers such as Agler and De Boeck (2017) have pointed out that although a nonsignificant total effect does not equate to a lack of mediation, it is nonetheless better to avoid testing for mediations when that relationship is absent due to the greater risk of false positives. Agler and De Boeck recommend that unless there is an a priori reason to suspect more complicated suppressor effects or inconsistent mediation, the best statistical approach is to follow the guidelines established by Baron and Kenny (1986) and others and only test for mediation when the requirement of a significant total effect is met. I adhered to this guideline so as to reduce the overall risk of false positives in my study and because none of my hypothesized mediation paths involved inconsistent mediation. The majority of possible mediation models I planned to test also did not have effects with opposing signs, with the exception of those involving a few political ideology measures that were scored in opposing directions. Therefore, all sets of variables that I subsequently included in mediation analyses first had to demonstrate significant predictor-mediator, mediator-criterion, and predictor-criterion correlations. In addition, variables had to be related to one another in the hypothesized direction to be included in any mediation analysis testing an a priori hypothesis, except for political ideology variables with no directional hypothesis. I also conducted additional exploratory mediation analyses to test relationships that were not in the hypothesized direction and had not been predicted prior to the study as well as moderator analyses to test for gender interactions.

Mediation models were tested using the PROCESS macro for SPSS developed by Hayes (2013). It uses ordinary least squares (OLS) regression to perform mediation analyses and also provides ways to test the significance of indirect effects. The PROCESS macro is popular among psychological researchers conducting mediation analyses and was used in some of the studies discussed earlier in this paper (e.g., Chan, 2018; Stoeber & Corr, 2015). Although I only used Model 4 of the macro for simple mediation and Model 1 for simple moderation, it has the capability to model far more complex mediated and moderated relationships and produces results that are effectively the same as those derived from structural equation modeling (Hayes, Montoya, & Rockwood, 2017). It also conducts simultaneous tests of mediation models in contrast to other approaches such as stepwise regression. Perhaps the most beneficial aspect of the PROCESS macro for the purposes of the present study was its ability to produce bootstrapped confidence intervals (CIs) for testing the indirect effect. Bootstrapped CIs are created through repeated sampling with replacement a certain number of times (often ≥ 1000), which allows for the calculation of path *a* and path *b* and therefore the indirect effect (the product of *a* and *b*) for each sample. These estimates of *ab* are then used to construct a confidence interval within which the true effect size is likely to be found. If the CI for the effect size does not contain zero, the indirect effect is considered significant and mediation is supported. Many researchers consider bootstrapped CIs to be the gold standard of indirect effect size testing, as demonstrated by Pieters' (2017) review of 138 mediation studies that found 94% of studies used some form of bootstrapped CI to test the indirect effect.

Bootstrapped CIs are also frequently used in place of or in addition to standard null hypothesis significance tests (Agler & De Boeck, 2017). For example, joint significance tests have long been used by researchers to test whether path *a* and path *b* are significantly different from zero; if both paths are significant, the null hypothesis is rejected and mediation can be claimed. Although joint significance tests produce comparable results to tests of indirect effects using bootstrapped CIs in most instances (Hayes & Scharkow, 2013), there are a number of drawbacks as well. Tests of joint significance do not provide information about the product of paths *a* and *b* (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002) and do not include confidence intervals to aid in interpretations of the effect size (Hayes & Scharkow, 2013). In recent years bootstrapped CIs have also been favored over commonly used effect size measures such as R^2. Preacher and Kelley (2011) explain that using R^2 can be problematic because the variance in Y that can be explained is almost never 100% of the total variance in Y, and differences in explainable variance across studies complicate cross-study comparisons using R^2. Another well-known effect size test, the Sobel test, performs worse in head-to-head comparisons with bootstrapped CIs due to a lack of power and a higher Type II error rate (Hayes & Scharkow, 2013). Additionally, the Sobel test assumes the sampling distribution of the indirect effect is normal, an assumption that often does not hold. Preacher and Hayes (2004) and others argue this makes the test less reliable than bootstrapped CIs since bootstrapping does not assume a normal distribution and does not rely on the standard errors of paths *a* and *b*.

Although the majority of researchers employing mediation analyses have settled on bootstrapped CIs as the method of choice for testing the indirect effect, there is still some debate as to which method of bootstrapping is preferable. Three commonly used bootstrapping methods for producing CIs for the indirect effect include bias-corrected, accelerated bias-corrected, and percentile bootstrap tests. Fritz, Taylor and MacKinnon (2012) found that although the bias-corrected and accelerated bias-corrected bootstrap had higher statistical power than the percentile version, they were also more prone to Type I errors, particularly in samples with fewer than 2,500 participants. Fritz et al.'s (2012) findings agree with those of Hayes and Scharkow (2013), who also recommended the percentile bootstrap as the best choice for researchers wishing to reduce their chances of Type I errors while still retaining enough statistical power. Any mediation effects in my study were likely to be small, as many other variables contribute to personality and political ideology besides handedness and approach/withdrawal motivation, so additional power from a bias-corrected bootstrapping version would have been advantageous in detecting a small effect size. However, the percentile bootstrap appeared to be the best choice overall as I was more concerned with Type I errors given the number of analyses I planned to conduct. Although slightly less powerful than other bootstrapping methods, the percentile version would also be expected to perform better as my sample size was smaller than 2,500. The PROCESS macro generates unstandardized and standardized indirect effects with percentile bootstrapped CIs and was therefore ideal for the present study.

In addition to the correlational and mediation analyses I conducted as tests of my eight hypotheses of interest, I also ran statistical tests to compare the REP and MTurk samples to one another, to investigate how varying handedness classifications could affect results, and to explore relationships between variables that had not been predicted a priori but could be of interest for future studies in this line of research. Specifically, I used independent samples t-tests to compare MTurk to REP participants on all hypothesized variables of interest, including the PID-5 facets. I also used independent samples t-tests to explore whether treating handedness as a dichotomous variable instead of a continuous one altered its relationship to the mediator and criterion variables, and whether changing the EHI cutoff values used for dichotomization had any effect on the significance of those relationships. Additionally, I conducted a series of independent-samples t-tests and moderation analyses to rule out the possibility that gender effects were responsible for observed predictor-mediator relationships. Finally, I observed that handedness was correlated with various measures of approach/withdrawal motivation and personality and political ideology in the opposite directions to those I had originally predicted in my hypotheses. I decided to run exploratory mediation analyses in these cases in order to provide a starting point for future research investigating these variables and to help clarify the results I found when testing my original hypotheses.

Descriptive Statistics

Sample sizes, means, and standard deviations for all predictor, mediator, and criterion variables can be found in Table 2, while Table 3 contains sample sizes, means, and standard deviations for the PID-5 facet scales. Both tables include descriptive statistics for the combined, REP, and MTurk datasets, and Table 2 also contains the hypothesized role of each variable in a potential mediation equation. The majority of self-report measures included the full *N* for that sample, although five out of 46 variables were missing participants. Finally, Table 2 contains descriptive statistics for a variable called Reported Handedness, a dichotomous variable based off of a single self-report question asking participants whether they were right- or left-handed. It was included in the study as a manipulation check of the EHI and also as an exploratory variable for later comparisons using different handedness cutoff values, but it was not used as a predictor variable in any mediation analyses.

Predictors. Given the importance of handedness in the current study, it is first necessary to note any differences in Laterality Quotient (LQ) and Laterality Quotient – Absolute Value (LQAbs) scores across the REP and MTurk samples and to compare those scores to previous research. In the combined dataset, LQ had a mean of 50.59, while the means for the REP and MTurk dataset were 57.95 and 33.77, respectively, out of a possible range of -100 (strongly left-handed) to +100 (strongly right-handed). Mean scores for LQ-Abs were somewhat higher, with a mean of 66.25 in the combined dataset, 69.74 in the REP, and 58.28 in the MTurk with possible scores ranging from 0 (strongly inconsistent-handed) to +100 (strongly consistent-handed). Independent-samples t-tests confirmed that the REP sample had significantly higher EHI scores than the MTurk sample for both LQ ($t(497) = -4.781$, $p < .001$) and LQ-Abs ($t(497) = -3.795$, $p < .001$). Conversely, Familial Non-Right-Handedness (Familial NRH) did not significantly differ between the REP ($M = 10.84\%$) and MTurk ($M = 13.52\%$) samples, $t(497) = 1.573$, $p = .116$, indicating that participants in both samples had roughly equivalent percentages of left-/inconsistent-handers in their immediate and extended families.

Median scores are generally preferred over means in the handedness literature, although sometimes neither are reported if the researchers decide to use a previously established cutoff value to dichotomize their data (e.g., Lyle & Grillo, 2014). Many articles report absolute value median scores between +75 to +85 on the EHI (e.g., Jasper et al., 2014), with +80 being the most popular and frequently used median cutoff (e.g., Christman et al., 2004). The REP sample from the current study hit this cutoff exactly for LQ-Abs ($Mdn = 80$) although the MTurk sample was much lower ($Mdn = 60$). Therefore, although the combined sample median for LQAbs ($Mdn = 73.33$) is not that much lower than the median values regularly cited in handedness studies, it is worth noting that the MTurk, and by extension the combined sample, appear to have higher numbers of inconsistent handers than is typical. Interestingly, however, the single-question Reported Handedness variable did not differ significantly between the two groups, $t(494) = -.105$, $p = .916$. Additionally, the percentage of self-reported left-handers in the combined sample (8.89%) was on par with most estimates of left-handedness in the population (e.g., Coren, 1994). This discrepancy could be due to any number of factors including potential response biases, differing interpretations of the questions on the EHI, or differences in sample size. It could also be caused by actual differences in the distribution of inconsistent-handers across the two samples. Since there was no ambidextrous or inconsistent-handed option on the Reported Handedness question, inconsistent-handed participants may have simply selected the right or left option and their true inconsistent-handed tendencies may only have become apparent on the more nuanced EHI.

I decided to further investigate the possibility that participants from the MTurk and REP samples were relying on different response sets by exploring one type of response bias, extreme responding, that can lead to skewed outcomes. Extreme responding occurs when participants rely more heavily on the endpoints of a scale and avoid responses in the middle. For example, a participant engaging in extreme responding would preferentially use the "strongly agree" or "strongly disagree" options and avoid the center of the response scale. For each participant, I calculated the number of times they selected either of the two endpoints as a response option and the number of times they selected a middle response option for each of the measures that had questions with multiple response options. I then summed the total number of times they chose an endpoint response option and divided this by the total number of responses they made across all the surveys to produce an extreme response percentage. MTurk and REP participants significantly differed in the percentage of time they used extreme responses ($t(497) = 3.944$, $p < .001$), with MTurk participants using the endpoints of scales 45.38% of the time and REP participants using the endpoints only 38.56% of the time. Responses to EHI items were not included in this percentage because the EHI does not employ a Likert-type response scale with endpoints. However, these differences in extreme responding tendencies offer one potential explanation for the greater number of mixed-handed responses in the MTurk sample. As the majority of people are right-handed, the established norm is that one dominant hand (usually the right) is used for tasks. Therefore, a normal or middle-of-the-road response to an EHI item could be considered any answer involving the use of one hand. A more extreme or less typical response, however, would be to report using both hands for a task. These possibilities and others relating to the ease of use and interpretability of the EHI will be discussed later in more detail.

Mediators. An examination of the mediator variables also highlights consistent differences between the MTurk and REP samples, although the overall means align with previous research for the most part. For example, the MTurk and REP samples differ significantly on BAS-FS ($t(497) = -6.907$, $p < .001$), BAS-RR ($t(497) = -4.811$, $p < .001$), BIS ($t(497) = -7.630$, $p < .001$), and FFFS ($t(497) = -6.390$, $p < .001$), although not on BAS-D. In each instance, the REP sample scored higher than the MTurk one, although never by more than three points. The BIS/BAS means from the combined sample are similar to those of previous studies that used the BIS/BAS, including Carver and White's (1994) reports of BIS and BAS means in their first paper introducing the scales. They reported a BIS mean of 19.99 (combined samples present study $M = 21.39$), a BAS-FS mean of 12.43 (present study $M = 11.11$), a BAS-RR mean of 17.59 (present study $M = 16.36$), and a BAS-D mean of 12.05 (present study $M = 10.74$). Means for the PANAS, the ATQ, and the MM scale were all comparable to past research as well but differed significantly between the REP and MTurk samples with the exception of the MM-Approach scale and the two mushroom AAT difference score variables. Once again, regardless of whether the scale was measuring positive or negative affect or approach or avoidance motivation, REP participants scored higher than MTurk participants on all PANAS, ATQ and MM scales except for one (MM-Avoid). This could be due to genuine differences between the participants on the measures, but the consistent pattern of REP participants scoring higher than MTurk ones, irrespective of measure, suggests that it could also be driven by other factors such as response sets or restricted response ranges.

Criteria. Similarly to the mediators, the BFAS and PID-5 criterion variables differed somewhat across REP and MTurk datasets, although their overall means were consistent with past research. REP participants scored significantly higher on BFAS Neuroticism ($t(497) = -5.687$, $p < .001$), Withdrawal ($t(497) = -5.964$, $p < .001$), Volatility ($t(497) = -4.382$, $p < .001$), Agreeableness ($t(497) = -4.753$, $p < .001$), Compassion ($t(497) = -7.051$, $p < .001$), Extraversion ($t(497) = -5.485$, $p < .001$), Enthusiasm ($t(497) = -6.306$, $p < .001$), and Assertiveness ($t(497) = -3.126$, $p = .002$) than their MTurk counterparts. In contrast, MTurk participants had significantly higher scores on the BFAS domain of Conscientiousness ($t(497) = 3.190$, $p = .002$) and the Industriousness ($t(497) = 6.211$, $p < .001$) and Intellect aspects ($t(497) = 3.343$, $p = .001$). REP participants scored higher on the Negative Affect domain of the PID-5 ($t(497) = -5.289$, $p < .001$, but MTurk participants demonstrated higher scores on Detachment ($t(497) = 5.159$, $p < .001$). The two samples also had significantly different scores on 13 of the 25 PID-5 facets.

Previous research has reported that individuals on Mechanical Turk tend to be more liberal than other participants (e.g., Berinksky et al., 2012), but that trend did not occur in the present study. However, the political ideology comparison groups used in

Berinsky et al. did not include college students, who are on average more politically liberal than the general population. This fact likely explains why REP participants scored significantly lower than MTurk participants on the Society Works Best (SWB) index ($t(497) = 3.911$, $p < .001$) and lower on RWA ($t(497) = 3.997$, $p < .001$), both of which indicate greater liberalism. REP participants also agreed more strongly with the statement that they favored the Democratic party, $t(489) = -4.968$, $p < .001$. The sample as a whole also appeared to skew more liberal than the general population as well. When Smith et al. (2011) first constructed the SWB and tested it with a non-student sample of 200 individuals, they found a mean score of -.95 out of a possible range of -14 (strongly liberal) to +14 (strongly conservative). By comparison, the mean score for the MTurk sample was -2.26 while the mean REP score was -4.55, indicating that on average the college students and MTurkers in the present study were significantly more liberal than the typical individual. This finding was further supported by the means on the single-item Political Spectrum Rank that asked participants to enter a number between 0 and 100 to describe their location on the political spectrum, with 0 being very liberal and 100 being very conservative. The combined sample mean was 41.45, the REP mean was 39.41, and the MTurk mean was 46.12, all of which signify a more liberal political affiliation.

Reliability. Although the MTurk and REP samples differed from one another on many variables and participants in the study skewed more liberal than the general population, the measures themselves demonstrated good reliability across the board. Table 4 contains Cronbach's α values for all predictor, mediator, and criterion scales and subscales, with an average α of .86 for all measures. Only one measure fell below .7 (FFFS; $\alpha = .65$) and this was almost certainly due to the fact that the FFFS subscale of the

BIS consists of only three items. Otherwise, besides the three measures with alphas of .73 (MM-Avoid) and .75 (SWB and BAS-FS), all measures had alphas in the .8 or .9 range, demonstrating excellent reliability.

Correlations Between Predictors and Mediators

Predictor intercorrelations. I created multiple correlation matrices to test the first seven of my hypotheses and to provide potential support for the mediation models predicted in my eighth hypothesis. With the exception of some exploratory analyses where the deviation is explicitly noted, all correlations described as significant were significant at the .01 alpha level. As expected, the three handedness predictors were all significantly correlated with one another in the combined, REP, and MTurk datasets, and these intercorrelations can be seen in Tables 5, 6, and 7. LQ and LQ-Abs exhibited an average correlation of .73 across the three datasets, while Familial NRH correlated on average -.18 with both LQ and LQAbs. In other words, the greater the percentage of non-right-handed relatives in a participant's family, the more likely they were to score lower on the EHI and be left- and/or inconsistent-handed.

Handedness correlations with mediators. In order to test Hypothesis 1—that right- and/or consistent-handers would score higher on measures of approach motivation while left- and/or inconsistent-handers would score higher on measures of withdrawal motivation—I created correlation matrices with all predictor and mediator variables for the three datasets (combined, REP, and MTurk). These are presented in Tables 8, 9, and 10. There were multiple significant correlations between the predictor and mediator variables across all datasets; however, only a few were in the hypothesized directions. BAS-RR, which is considered an approach-related mediator in this study, demonstrated positive correlations with LQ-Abs in both the REP (r = .15) and combined (r = .13) datasets. This relationship, and the lack of any corresponding relationship between LQ and BAS-RR, indicates that consistent-handed individuals score higher on BAS-RR than inconsistent-handed ones, regardless of direction (right or left) of handedness. The only other finding that was significant in the combined dataset in the hypothesized direction was a positive correlation between Familial NRH and MM-Avoid of .12 in the combined dataset and .33 in the MTurk sample. While individuals high in Familial NRH are not necessarily left- or inconsistent-handed themselves (although they are more likely to be), they demonstrate similar patterns of interhemispheric communication to left- and inconsistent-handers. Therefore, any associations such as this one could be considered at least weak evidence for a possible connection between hemispheric asymmetries, handedness, and approach/withdrawal motivation.

Crucially, however, there were a number of significant associations between the predictor and mediator variables that directly contradicted Hypothesis 1. In the combined dataset, multiple withdrawal-related measures including the BIS, BIS-A, FFFS, NA, and ATQ-Avoid were positively correlated .15 on average with LQ, and the BIS, BIS-A, FFFS, and ATQ-Avoid exhibited a .19 average correlation with LQ-Abs. BIS and BIS-A were also correlated with LQ-Abs at similar levels in the REP sample, while FFFS was positively related to LQ-Abs in the MTurk sample as well. Taken together, these significant associations suggest that consistent- and right-handers score higher on most withdrawal-related measures, which contradicts Hypothesis 1. However, as the relationships between BAS-RR and LQ-Abs and Familial NRH and MM-Avoid were significant in the hypothesized direction, I decided it was still worthwhile to consider them as contenders for mediation analyses.

While potential explanations for these unexpected findings will be discussed in detail later in this paper, one possible explanation relies on the fact that the BIS and BAS operate somewhat independently of one another. Since individuals can score highly on both the BAS and the BIS, this allows for the possibility that right- and/or consistent-handedness could be associated with both approach and withdrawal motivation. Although this interpretation leaves many questions unanswered regarding hemispheric asymmetries and does not directly address the Familial NRH – MM-Avoid correlation, other explanations are also possible. For example, the MM-Avoid scale may be tapping into a different type of withdrawal/avoidance motivation than the other, more interrelated measures. To investigate these possibilities for future research and to better judge between competing explanations for these disparate findings, I chose to also consider the significant correlations between LQ-Abs and various withdrawal measures as candidates for unplanned exploratory mediation analyses.

Furthermore, I decided to conduct additional analyses to investigate the effects of one particular variable that often interacts with both handedness and approach/withdrawal measures. Gender has long been associated with handedness as many studies report higher levels of left-handedness in males (e.g., Tran et al., 2014), while others have uncovered gender-linked hemispheric asymmetries (e.g., Montag et al., 2013). Gender interactions have also been observed with the BIS/BAS, with females typically scoring higher on the BIS and males on the BAS, and Wright et al. (2009) found that gender moderated the relationship between handedness and BIS/BAS scores since left-handed females scored higher on the BIS. Given these previously reported interactions, gender could have moderated the relationships between handedness and the various measures of approach/withdrawal in my study. Additionally, since my sample was predominantly female, any such interactions could lead to skewed results. If detected, interactions due to gender could potentially explain the unexpected patterns of results and would need to be controlled for in subsequent correlation and mediation analyses.

Gender effects on the predictors and mediators. First, I conducted a series of independent-samples t-tests to test whether self-reported gender had an effect on the predictor and mediator variables. Since only three individuals chose the other/prefer not to respond option on the gender question, there were not enough individuals in that group to include in analyses. Although there were no significant differences between males and females on Familial NRH, females scored significantly higher (M = 69.35) than males (M = 60.18) on LQ-Abs, $t(495) = 3.076$, $p = .002$. Females also scored significantly higher (M = 55.90) than males (M = 40.30) on LQ, $t(495) = 3.102$, $p = .002$. There were similar effects of gender on the mediators. Females scored significantly higher than males on the BIS ($t(495) = 9.530$, $p < .001$), BIS-A ($t(495) = 9.171$, $p < .001$), FFFS ($t(495) = 7.578$, $p < .001$) and BAS-RR ($t(495) = 4.905$, $p < .001$). Conversely, males and females did not differ on BAS or the BAS-D and BAS-FS subscales. Males and females also significantly differed on other mediator variables, including ATQ-Approach ($t(495) = 2.691$, $p = .007$), ATQ-Avoid ($t(495) = 7.014$, $p < .001$), PANAS-NA ($t(495) = 3.581$, $p < .001$), and MM-Approach ($t(495) = 3.449$, $p = .001$). In each case, females once again scored higher than males.

In order to determine whether gender was moderating the relationships between handedness and the various mediators, I next ran a series of moderation analyses using Model 1 of the PROCESS macro. Self-reported gender was the moderator in each analysis, while LQ, LQ-Abs, and Familial NRH were the predictor variables and all of the mediators (including the AAT mushroom difference score variables) were the outcome variables. Two moderation analyses were trending towards significance with p-values below .05. Gender appeared to slightly moderate the relationship between BAS-D and Familial NRH ($p = .049$) as well as the relationship between LQ-Abs and the difference in error rates between pull and push trials on the mushroom AAT ($p = .035$). However, none of the handedness by gender interaction effects were significant at a .01 alpha level, indicating that gender did not moderate the relationships between the multiple measures of handedness and the approach/withdrawal measures. Therefore, although handedness and multiple mediators were independently influenced by gender, handedness by gender interactions do not seem to be responsible for the unexpected relationships between withdrawal measures and consistent-handedness or the predicted relationships between BAS-RR and consistent handedness and Familial NRH and MM-Avoid.

Correlations Between Predictors and Criteria

Predictor correlations with the BFAS. While the goal of Hypothesis 1 was to detect the existence of a potential path *a* between a predictor and mediator in a mediation model, Hypotheses 2, 3, and 4 were designed to test the significance of path *c* between a given predictor and criterion (otherwise known as the total effect). This required calculating the correlations between the predictors and all the criterion variables in each of the three datasets, as well as the intercorrelations between the predictors and the 25 PID-5 facet scales (see Tables 11, 12, 13, and 14). There was partial support for Hypothesis 2, which predicted that right- and/or consistent-handers would score higher on approach-related BFAS aspects while left- and/or inconsistent-handers would score higher on withdrawal-related BFAS aspects. Volatility, hypothesized to be the more approach-related aspect of Neuroticism, correlated .13 with LQ in the combined dataset. Another theoretically approach-related BFAS aspect, Compassion, correlated .13 with LQ and .17 with LQAbs in the combined dataset. These findings indicated that right-handers tended to be stronger in Volatility than left-handers, while right- and consistent-handers were more likely to be higher in Compassion than left- and inconsistent-handers. The findings also extended to the broader domains, with right- and consistent-handers scoring higher in overall Neuroticism and consistent-handers scoring higher in overall Agreeableness. These relationships may have been driven by the significance of their respective aspects and by extension approach/withdrawal motivation, or Neuroticism and Agreeableness could be associated with handedness due to other factors. In order to investigate further, I decided to consider the relationships between handedness and these two domains along with the BFAS aspects of Volatility and Compassion for inclusion in mediation analyses.

Although these handedness relationships with approach-related BFAS measures were significant, the other half of Hypothesis 2 was not supported. There was no evidence that left-handers and inconsistent-handers scored higher on any withdrawal-related BFAS aspects in any of the three datasets. Just as with Hypothesis 1, there were contradictory results in the opposite direction as well. Specifically, the Withdrawal aspect of Neuroticism correlated .15 with right-handedness (LQ) and .14 with consistent-handedness (LQAbs). For the same reasons I outlined regarding Hypothesis 1 and the testing of alternative explanations, I decided to include the Withdrawal aspect of Neuroticism as a criterion variable in the aforementioned exploratory mediation analyses. One final caveat regarding Hypothesis 2 is that the significant associations in the predicted directions only became apparent after both the MTurk and REP samples were combined and were not detectable in either individual sample, likely due to small sample size. As the effects only appeared in a larger dataset, they may be smaller or weaker effects that require greater power to uncover.

Predictor correlations with the PID-5. The PID-5 also exhibited significant correlations with handedness, although none of the observed relationships supported Hypothesis 3, which stated that left- and/or inconsistent-handers would score higher on the PID-5 Detachment and Negative Affect domains and on a greater number of PID-5 facets than right- or consistent-handers. Instead, Negative Affect was positively correlated .17 with LQ in the combined and REP datasets and .14 with LQAbs in the combined dataset only. These findings directly refute Hypothesis 3 as they support a positive relationship between right- and consistent-handedness and Negative Affect. I decided to include PID-5 Negative Affect as another potential criterion variable in my post hoc exploratory analyses since the association seemed to fit a similar pattern as those I had uncovered when testing Hypotheses 1 and 2. There was also no difference in the number of facets associated with left-/inconsistent-handedness versus right-/consistent-handedness. Inconsistent handedness was positively correlated with Callousness and Familial NRH demonstrated positive correlations with Eccentricity and Unusual Beliefs in the combined dataset. Right-handedness was positively associated with Emotional Lability and right- and consistent-handedness were both associated with Separation Insecurity and Submissiveness in the same dataset. Additionally, although not officially a predictor, exploratory analyses revealed that the single-item Self-Report Handedness measure was positively correlated with Depressivity, indicating that right-handers were higher on that trait. These associations were somewhat unexpected given previous literature and I will discuss them in greater depth at a later point.

Another PID-5 domain-handedness correlation, while not supporting Hypothesis 3 directly, nonetheless highlighted an interesting connection worthy of future investigation. PID-5 Psychoticism correlated with Familial NRH in the combined dataset (r = .13) and in the MTurk dataset (r = .26). As any theories regarding Psychoticism and its relationships with approach and withdrawal motivation were speculative at best, I had not predicted any a priori directional relationship between Psychoticism and handedness beyond hypothesizing that the two variables would be significantly correlated in some way. Although a single correlation between two variables does not explain why they are related, additional findings linking Psychoticism to approach or withdrawal motivation could help shed light on this newfound association.

Predictor correlations with political ideology. In a similar vein, I had not formed any directional hypothesis regarding handedness and its relationship to political ideology measures. Hypothesis 4 simply predicted that both liberal and conservative political ideology would be significantly associated with handedness. This hypothesis was generally supported as Familial NRH positively correlated with RWA (r = .22) and negatively correlated with Self-Report Democrat (r = -.21) and MFQ-Progressivism (r = -

.24), all of which suggests that participants with more left- and inconsistent-handed family members tended to be more conservative and authoritarian and less liberal. These findings do appear to align with the hypothesis that left- and inconsistent-handers and those with genetic links to left- and inconsistent-handedness are more likely to be conservative, potentially due to higher levels of withdrawal motivation caused by greater right-hemisphere activation.

However, any such conclusions should be tempered by the knowledge that these correlations were only significant in the MTurk dataset and did not extend to either measure of degree or direction of handedness, which calls into question the robustness of the findings. Smaller samples are more prone to extreme results and the MTurk sample significantly differed from the REP one in political ideology; both limitations should also be accounted for when weighing the implications of these results. Even when I used various EHI dichotomization scores in my exploratory analysis, there were still no significant associations between handedness and political ideology at the .01 alpha level in the combined dataset. Only when I adjusted the alpha level to .05 during these exploratory analyses did one finding reach significance: a positive correlation between LQAbs and Self-Report Democrat, which meant that consistent-handers were more likely to report favoring the Democratic party. Therefore, while these findings associating handedness with political ideology are intriguing and worth including in any mediation model in the present study, it would be beneficial to replicate them in a larger sample as well.

In summary, Hypotheses 2, 3, and 4 provided tentative support for various predictor-criterion relationships that could serve as path *c* in a mediation analysis. LQ was significantly correlated with BFAS Volatility, BFAS Compassion, and BFAS Neuroticism, LQAbs with BFAS Compassion, BFAS Agreeableness, and BFAS Neuroticism, and Familial NRH with PID-5 Psychoticism, RWA, Self-Report Democrat, and MFQ-Progressivism. However, in order to be included in a mediation model, these criterion variables would also have to exhibit significant correlations with the same mediator variables (BAS-RR and MM-Avoid) that previously correlated with their respective predictors (path *b* in a mediation analysis). My main objective in testing the next set of hypotheses was to establish those final paths for prospective mediation models.

Correlations Between Mediators and Criteria

Mediator correlations with the BFAS. Hypothesis 5 predicted that measures of approach motivation would positively correlate with the more approach-related aspects of the BFAS. These were hypothesized to be both aspects of Extraversion, both aspects of Openness/Intellect, the Industriousness aspect of Conscientiousness, the Volatility aspect of Neuroticism, and the Compassion aspect of Agreeableness. On the other hand, measures of withdrawal motivation were hypothesized to positively correlate with the withdrawal-oriented aspects: the Orderliness aspect of Conscientiousness, the Withdrawal aspect of Neuroticism, and the Politeness aspect of Agreeableness. As in Hypothesis 2, any significant association with a broader domain was considered a candidate for further analysis as long as at least one of its aspects was also significant in the predicted direction.

As can be seen in Tables 15, 16, and 17, this hypothesis was well-supported on the whole. Although the high number of significant associations precludes my summarizing them here, there were some general trends among the data that clearly supported Hypothesis 5. For example, the withdrawal-related scales of the BIS, BIS-A and FFFS exhibited strong positive correlations with BFAS Withdrawal across all datasets, with an average correlation of .66 in the combined dataset. The BIS, BIS-A and FFFS also positively correlated with the BFAS Politeness (average r = .27 in the combined dataset) and Orderliness (average r = .23) aspects. Therefore, these results alone provided full support for the second half of Hypothesis 5 relating withdrawal measures to those specific scales. This interpretation was further strengthened since other withdrawal-related measures such as ATQ-Avoid exhibited positive correlations with BFAS Withdrawal and Politeness (although not with Orderliness) while PANAS-Negative Affect (NA) demonstrated a positive correlation with Withdrawal.

It is important to keep in mind that approach and withdrawal and the instruments designed to measure them are not the inverse of one another and so cannot be compared in that way (i.e., evidence of a negative correlation between the BAS and a variable does not necessarily mean that variable is related to withdrawal motivation). However, discovering negative associations between the BFAS Withdrawal, Orderliness, and Politeness aspects and the BAS and other approach measures would provide additional evidence that these BFAS variables are not strongly affiliated with approach motivation. This is precisely what I found for the Withdrawal aspect. BAS-D, an approach-related mediator, was negatively correlated with BFAS Withdrawal across all datasets (r = -.20 in the combined dataset), and the other BAS measures were negatively correlated with Withdrawal in the REP dataset. PANAS-Positive Affect (PA) was also negatively correlated with BFAS-Withdrawal across all datasets (r = -.39 in the combined dataset) as was ATQ-Approach in the REP dataset (*r* = -.24). The results were more mixed for Politeness and Orderliness, with some approach-related variables demonstrating positive associations with the BFAS aspects and others negative. Overall, however, the three BFAS aspects hypothesized to relate to withdrawal motivation did appear to correlate more strongly with measures of withdrawal motivation than approach.

The approach-related BFAS aspects also appeared to correlate more strongly with approach-related mediators, as hypothesized. Both aspects of Extraversion and the broader Extraversion domain showed particularly strong associations with the BAS and all the BAS subscales, with an average *r* of .40 in the combined dataset. The majority of BAS subscales also demonstrated positive relationships with the BFAS Openness/Intellect domain and the Openness and Intellect aspects, although these varied more depending on BAS subscale and dataset. Even so, the average correlation across the REP and MTurk samples was .20 for all the BAS scales and the Openness/Intellect domain, .19 for the Openness aspect, and .15 for the Intellect aspect. The results for PA, ATQ-Approach and MM-Approach all showed similar patterns for both the Extraversion and Openness/Intellect aspects. In addition, with the exception of BAS-Fun Seeking, which was negatively correlated with BFAS Industriousness, and BAS and BAS-RR, which were not significantly correlated with it, Industriousness demonstrated positive correlations with all other approach measures. Compassion was similarly positively associated in the combined dataset with PA, ATQ-Approach, MM-Approach, and the BAS and all of its subscales except BAS-D. Overall Agreeableness, too, positively correlated with all approach measures except for BAS-FS and BAS-D, although it positively correlated with some withdrawal measures as well, likely due to the divergent effects of Politeness and Compassion.

As supplementary evidence that these particular BFAS traits are more associated with approach than withdrawal motivation, the BIS, BIS-A, FFFS, NA and ATQ-Avoid all generally exhibited negative correlations across the multiple datasets with both aspects of Extraversion and Openness/Intellect and less consistently with Industriousness and Compassion. BFAS Volatility was the only one of the hypothesized approach-related aspects to show a weaker connection to approach measures. Although Volatility positively correlated with the supposedly approach-related BAS-RR, its other significant correlations were positive ones with the BIS, BIS-A, FFFS, and NA and negative ones with PA and MM-Approach. Taken together, however, the other BFAS findings provide strong support for the first half of Hypothesis 5 connecting approach-related mediators to the approach-oriented aspects of the BFAS.

Along with this robust evidence linking approach-related aspects to measures of approach and withdrawal-related aspects to measures of withdrawal, there was evidence that some of the mediator-criterion correlations necessary for mediation were significant. In order to decide which BFAS variables should be included in a mediation analysis, it is necessary to revisit the relationships that have been established up to this point. I first found significant predictor-mediator relationships between LQ-Abs and BAS-RR and Familial NRH and MM-Avoid. Therefore, in order to meet the necessary conditions I established for continuing to a mediation analysis, the mediator variables of BAS-RR and MM-Avoid must correlate in the hypothesized direction with any candidate BFAS criterion variables. Furthermore, those criterion variables themselves must also correlate with the original predictor. As discussed earlier in regards to Hypothesis 2, LQ was found to significantly correlate with BFAS Volatility, BFAS Compassion, and BFAS Neuroticism, while LQ-Abs correlated with BFAS Compassion, BFAS Agreeableness, and BFAS Neuroticism. However, as LQ was not associated with any mediator variables in the hypothesized direction as required by the rules I established, it could not be included in a mediation analysis. Additionally, since LQ-Abs only correlated with BFAS Neuroticism and not with a Neuroticism aspect with an associated a priori hypothesis, Neuroticism also had to be removed. This left BFAS Compassion and BFAS Agreeableness, both of which exhibited significant positive correlations with BAS-RR across all three datasets, as possible criterion variables for a mediation analysis. This meant there were two separate mediation analyses involving the BFAS that could be conducted: one with LQ-Abs as the predictor, BAS-RR as the mediator, and BFAS Agreeableness as the criterion, and one with LQ-Abs as the predictor, BAS-RR as the mediator, and BFAS Compassion as the criterion. Since no BFAS aspects correlated with Familial NRH, any mediation analysis involving Familial NRH as a predictor would require different criterion variables. Examining the correlations used in tests of Hypotheses 6 and 7 provided an opportunity to identify those potential criteria.

Mediator correlations with the PID-5. Hypothesis 6 closely mirrored Hypothesis 3 except it predicted a positive association between the PID-5 domains of Detachment and Negative Affect and withdrawal motivation instead of left- and/or inconsistent-handedness. It also stated that more PID-5 facet scales would be positively associated with withdrawal measures than with approach measures. The correlations between the mediator variables and the PID-5 domains can be found in Tables 15, 16, and 17 while correlations with the PID-5 facets can be found in Table 18. First, there was evidence to support a relationship between PID-5 Detachment and withdrawal motivation, as Detachment showed positive correlations with the BIS, NA, and ATQ-Avoid in the REP and MTurk datasets and with FFFS in the MTurk dataset, with an average correlation of .34 across all the measures. PID-5 Negative Affect was even more strongly associated with measures of withdrawal motivation, as it correlated .61 on average with all measures of withdrawal in the combined dataset except for MM-Avoid. Results for the remaining three PID-5 domains were more variable, and all domains exhibited significant correlations with both approach and withdrawal measures, although Psychoticism appeared to be more strongly associated with withdrawal than approach measures overall. One characteristic shared by all five domains was a moderate to strong positive correlation with NA, which is understandable given the maladaptive nature of the PID-5 domains.

The second portion of Hypothesis 6 was also supported by the data. Overall, 14 PID-5 facets demonstrated positive correlations with approach scales or subscales, while all but one of the 25 facets exhibited positive correlations with measures of withdrawal. The average correlation between the PID-5 facets and all withdrawal measures was .14, while the average PID-5 facet correlation across all approach measures was -.04, providing additional evidence that more PID-5 facets were associated with withdrawal measures rather than approach. These averages of approach and withdrawal measures did not include the AAT mushroom difference scores as these failed to correlate with any PID-5 aspects, demonstrated low convergent validity with other approach/withdrawal measures, and resulted in significantly attenuated correlations when included in the average. In conclusion, Hypothesis 6 was strongly supported given the positive associations between withdrawal measures and Detachment, Negative Affect, and the PID-5 aspect scales. However, neither Negative Affect nor Detachment was significantly correlated with MM-Avoid, so no PID-5 domains could be used as a criterion variable in a mediation analysis with Familial NRH as a predictor and MM-Avoid as a mediator.

Mediator correlations with political ideology. Hypothesis 7, the final hypothesis designed to test whether mediators correlated with a specific category of criterion measures, posited that measures of approach and withdrawal would significantly correlate with measures of political ideology. Like its counterpart, Hypothesis 4, it was purposely non-directional and was intended to help resolve ambiguities in the literature. The correlations between approach and withdrawal measures and political ideology variables are included in Tables 15, 16, and 17. There were too many significant associations between the mediators and political ideology criterion variables to describe in detail here, but a few general trends should be noted.

First, although a number of the BAS measures failed to correlate with any political ideology measures, BAS-RR was negatively correlated with SDO and BAS-D was negatively correlated with MFQ-Progressivism. Second, BIS, BIS-A, FFFS, and ATQ-Avoid all tended to negatively correlate with RWA, SDO and other measures of conservative political ideology while correlating positively with Self-Report Democrat scores. NA also correlated positively with Self-Report Democrat and negatively with RWA and conservatism. Conversely, PA correlated negatively with MFQ-Progressivism, meaning that participants high in positive affect scored lower on the progressivism measure and were less liberal. Third, the MM-Approach and MM-Avoid measures correlated with political ideology in ways that distinguished them from the rest of the approach and withdrawal measures, a finding which could be due to the greater degree of politically-relevant content in the Moral Motives measures. For instance, MM-Avoid correlated positively with all measures of conservatism as well as RWA and SDO, whereas the other withdrawal measures exhibited the opposite pattern. MM-Approach, on the other hand, correlated positively with measures related to liberalism and negatively with measures related to conservatism. The potential implications of these differences will be discussed further on. Finally, in addition to Hypothesis 7 being clearly supported, every political ideology variable was also significantly correlated with MM-Avoid, albeit in varying directions. Therefore, a mediation analysis involving Familial NRH and MM-Avoid was a possibility.

To meet the necessary steps for mediation, the same political ideology variables that correlated with MM-Avoid had to also correlate with Familial NRH. Since RWA, Self-Report Democrat and MFQ-Progressivism all correlated with both Familial NRH and MM-Avoid, they were all suitable candidates for mediation analysis. One important caveat was that since the relationships between Familial NRH and RWA, Self-Report Democrat and MFQ-Progressivism were only significant in the MTurk dataset, the mediation analysis was also restricted to the MTurk dataset. The smaller sample size of this dataset and the fact that these associations were not found in the REP dataset as well are both factors that should be considered when interpreting the results of this mediation analysis. As each of the political variables exhibited different associations with MM-Avoid and Familial NRH, I decided to conduct three separate mediation analyses. In each of the three, the predictor was always Familial NRH, the mediator was always MM-

Avoid, and the criterion was either RWA, Self-Report Democrat, or MFQ-Progressivism. The goal of these mediation analyses, in addition to the two mediation analyses discussed earlier, was to test Hypothesis 8: that measures of approach or withdrawal motivation would partially mediate the relationship between handedness and the criterion variables of the BFAS, PID-5, and political ideology measures. Due to the lack of the necessary significant relationships with the PID-5, the mediations used in tests of Hypothesis 8 were only able to address the BFAS and political ideology criterion categories.

Mediation Analyses

I first graphed the predictor-mediator, predictor-criterion, and mediator-criterion relationships in order to better understand the relationships. I also used Q-Q plots to visually test for major violations of the normality assumption. Next, a total of five mediation analyses were conducted with OLS regression using the PROCESS macro for SPSS. As only one predictor and one mediator were significant in the combined dataset and in the MTurk dataset, I chose to run simple mediation analyses that did not involve multiple predictors or mediators or any additional covariates. An alpha level of .01 was used for all significance tests, the level of confidence for all of the confidence intervals used to test the indirect effects was 99%, and 5,000 bootstrap samples were used to construct the CIs. The 99% CI was constructed by calculating the indirect effects at the 0.5^{th} and 99.5^{th} percentile and using those estimates as the upper and lower bounds of the CI. By using more stringent alpha levels and CIs I hoped to reduce the probability of a Type I error, while my aim in increasing the number of bootstrapped samples above 1,000 was to provide a more accurate test of the indirect effect. I chose to report the bootstrapped completely standardized indirect effect as Hayes and others have recommended using the standardized version for more effective cross-mediation comparisons of effect size. Table 19 provides the associated statistical output and the tests of significance of the *a*, *b*, *c*, *c'* and *ab* paths for all five mediation analyses for easier comparison across or within mediations.

Analyses with BAS-RR as mediator. Two mediation models were constructed using the combined dataset to test the relationships between the predictor LQ-Abs, the mediator BAS-RR, and the criterion variables of either BFAS Agreeableness or BFAS Compassion. For the first mediation, the hypothesis that BAS-RR mediated the effect of handedness degree as measured by LQ-Abs on BFAS Agreeableness was supported. Handedness degree significantly predicted BAS-RR, $b = .011$, $SE = .004$, $p = .003$, and BAS-RR significantly predicted BFAS Agreeableness, $b = .081$, $SE = .010$, $p < .001$. In addition, after controlling for BAS-RR, handedness degree no longer significantly predicted BFAS Agreeableness, $b = .002$, $SE = .001$, $p = .015$. Together the predictor and mediator accounted for 13.4% of the variance in BFAS Agreeableness ($R^2 = .134$), although the mediator accounted for the majority of it. These findings supporting mediation are confirmed by the bootstrapped estimation of the completely standardized indirect effect, $ab_{cs} = .045$, $SE = .018$, 99% CI = [.004, .101]. Since the CI does not include zero, it is considered significant, even if it is close to zero as in this case.

The second mediation analysis investigating whether BAS-RR mediates the relationship between handedness degree and BFAS Compassion was also significant. However, the findings were less clear-cut. Handedness degree as measured by LQ-Abs significantly predicted BAS-RR just as it did in the Agreeableness mediation model, while BAS-RR significantly predicted BFAS Compassion, $b = .115$, $SE = .013$, $p < .001$.

Handedness degree and BAS-RR together accounted for a higher percentage of the variance—17.2%—in BFAS Compassion ($R^2 = .172$) compared to BFAS Agreeableness. This time, however, handedness degree still significantly predicted BFAS Compassion after controlling for BAS-RR, $b = .003$, $SE = .001$, $p = .003$. According to Baron and Kenny (1986) and others who use the causal steps model, a significant direct effect is a sign that mediation is not occurring. However, more recent schools of thought (e.g., Rucker et al., 2011; Hayes, 2009) do not agree and instead suggest relying on the tests of the indirect effect. In this case, the bootstrapped estimates of the CI for the indirect effect did not include zero, indicating that BAS-RR was mediating the relationship between handedness degree and BFAS Compassion, $ab_{cs} = .051$, $SE = .021$, 99% CI = [.005, .111]. In fact, the effect size for the mediation involving BFAS Compassion was slightly larger than the BFAS Agreeableness mediation model, although both are still relatively small when compared to other mediation analyses I conducted. In conclusion, although the effects of the mediator on the relationship between handedness degree and BFAS Compassion are not large, they do appear to be significant.

Analyses with MM-Avoid as mediator. Next, I used the MTurk dataset to test mediation models with Familial NRH as the predictor and MM-Avoid as the mediator. The first model, which included MFQ-Progressivism as the criterion variable, demonstrated that Familial NRH significantly predicted MM-Avoid, $b = .017$, $SE = .004$, $p < .001$, and MM-Avoid significantly predicted MFQ-Progressivism, $b = -2.015$, $SE = .237$, $p < .001$. After controlling for the mediator, Familial Non-Right-Handedness ceased to be a significant predictor of MFQ-Progressivism, $b = -.007$, $SE = .012$, $p = .536$. The bootstrapped test of the indirect effect further indicated a significant effect, $ab_{cs} = -.195$, *SE* = .049, 99% CI = [-.331, -.069], so I concluded that mediation was occurring. Since this mediation model involved negative associations between the criterion and both the predictor and mediator, the effect size estimate and the coefficients for paths *b*, *c*, and *c'* were all negative. This was also the case for the second model I tested, which involved the identical predictor and mediator variables but instead tested their effects on Self-Report Democrat scores. The unstandardized coefficients, standard error and p-value were all the same for the Familial NRH – MM Avoid relationship; however, MM-Avoid did not significantly predict Self-Report Democrat scores, $b = -.279$, $SE = .128$, $p = .031$. This finding alone suggests there is no mediation occurring. Although the direct effect of Familial NRH on Self-Report Democrat was not significant ($b = -.011$, $SE = .006$, $p = .079$) after controlling for MM-Avoid, as would be expected in a significant mediation analysis, examining the bootstrapped CIs confirmed there was also no significant indirect effect, $ab_{cs} = -.062$, $SE = .033$, 99% CI = [-.162, .015]. Therefore, the hypothesized mediation model was not supported.

The final hypothesized mediation was modeled with Familial NRH as the predictor, MM-Avoid as the mediator, and RWA as the criterion. Familial NRH again had a significant effect on MM-Avoid, as demonstrated in the two prior analyses, and MM-Avoid also significantly predicted RWA, $b = 21.506$, $SE = 2.582$, $p < .001$. Additionally, controlling for MM-Avoid eliminated the formerly statistically significant relationship between familial non-right-handedness and RWA, $b = .048$, $SE = .129$, $p = .710$. This result, along with the finding of a significant indirect effect ($ab_{cs} = .193$, $SE = .049$, 99% CI = [.072, .324]), suggests that MM-Avoid accounted for part of the relationship between Familial NRH and RWA. In addition, the completely standardized effect size of .193 was relatively large in this model, similar to the -.195 effect size observed in the mediation model with MFQ-Progressivism. Although it is challenging to compare across mediation models, especially since these two models were tested in a smaller sample with a different makeup than the combined sample, the larger standardized effect sizes indicate that these mediation effects may be stronger than those for LQ-Abs, BAS-RR and the two BFAS domains. Further investigation and replication are of course needed to confirm these findings. However, the results of these initial mediation analyses support Hypothesis 8 and indicate that at least some approach and withdrawal measures may mediate relationships between handedness and personality and political ideology.

Intercorrelations and Supplementary Analyses

Although the primary goal of the present study was to test Hypotheses 1-8, the wealth of data available made it possible to conduct additional planned analyses as well as unplanned exploratory post hoc analyses related to a number of different questions. Some questions arose during the course of testing the main hypotheses, while other questions were derived from disputes in the literature. Other questions were designed to help inform future research by assessing interactions between measures that had not previously been studied in tandem. One question that arose from previous debates in the literature was whether various self-report measures of approach and withdrawal would strongly correlate with one another. Specifically, I wanted to test how well newer measures such as the ATQ correlated with more established measures such as the BIS/BAS, how well the more politically-oriented MM-Avoid and MM-Approach correlated with other approach/withdrawal measures, and whether my newly developed behavioral measure of approach/withdrawal (the mushroom AAT) would correlate with self-report measures. Tables 20, 21, and 22 contain all of the mediator-mediator intercorrelations for the three datasets (combined, REP, and MTurk) and help to answer these questions. These intercorrelation matrices are reported as part of the main body of the study and are not exploratory per se; however, they served to inform supplementary analyses designed to address the questions listed above.

Intercorrelations among mediators. First, after taking the absolute values of all scores to account for opposite keying, the various approach scales and subscales exhibited a relatively weak average correlation (r = .18) with one another. However, after removing the AAT mushroom difference score scales, the average correlation increased substantially to r = .43. The same pattern held true for the withdrawal-associated scales and subscales. With the mushroom AAT difference score measures included, the average strength of the correlation between all measures was .09, but this rose to .24 when the AAT difference score scales were excluded. The difference score measures themselves also failed to exhibit any significant correlations with any of the other approach/withdrawal measures, although the two RT and error rate measures correlated .30 with one another in the combined dataset. Furthermore, the AAT difference score variables did not demonstrate significant correlations with any of the other variables in the study, although there were a few trending correlations with predictors and criteria (specifically with multiple handedness variables, the domains and aspects of BFAS extraversion, and the Intellect aspect in the REP dataset) that were significant at the .05 alpha level. Therefore, if one overlooks the difference score measures, the majority of the self-report measures of approach/withdrawal correlated at a moderate level with one another.

Secondly, although the approach and withdrawal measures were moderately intercorrelated with one another on the whole, specific intercorrelations between measures were much more varied. The BIS/BAS and the ATQ were fairly highly correlated, with ATQ-Avoid and the BIS and its subscales exhibiting intercorrelations with an average strength of $r = .59$ and the ATQ-Approach correlating .48 on average with the BAS and its subscales. However, the BIS and the BAS were less highly correlated overall with other withdrawal or approach measures than the ATQ. The BIS correlated .41 with the other withdrawal-associated measures while ATQ-Avoid correlated .47 with the same measures, and the BAS exhibited a correlation of .36 with other approach measures compared to the ATQ-Approach's overall correlation of .53. As I expected, the Moral Motives scales demonstrated somewhat weaker correlations with the other measures, although this was more true for the MM-Avoid scale. MM-Avoid showed an overall correlation of .14 with all other measures and a .11 correlation with other withdrawal measures specifically, while MM-Approach demonstrated an overall correlation strength of .17 and a stronger .29 correlation with other approach measures. By comparison, PA correlated .40 with other approach measures and NA .38 with the remaining withdrawal measures.

Intercorrelations among criteria. Other questions of interest related to the intercorrelations among the various categories of criterion variables. I placed the criterion intercorrelations into tables organized by their broader criterion category (BFAS, PID-5, and political ideology measures) for easier direct comparisons. The intercorrelations between the BFAS and all criterion variables (BFAS, PID-5, and political ideology measures) can be found in Tables 23, 24 and 25, while the intercorrelations for the PID-5 and all criterion variables can be seen in Tables 26, 27, and 28. Finally, Tables 29, 30, and 31 contain the intercorrelations between the political ideology measures and all the criterion variables. As can be seen in the tables, the political ideology measures were strongly intercorrelated, with an average correlation strength of .60 among all the scales (calculated using absolute value to account for differences in sign). My main question of interest regarding the criterion intercorrelation matrices was whether the intercorrelations between criteria I observed in my study would align with the results of previous research. The BFAS and the political measures, in particular, have been extensively studied, so there is a rich literature to compare my results against. In addition, there were numerous significant correlations among the PID-5 and the BFAS that should be of interest to future research; for instance, the PID-5 domain of Detachment exhibited significant correlations with 14 out of 15 of the BFAS domains and aspects.

Even a cursory glance at these tables shows a multitude of significant intercorrelations between the criterion variables, and exploring many of those associations is beyond the scope of this paper. However, novel or unexpected associations found in these tables can still serve as the impetus for future studies or replications. One such association that to the best of my knowledge has not been studied yet is the relationships between the PID-5 and political measures. One study on the PID-5 by Anzani, Di Sarno, Sacchi, and Prunas (2018) included a question about political identification, but they only used that question to predict negative attitudes about transgender people and did not report whether political identification correlated with the

PID-5. As can be seen in Table 26, which contains the PID-5 correlations with all the criterion measures for the combined dataset, there were a number of significant correlations between the PID-5 domains and multiple measures of political ideology. Every PID-5 domain with the exception of Negative Affect was positively correlated with SDO, while both Detachment and Antagonism were positively correlated with conservatism as measured by the SWB index. As additional evidence for the link between Antagonism and conservatism, MFQ-Progressivism was negatively correlated with Antagonism. Finally, in a finding that mirrors previous work on political ideology and positive and negative affect (e.g., Napier & Jost, 2008), participants who said they favored the Democratic party more were also significantly higher on the PID-5 Negative Affect domain. These findings could all have interesting repercussions for work on the intersection between maladaptive personality and political ideology.

In addition to the PID-5 domain scales, the PID-5 facet scales also demonstrate significant correlations with political ideology, as well as with the BFAS and of course, with the PID-5 domains themselves. These PID-5 aspect intercorrelation matrices can be viewed in Tables 32, 33, and 34 and like the other criterion variables, they too offer a wealth of information about how these relatively new facet scales relate to other personality and political variables.

Finally, I conducted a series of post hoc correlational analyses to explore how the demographic variables of age and gender related to the predictors, mediators, and criteria. There were a number of significant relationships that can be seen in Tables 35 and 36. Although an investigation of age and gender interactions is beyond the scope of the present study, these results provide a starting point for future research.

Comparing handedness scoring methods. Another question I wanted to explore in more detail in post hoc analyses was the degree to which changing cutoff values or the dichotomization of EHI scores affects patterns of results. As discussed earlier in this paper, a common practice of handedness researchers is to use the median score on the EHI to split their participants into two groups of inconsistent and consistent handers. Other times, they may use the median scores to separate only the right and left handers at either extreme of the -100 to +100 distribution, or might instead rely on a well-established median split value (typically +80) to dichotomize their data, even if it differs from the median value in their own study. I wanted to test whether these practices would result in differing patterns or directions of results or, more likely, whether switching from one cutoff value to another would alter a p-value enough so it changed from significant to non-significant or vice versa. Furthermore, I wanted to compare these dichotomized versions with the continuous versions of the EHI I used in this paper to see whether the two methods produced different results. By conducting these additional analyses, I hoped to better understand any potential repercussions of these practices that are widely accepted in the field of handedness research.

I created five dichotomized versions of the original EHI data using various cutoff values and practices, all of which were based on research practices I had observed in published articles on handedness. First, I used participants' answers to the Self Report Right-Left question in the study to split them into self-reported left- and right-handers. Next, I used the common median split value of +80 to divide participants into consistent- and inconsistent-handers, and then I followed the same steps using my study's overall median value of +71. In another version, I used the same 71 median value to compare only right-handers above +71 or left-handers below -71 to one another and removed all participants in the middle, while in a final version, I used a cutoff value of +/- 50 and again split participants into strong right- and strong left-handed groups and removed the participants in between. In an effort to better detect differences between methods, and because a .05 alpha value is used in almost all handedness studies, I chose to include any associations that were significant at the .05 level. The effects of these changes on the relationships between handedness and mediators, criteria, and the PID-5 aspects can be seen in Tables 37, 38, and 39 and will be discussed in more detail shortly.

Exploratory post hoc mediation analyses. Finally, as discussed previously, I decided to consider certain relationships between variables for inclusion in exploratory post hoc mediation analyses. After noticing that the correlations between handedness and the BIS, BIS-A, FFFS, and ATQ-Avoid were in the opposite direction from what I had hypothesized, I wanted to investigate further so I could better understand my hypothesized results. My primary research question involved determining whether approach and withdrawal motivation influence the relationships between the other variables of interest and what the form of that influence takes. Therefore, my reasons for conducting these additional analyses were to provide a more comprehensive answer to that question and to provide additional information for future studies. A deeper understanding of how handedness interacts with any approach or withdrawal measures is crucial for comprehending the full picture, even if the results went against my initial hypotheses. After finding that BFAS Neuroticism, BFAS Withdrawal, and PID-5 Negative Affect all significantly correlated with the aforementioned mediator variables as well as both LQ and LQ-Abs, I was able to include those predictors in mediation models.

I followed the identical format when conducting these mediation analyses as I did for the earlier hypothesized analyses. The main difference was that in these exploratory analyses, all the variables exhibited significant correlations in the combined dataset, so I was able to take advantage of the larger sample size ($N = 499$) when running these analyses.

I analyzed a total of 24 simple mediation analyses that each included one predictor, one mediator, and one criterion. All statistics for the paths of each mediation model, including the unstandardized coefficients, standard errors of the coefficients, p-values, and estimates of the indirect effect, can be seen in Table 40. The two predictors used in the analyses were LQ and LQ-Abs (direction and degree of handedness), the four mediators were the BIS, BIS-A, FFFS and ATQ-Avoid, and the three criteria were BFAS Neuroticism, BFAS Withdrawal, and PID-5 Negative Affect. I used the same bootstrapped 99% CIs as in the earlier mediation analyses to judge whether the completely standardized indirect effect was significant or not. The indirect effect was significant in all 24 models, which suggests that the various measures of withdrawal were partially explaining the relationships between handedness and BFAS Neuroticism, BFAS Withdrawal, and PID-5 Negative Affect. Implications of these findings and how they might relate to the hypothesized results are addressed in the following section.

Discussion

The primary aims of the present study were to clarify the role of approach and withdrawal motivation in the relationship between handedness and personality and political ideology and to gain a deeper understanding of how handedness relates to those constructs. In addition to providing answers to these two research questions, another benefit of the study was that any knowledge gained could help inform research on hemispheric asymmetries. Although previous research has independently linked right and left hemispheric asymmetries to both handedness and approach/withdrawal motivation, as far as I am aware no other study to date has combined handedness and approach/withdrawal in a mediation model. While this study did not directly test for hemispheric asymmetries, incorporating them in the theory underlying the model presents new opportunities for future research. Theoretical explanations for connections between handedness and personality and political ideology are often brief or scattershot. Therefore, although I was unable to determine if hemispheric lateralization contributed to my findings, the ideas proposed in the current study should provide a platform for the testing and development of rigorous hypotheses more firmly grounded in theory. For instance, cerebral motivational asymmetries could provide an explanation for any observed association between handedness and approach/withdrawal motivation. Additionally, they could have causal effects on variables such as personality and political ideology that have been empirically shown to be influenced by genetics and brain structure. Another strength of this study is its interdisciplinary nature. All of the variables included in the present study—handedness, approach/withdrawal motivation, and personality/political ideology—tend to be studied in isolation from one another, which makes it challenging to apply results from, say, a study on frontal hemispheric asymmetries and the BIS/BAS to a study on handedness and maladaptive personality traits. By measuring these constructs directly in a single study and employing a shared explanatory framework based on hemispheric asymmetries, I was able to test for associations between them and to propose questions for further study.

In this section, I will first discuss the results of those tests and their theoretical implications before reviewing the limitations of the present study and offering suggestions for future research. Although support for my hypotheses was mixed at best, there is no shortage of interesting findings, many of which could lead down new research avenues.

Handedness and Approach/Withdrawal Motivation

There was limited evidence in support of the hypothesis that right- and/or consistent-handedness would be associated with approach motivation and left- and/or inconsistent-handedness would be associated with withdrawal motivation. Consistent-handedness as measured by LQ-Abs was positively associated with the approach-related BAS-RR scale, while familial non-right-handedness was associated with MM-Avoid, a withdrawal-related measure. However, the correlation between Familial NRH and MM-Avoid was only significant in the MTurk dataset, making it a less trustworthy finding. More problematically for Hypothesis 1, multiple measures of withdrawal motivation including the BIS, BIS-A, FFFS, ATQ-Avoid and NA all correlated with right- and/or consistent-handedness in either one or both datasets.

This finding not only fails to support my hypothesis but is inconsistent with previously discussed research by Wright et al. (2009), Hardie and Wright (2014), and Beaton et al. (2015). Researchers investigating highly related constructs, such as anxiety, have discovered that left-handers are more anxious than right-handers overall (Lyle et al., 2013) and that left-handers show greater increases in state anxiety than right-handers after completing a task designed to induce anxiety (Wright & Hardie, 2012). Other studies that focused on cognitive processes with clear parallels to the BIS, the FFFS and other withdrawal-oriented measures found similar patterns of results (Wright et al., 2013; Jasper et al., 2014; Harmon-Jones, 2006; Westfall et al., 2012). As the hypothesized relationships between handedness and approach/withdrawal motivation serve as the foundation for the rest of the study, it is necessary to explore potential factors that might explain this discrepancy.

Differences in sample composition. First, one important point to consider is that while Wright et al. (2009), Hardie and Wright (2014) and Beaton et al. (2015) all found associations between the BIS and left-handedness, their findings were complicated by interactions with gender and methodology. Beaton et al.'s results were significant when they split participants into right- and left-handed categories for analysis, but not when they used a continuous EHI measure of direction or degree. Wright et al.'s effects were likewise only significant in certain cases; specifically, left-handed females but not males scored higher on the BIS than right-handers. In the present study gender was independently related to handedness and measures of approach/withdrawal including the BIS/BAS; however, post hoc analyses did not support any moderating effects of gender.

Although gender does not appear to be a key factor in the present study, a number of the findings identified in Hardie and Wright's (2014) study could be useful when attempting to explain the unexpected results. Hardie and Wright used a number of different EHI score cutoffs ranging from +/- 45 to +/- 85 to categorize participants in an attempt to show how this common practice leads to changes in significance and differing patterns of results. They also varied the number of categories used from two (consistent and inconsistent) to three (consistent left, consistent right, and inconsistent) to four (strong left, inconsistent left, inconsistent right, and strong right). When comparing BIS scores between inconsistent- and consistent-handers, Hardie and Wright found that consistent-handers scored significantly higher using most cutoff values. When they compared all four groups, they found that consistent-left handers scored higher on the BIS than the other three groups; however, the effect was only significant for some EHI cutoff values.

Tables 35, 36, and 37 demonstrate the effects of using a similar dichotomization process and varying the EHI cutoffs in the current study. These tables show how relatively minor alterations, such as moving a cutoff point from +71 to +80, can cause results to change in significance or degree of significance. This reinforces the importance of using continuous measures of handedness, or if researchers insist on dichotomizing, at least agreeing to follow the same approaches when choosing a median split value, deciding what to do with strong left-handers, etc. so as to ensure more reliable results that can be compared across studies. Although it is unclear if p-hacking or similar practices are common in the handedness literature, these tables show how easy such practices could be in theory if all that is needed to make a p-value significant at .01 instead is a slight adjustment to a median split cutoff. Another finding was that on the whole, measures associated with right-handedness were also associated with consistent-handedness, and measures associated with left-handedness were associated with inconsistent-handedness in the same direction, even when various cutoffs were used. This could be construed as evidence in favor of the view that right- and consistent-handers are similar to one another in cognitive processes and personality traits, as are left- and inconsistent-handers. However, these associations may be solely artifactual as the majority of consistent-handers in the present study were also right-handed.

The effect that changing cutoffs and dichotomization can have on the malleability of EHI data is further demonstrated by Hardie and Wright's analyses of BAS and FFFS scores. They found that consistent-handers scored higher than inconsistent-handers on the FFFS and that consistent-right handers scored higher than both inconsistent-right and inconsistent-left handers, although once again the results varied depending on the EHI cutoff used. There was no significant difference between consistent-right and consistent-left handers in FFFS scores. BAS-RR showed a different pattern of results, with consistent-handers scoring higher overall and consistent-left handers scoring higher than both consistent-right and inconsistent-handers, although these results were weaker.

The similarities between some of Hardie and Wright's (2014) results and mine, such as the positive relationship between consistent-right handedness and the FFFS and the positive relationship between BAS-RR and consistent-handedness, are interesting to note. Furthermore, their results suggest a number of potential explanations for the discrepancies between my findings and those of previous research. One potential explanation is that my smaller sample of consistent left-handers did not provide the power needed to detect BIS differences between consistent right-handers and consistent left-handers. Individual variation among left-handers may have overshadowed group trends related to BIS scores and other related withdrawal measures such as the ATQ-Avoid. This explanation does not account for the fact that left-handers still scored higher than right-handers on other measures in my study; however, the BIS effects could be particularly small and therefore more difficult to detect with a smaller sample of true left-handers. This is supported by my statistical results as well as Hardie and Wright's, as they state that handedness explained only a small portion of the total variance in

BIS/BAS scores. For example, when they added handedness to a regression model predicting BIS it only resulted in a change in R^2 of .012 (results for the continuous measure of handedness alone were not reported). Seemingly minor and unrelated factors such as time of day and season can affect frontal asymmetries, with right frontal activity highest on fall mornings (Peterson & Harmon-Jones, 2009), so it is plausible that already small effects related to hemispheric asymmetries, handedness, and approach/withdrawal could be easily affected by unknown confounds.

Another possibility is that even slight differences in the handedness composition of a sample could lead to dramatically different results. As Hardie and Wright demonstrated, simply changing the number of comparison categories or EHI cutoffs is enough to alter the significance of results. Even with continuous scores, sample populations that are skewed more heavily left or right or have a higher percentage of inconsistent-handers could produce findings that disagree with past research. Hardie and Wright reported that their sample's overall median EHI score was +60, which exactly matches the median score in my MTurk sample but is lower than my combined sample median of +73.33 and much lower than the commonly used median score of +80. This is a problem because it is improbable that continuous EHI scores are reliable indicators of the point at which a consistent-handed individual's brain begins to resemble that of an inconsistent-hander. Dichotomized categories created by median cutoff scores selected on a case-by-case basis would be even less likely to align with the underlying neural architecture, such as the degree of interhemispheric communication or hemispheric dominance. For instance, if levels of right-hemisphere lateralization hypothetically only start to increase at an EHI score of +40, a sample with a lower median score and more inconsistent-handers would include more truly right-lateralized individuals among its inconsistent-handers. A sample with a higher median score, conversely, would include more individuals who are inconsistent-handed according to their EHI score but are more similar to consistent-handers in their brain structure. Another problem related to EHI scoring is that individuals who answer that they always use the same hand for a task and select all 2s on the EHI and individuals who answer that they mostly use the same hand for a task and select all 1s on the EHI both receive an identical score of either +100 or -100. This means that while some of those individuals are truly strong-handed, others are technically inconsistent-handers mistakenly classified as completely strong, potentially adding to the disconnect between a participant's EHI score and degree of cerebral lateralization.

In addition, it is most likely the case that there is a wide range of scores within which an individual's neural processes and structures may more closely resemble those of either a consistent- or inconsistent-hander. Within this range an individual with a lower EHI score may have a brain that resembles those of consistent-handers while another with a higher EHI score may have a brain more typical of an inconsistent-hander, resulting in atypical scores on other measures. As another example, someone who scores a +50 on the EHI may have levels of interhemispheric communication resembling that of a right- or consistent-hander, while another individual with the identical score may more closely resemble a left- or inconsistent-hander. Hypothetically speaking, if the most variability in neural structure and function was found in the 0 to +60 EHI range, the proportion of individuals in a particular sample who score in that range could bias the results. If one sample had a large number of individuals in the 0 to +60 range while another had fewer individuals in that range, the first sample could be more prone to bias because of the increased chance that an individual's EHI score would not be reflective of their actual degree of lateralization.

In their fMRI study of corpus callosum size and handedness, Luders et al. (2010) mention differences in sample lateralization as one reason why researchers have found contradictory results when studying neuroanatomical differences related to handedness. Furthermore, if hemispheric asymmetries do cause differences in approach and withdrawal motivation and personality/political ideology, this phenomenon could help explain why those variables differ in their relationships with handedness across samples. Specifically, such an interpretation could explain why the MTurk and REP samples in my study, with their different median handedness scores, also demonstrated divergent relationships between handedness and multiple mediator and criterion variables.

Differences in brain structure and lateralization. Evidence from some neuroscientific studies suggests that this type of variability may be a greater problem than most handedness researchers acknowledge. One study using transcranial magnetic stimulation (TMS) by van den Berg, Swinnen, and Wenderoth (2011) found that applying TMS to the primary motor cortex of right- and left-handers resulted in different response patterns. Application of TMS to right-handers' contralateral (left) hemisphere led to greater task disruption, whereas some left-handers were disrupted when TMS was applied to their contralateral (right) hemisphere while others were only impeded by ipsilateral (left) hemisphere application. Although the sample size in this study was small and the results may not generalize to frontal areas, the results indicate that what holds for right-handers may not be true for left-handers, and further suggests that handedness relates to asymmetries in sometimes unpredictable ways.

These differences between left- and right-handers suggest a further question: do inconsistent-right handers exhibit different brain structure and behavioral patterns than inconsistent left-handers? If so, any differences between samples in the proportion of inconsistent-left and inconsistent-right handers could also lead to confusing or even contradictory results. Another possibility could be that inconsistent right-handers are more similar to strong right-handers than inconsistent left-handers are to strong left-handers or vice versa, which again could lead to conflicting and hard-to-interpret results. Two studies by Cherbuin and Brinkman support the hypothesis that inconsistent and consistent left-handedness relate to one another in different ways than inconsistent and consistent right-handedness. In their first study with a sample of right-handers of varying handedness strength, Cherbuin and Brinkman (2006a) found that behavioral measures of hemispheric interaction were related to the speed of callosal transfer, but that neither measure related to handedness strength. When they replicated that study with a left-handed sample, Cherbuin and Brinkman (2006b) found that consistent left-handers exhibited more efficient interhemispheric transfers than less consistent left-handers. Further comparisons with the right-handed data from the first study showed that the more consistently left-handed a participant was, the faster their interhemispheric interactions.

As I did not collect measures of hemispheric lateralization or interhemispheric communication in my study, I am unable to test whether my unexpected findings are due to neuroanatomical differences between the participants that are not accurately reflected in their handedness scores. However, given the nature of these findings, it is a definite possibility. For instance, if my (small) population of consistent left-handers was more strongly lateralized, my population of consistent right-handers was less strongly lateralized, and my population of inconsistent right-handers was more strongly lateralized than usual, that could explain why right- and consistent-handers appeared to score higher on withdrawal-related measures such as the BIS. It could also be the case, of course, that the observed associations between withdrawal-related measures and right- and consistent-handedness are driven by some other factor besides a right-hemisphere bias toward withdrawal.

Differences in memory and other variables. Right- and left-handers differ in other ways besides approach and withdrawal motivation that have also been linked to hemispheric asymmetries. For instance, non-right-handed participants have been shown to perform better than right-handed participants on memory tasks that involve integrating information across both hemispheres (Lyle et al., 2008). Left-handers are also faster at self-description, which is thought to be due to a right-hemisphere bias (Platek et al., 2003), although there is an ongoing debate about whether self-awareness and self-consciousness are right- or left-lateralized processes. Propper et al. (2005) further demonstrated that inconsistent-handers have more accurate episodic memories than consistent-handers, another process thought to be right-hemisphere dependent. Questions on the BIS/BAS, the ATQ, and other approach/withdrawal measures involve thinking about how well a statement applies to oneself or remembering past events in order to judge the personal relevance of a descriptor. Therefore, it is plausible that some of these differences in memory and self-description could lead to consistent- or right-handers erroneously focusing more on withdrawal-related memories, even if they generally engage in more approach-related behaviors in daily life. This interpretation is supported by Niebauer's (2004) discovery that consistent-handers engage in negative self-rumination more often than inconsistent-handers, who are more likely to engage in self-reflection, although this can also be taken as evidence in support of a relationship between consistent-handedness and negatively-valenced, withdrawal-related emotions.

Another possible explanation that should not be overlooked for right- and consistent-handers' higher scores on withdrawal motivation is that handedness differences in lateralization have been overstated. Past research has reported handedness differences in interhemispheric activation, corpus callosum density, and frontal activation (e.g., Brookeshire & Casasanto, 2012; Propper et al., 2012, Luders et al., 2010). Some of these findings have been inconsistent or have failed to replicate across samples, however. Therefore, the relationships between cerebral asymmetries and handedness may be weaker than previously thought or even non-existent, a possibility that will be further discussed in the last section on future directions. If this alternative explanation is correct, then right- and consistent-handers would be more withdrawal-oriented than left- and inconsistent-handers for reasons unrelated to interhemispheric communication and frontal asymmetries. Such differences could be due to the activation of other brain areas that are also involved in motivational processing and associated with handedness but are differently lateralized. For instance, Spielberg, Stewart, Levin, Miller and Heller (2008) list right parietal regions and the ventral striatum as areas involved in approach and withdrawal motion that deserve more in-depth study. Although I am not aware of any studies that have specifically examined whether activity in those areas is linked to handedness, such a finding would indicate that non-frontal asymmetries unrelated to the corpus callosum are important in the relationship between handedness and approach/withdrawal motivation.

Social and environmental influences could be another potential cause of a right- or consistent-handed association with withdrawal motivation. As part of a majority group, right-handers may be more accustomed to situations and objects that are designed with them in mind and therefore require no adjustments or responses on their part, leading to reduced approach motivation. Left- and inconsistent-handers, however, from childhood on have to adjust desks, scissors, notebooks, sporting equipment, instruments and tools for left-handed use and they frequently discuss these methods of self-accommodation with one another (Grimshaw & Wilson, 2013). The necessity of interacting with one's environment in a more creative, approach-oriented fashion could conceivably lead to enhanced approach motivation over the lifespan. Similarly speculative hypotheses can be advanced regarding other environmental factors such as childhood attachment or higher levels of outgroup identification among left- or inconsistent-handers, although none of these explanations have been empirically tested.

However, a few studies can be interpreted as providing support for the assertion that left-, and particularly inconsistent-handers, are more approach-oriented than right- and consistent-handers. Inconsistent-handers are more likely to update their beliefs (Jasper et al., 2014), are more likely to switch between categories when naming animals (Sontam et al., 2009), and exhibit greater priming for multiple meanings of ambiguous words (Sontam & Christman, 2012). In addition, magical ideation and creativity have been linked to inconsistent-handedness (although this may be artifactual). All of these traits could be indicative of greater approach motivation and open-mindedness. However, if this were the case, we would also expect inconsistent-handers to score higher on the BAS and other related approach measures, which was not the case in the current study. Alternatively, consistent-handers may show greater withdrawal motivation than inconsistent-handers but there may be no differences between the two groups in approach motivation. Results from a few studies also support this interpretation, such as Christman's (2014) findings of decreased sensation seeking and greater disgust in consistent-handers, both behaviors that could be classified as withdrawal-oriented. However, these alternative explanations deviate from other findings relating inconsistent- and left-handedness to anxiety, depression, and withdrawal-related measures (e.g., Denny, 2009).

Differences in frontal asymmetries between inconsistent-, consistent-, right-, and left-handers could also be slight and difficult to detect in smaller samples. Furthermore, they may not be reliably related to observable differences in behavior or measures such as the BIS/BAS due to a high degree of variation among individuals. Harmon-Jones et al. (2010) recommended testing stable trait asymmetries in more extreme populations as asymmetries are harder to detect in other types of samples. These factors could lead to a file-drawer problem where researchers test for handedness-related asymmetries, fail to find any due to a small or less polarized sample or one without an adequate number of left-handers, and decide not to publish. This would explain why only a few studies associating frontal EEG asymmetries with handedness have been published (e.g., Propper et al., 2012). Small, hard-to-find effects that vary based on individuals' brain lateralization could also be responsible for some of the disagreement among studies linking the BAS to left-hemisphere activation and the BIS to right (e.g., Hewig et al., 2006; Wacker et al., 2010). Testing these possibilities in a highly-powered neuroimaging study with measures of approach/withdrawal and a large number of consistent left-handers as well as inconsistent-handers and consistent right-handers would help eliminate some of these explanations and hopefully allow for a more nuanced understanding of how handedness interacts with frontal motivational asymmetries and approach/withdrawal motivation.

Differences in response biases. One final explanation for the unexpected positive association between withdrawal measures and consistent-/right-handedness relies on differing response tendencies between individuals with varying handedness levels. For instance, Edlin et al. (2013) reported superior memory for hand use in mixed-handers compared to strong-handers, which could potentially affect how individuals score on the EHI. In another example, Badzakova-Trajkov et al. (2011) replicated Bryson et al.'s (2009) earlier finding of a connection between increased magical ideation and inconsistent-handedness. However, the handedness differences disappeared on performance-based measures of handedness. One explanation Badzakova-Trajkov et al. offered for this perplexing finding was that people who are naturally more open and predisposed to magical ideation also answer handedness questionnaires in a similarly open-minded fashion. For instance, they may be more open to answering that they use two hands for some tasks, or are able to think of more times when they went against the norm and used their non-dominant hand, even if those answers do not reflect their day-to-day tendencies or their scores on performance measures of handedness. These reports that handedness questionnaires lead to oversampling of inconsistent-handers and do not always align with performance measures form the basis of many critiques of handedness measures such as the EHI. Given the complicated nature of the EHI and the possibility of response biases across participants, I decided to explore whether something similar could be happening in the present study.

I had already calculated the percentage of extreme responses (responses at the endpoints of a response scale, such as 'strongly agree' or 'strongly disagree') per participant, so I was able to conduct post hoc correlational analyses using this variable and measures of handedness. As discussed earlier, although there are no "extreme" response options per se on the EHI, any response involving the use of two hands for tasks could be considered more out-of-the-norm or extreme, as the majority of individuals use just one hand for most activities. I found negative correlations that came very close to significance between both LQ-Abs and the total percentage of extreme responses across measures ($r = -.11$, $p = .014$) and LQ and percentage of extreme responses ($r = -.12$, $p = .010$). These correlations indicated that left-handed and inconsistent-handed individuals were more likely to respond to questions using the endpoints of the scales than consistent- or right-handed individuals.

Although it is difficult to determine the exact meaning of this bias, it raises a number of interesting possibilities. Individuals who are naturally prone to extreme responding may also answer in a more extreme or counter-normative fashion on the EHI and be more likely to say they use both hands or their left hand more, as in the case of magical ideation and inconsistent-handedness. This could mean these individuals are not truly inconsistent-handed or non-right-handed, but are simply answering the EHI questions in a less typical fashion. Additionally, an individual who answers in such a way is likely to be more open-minded, as with the magical ideation example, and potentially more approach-oriented. If even some approach-oriented individuals are choosing more extreme options on the EHI that make them appear to be more inconsistent- or left-handed than they actually are, it could help explain the surprising associations between consistent-handed individuals and withdrawal measures. Of course, this hypothesis would need to be confirmed in future samples. Nevertheless, it provides a starting point for an investigation into how response biases could affect EHI scores, an area of research that has received little to no attention to date.

Handedness, MM-Avoid and BAS-RR. The relationships that supported Hypothesis 1 also deserve further scrutiny. As demonstrated earlier in the discussion of mediator intercorrelations, MM-Avoid was not highly correlated with the other withdrawal measures (r = .11), indicating that it may be measuring a different type of "withdrawal." One could argue that the MM-Avoid scale is measuring something more akin to avoidance or disgust or active withdrawal from threat given its positive correlation with political conservatism measures, as past research has linked conservatism to those processes. These types of associations are also apparent when examining items in the MM scale (e.g., 'People should not be completely free to express themselves through their own choice of lifestyle, even if they don't harm others.'). Conversely, the other withdrawal or avoidance scales such as the BIS/BAS and ATQ are likely measuring a construct closer to response-related inhibition or indecision, as has been argued by the numerous researchers who develop and use those scales. If this is true and these scales are measuring different types of withdrawal motivation or inhibition, it also introduces the question of which type of withdrawal/inhibition is more strongly right-lateralized. FFFS complicates matters further, as it correlates more highly with the

BIS, ATQ-Avoid and other measures than with MM-Avoid, even though it should theoretically also be measuring active withdrawal from threat. Finally, researchers in different areas of inquiry seem to have distinct meanings in mind when they discuss constructs such as withdrawal and approach, which makes it more challenging to compare these measures with one another and to determine their relationships with variables such as handedness. This possibility will be discussed in more detail in the section on political measures and approach/withdrawal motivation.

Finally, the relationship between BAS-RR and right-/consistent-handedness, although in the predicted direction, is also of interest for a number of reasons. First, while clearly an approach-related scale, it demonstrated a more heterogeneous pattern of intercorrelations with other mediator variables. Although it was highly positively correlated with the BAS and the other BAS subscales, PA, ATQ-Approach and MM-Approach, as expected, it also exhibited small to moderate positive correlations with the BIS, BIS-A, FFFS, and ATQ-Avoid in the combined dataset. Secondly, previous studies have reported correlations between BAS-RR and the BIS (e.g., Heym et al., 2008). Therefore, although the relationship between BAS-RR and right-/consistent-handedness may be due to the association between frontal left-hemisphere activation and approach motivation, an alternative explanation is that BAS-RR correlated with right-/consistent-handedness in that direction due to its shared variance with the BIS and other withdrawal-oriented measures and for the same (currently unknown) reasons. More research is needed to test between these two competing prospects.

Relationships Between Handedness, Approach/Withdrawal Motivation, and the Big Five

BFAS Volatility was positively associated with right-handedness and BFAS Compassion was positively associated with right- and consistent-handedness, in line with my predictions in Hypothesis 2. However, the BFAS Withdrawal aspect was also positively correlated with right- and consistent-handedness, contrary to what I had hypothesized. In addition, neither the finding from my pilot study that right- and right-leaning inconsistent-handers were higher in the Enthusiasm aspect of Extraversion nor Grimshaw and Wilson's (2013) finding that inconsistent-handers were lower on Extraversion replicated in the current study. Sampling error could be responsible for these disagreements, especially since MTurk and REP participants diverged on many of the BFAS aspects and there were marked differences among the two groups in EHI scores as well. One caveat is that differences in means do not necessarily imply differences in relationships with other variables. The conflicting results could also be due to one or more of the explanations outlined in previous sections, such as response biases or undetected differences in lateralization.

The variance in responses between Grimshaw and Wilson's study, my pilot study, and the current study is likely explained as well by factors related to sample size. In all three studies, the percentage of variance in Big Five personality traits explained by handedness is quite small. Small effect sizes are harder to detect reliably and unearthing them requires greater power and larger *N*s. Although the current study analyzed data from almost 500 participants and the two combined samples analyzed in the pilot study contained data from more than 600 participants, these relatively large sample sizes may still be too small to accurately detect these types of effects, especially in heterogeneous samples. If more studies are conducted on handedness and the BFAS in the future, a meta-analytic approach could be valuable in determining which effects are reliable and which are artifacts due to sampling error or other causes. Until that point, any strong conclusions about relationships between the Big Five and handedness are not warranted.

Support for Hypothesis 5 was stronger overall, as most of the Big Five aspects correlated with approach or withdrawal measures in the predicted direction. Approach measures were highly positively related to both the Enthusiasm and Assertiveness aspects of Extraversion as well as the broader Extraversion domain, in line with previous work by Smits and Boeck (2006), Segarra et al. (2014), Mitchell et al. (2007), Elliot and Thrash (2002), and Quilty et al. (2014). Openness/Intellect and its two aspects showed similar positive associations with approach-related mediators, in agreement with Quilty et al.'s (2014) findings and other researchers such as Bipp et al. (2008). In fact, Openness/Intellect was linked to approach motivation more strongly in the current study than in Smits and Boeck's. In their study, Openness/Intellect was only significantly positively correlated with BAS-FS, but in the current study, Openness/Intellect was positively associated with all three BAS subscales, albeit at a weak to moderate level, and with the other approach measures including PA, ATQ-Approach, and MM-Approach.

The more complex hypothesized associations between approach and withdrawal motivation and the remaining three domains of Neuroticism, Conscientiousness, and Agreeableness were largely supported as well, with some exceptions. Neuroticism exhibited overall positive relationships with the various withdrawal-associated mediators in agreement with work by Segarra et al. (2014), Gable et al. (2003) and others, as well as negative relationships with some approach measures. Surprisingly, Neuroticism did not exhibit negative correlations with the BAS, however, even though Quilty et al. (2014)

found negative correlations between Neuroticism and two approach factors that comprise BAS subscales. Another unanticipated finding that has not been reported in previous studies was the positive correlation between Neuroticism and BAS-RR. The similarly positive associations between BAS-RR and other withdrawal measures such as the BIS that were observed in this study and previous ones make this outcome seem less unusual, however. BFAS Withdrawal correlated positively with the BIS, BIS-A, FFFS and ATQ-Avoid, which agreed with both my predictions and past research. BFAS Volatility, on the other hand, only exhibited a positive correlation with BAS-RR and no other approach-related domains, regardless of its associations with the approach-related trait of anger (DeYoung, 2010a) or its positive association with an approach factor in one of Quilty et al.'s (2014) samples. In addition, while Volatility demonstrated positive associations with FFFS as predicted by DeYoung (2010a), BFAS Withdrawal correlated even more strongly with FFFS. Not only does this finding disagree with any hypotheses linking the FFFS to Volatility more so than Withdrawal, it further demonstrates that the FFFS may be more withdrawal-oriented than researchers such as Wacker et al. (2008) had previously reported.

As I predicted, Compassion and, to a slightly lesser degree, Industriousness exhibited positive associations with multiple approach measures and few withdrawal measures. Orderliness and Politeness were also generally correlated in a positive direction with various withdrawal measures including the BIS and the FFFS and less strongly associated with approach measures. These results serve to clarify previous research on Conscientiousness and Agreeableness, as most studies have not used the BFAS and hence could not distinguish between two aspects, each with differing approach/withdrawal associations. For instance, Smits and Boeck (2006) and Segarra et al. (2014) reported positive associations between Conscientiousness and both approach and withdrawal measures. Results from the present study suggest that those findings were likely due to the disparate contributions of the Orderliness and Industriousness domains. Quilty et al. (2014), who did use the BFAS, reported results indicating the existence of stronger relationships between the approach factors and Industriousness rather than Orderliness. Past findings relating to Agreeableness linked the domain much more strongly to withdrawal than approach (Smits & Boeck, 2006; Mitchell et al., 2007; Keiser & Ross, 2011; Robinson, 2007). Once again, Quilty et al.'s results using the BFAS aligned with those of the current study and reinforced the importance of using aspect scales. They found that overall Agreeableness and Compassion were positively associated with approach factors, while Politeness negatively correlated with those factors.

Nevertheless, there were still results that were challenging to interpret in light of these hypotheses. A few of these puzzling associations included the positive correlations between BAS-RR and Orderliness and between multiple withdrawal measures and Compassion. These incongruous associations merit further examination; moreover, they suggest that the distinctions made between approach-related and withdrawal-related BFAS aspects for prediction purposes may not be as clear-cut as originally thought. As the Big Five lack simple structure and consistently exhibit intercorrelations with one another, it is possible that their respective approach and withdrawal components also overlap, further complicating any observed associations.

This area in particular seems ripe for a behavioral approach given the often-contradictory nature of these findings. For instance, if one withdrawal measure correlates positively and another withdrawal measure negatively with a BFAS aspect, it makes it far more challenging to categorize that aspect or use it to predict other withdrawal-related behavioral outcomes. While the mushroom AAT did not correlate significantly with other measures, a modified and improved version could be used alongside questionnaires to help settle these disagreements. A task that is designed to elicit true "withdrawal" or avoidance as well as response inhibition could be designed to better determine which traits are comprised of inhibitory elements and which are driven by withdrawal. It could also help clarify the distinctions between the two types of responses that are so often conflated in the literature. Such a task could require participants to escape or avoid a threatening stimulus on some trials, perhaps by moving backward or pushing a joystick away from them, and on other trials to inhibit a prepotent response by refraining from clicking a mouse or hitting a button in response to a stimulus. On approach trials, participants would have to either physically move themselves or a joystick toward a rewarding stimulus, while on other trials they would have to actively respond by pressing a button or mouse. Participants' performance on each portion of the task could then be compared with their scores on various approach/withdrawal and personality measures to determine not only the degree of approach/withdrawal motivation but the type of motivation associated with a particular measure.

Relationships Between Handedness, Approach/Withdrawal Motivation, and the PID-5

The hypothesized relationships between non-right-handedness and the PID-5 domains of Detachment and Negative Affect were not supported, and neither was the second half of Hypothesis 3 which predicted that left- and/or inconsistent-handers would score higher on more PID-5 facets than right-/consistent-handers. Instead, right- and consistent-handers scored higher on Negative Affect, while non-right-handedness and right-/consistent-handedness were associated with a roughly equal number of facets. PID-5 Negative Affect was highly positively correlated with multiple withdrawal measures such as the BIS, FFFS, etc., so the reasons for that unpredicted finding are likely the same as those that contributed to the aforementioned positive relationships between right-/consistent-handedness and those withdrawal measures. However, this positive association as well as the associations between right-/consistent-handers and the PID-5 aspects of Separation Insecurity, Submissiveness, Emotional Lability, and especially Depressivity contradict past research on this topic. One of the most commonly-cited claims in the handedness literature is that non-right-handedness exhibits a small but significant correlation with various psychological disorders (e.g., Denny, 2009; van der Hoorn et al., 2010; Elias et al., 2001; Milenkovic & Paunovic, 2015). A closer look at this sampling of studies, however, shows that only Denny and van der Hoorn et al. established an unequivocal albeit weak relationship between handedness and psychological disorders; the other two have caveats related to gender (Elias et al.) or strength of handedness (Milenkovic & Paunovic). The current study's results appear to support the conclusions of Badzakova-Trajkov et al. (2011) that any perceived connections between psychopathology and non-right-handedness may be illusory and caused by response biases on handedness questionnaires (if not simple sampling error).

It is important to distinguish between schizophrenia and other psychological disorders, however. The majority of studies on psychological disorders besides schizophrenia have relied heavily on self-report measures (e.g., Shobe & Desimone, 2016; Coren, 1994; Beratis et al., 2011), although this practice could also explain the inconsistent findings if participants' dishonesty about their symptoms weakened any associations with handedness. In comparison, the evidence for a link between schizophrenia and non-right-handedness is stronger and comes from a wider variety of studies, including genetic and neuroscientific studies and meta-analyses (e.g., Francks et al., 2003; Sommer et al., 2001). Evidence from the pilot study and the current study, while based on self reports, also supports this claim. In the present study I found a positive correlation between Familial NRH and the PID-5 domain of Psychoticism, which is closely related to schizophrenia and includes items such as, "Sometimes I can influence other people just by sending my thoughts to them." Although I had initially hypothesized that PID-5 Psychoticism would be related to handedness, I had refrained from forming a directional hypothesis as I suspected that the negative and positive symptoms of schizophrenia could show differential relations to approach and withdrawal motivation. This non-directional hypothesis was supported and reinforced previous research associating schizophrenia with non-right-handedness. Furthermore, while speculative, the observed relationship between Familial NRH and PID-5 Psychoticism could be indicative of a genetic link (e.g., Francks et al., 2003).

I was also able to answer the questions I had posed regarding the relative contributions of approach and withdrawal motivation to the Psychoticism domain. While Psychoticism positively correlated with the approach-related BAS-FS and BAS-D subscales, these correlations were weaker than those with the withdrawal measures of ATQ-Avoid and PANAS-NA. Furthermore, Psychoticism demonstrated negative correlations with MM-Approach and PANAS-PA, suggesting that overall the domain is more closely linked to negative emotion and withdrawal than to positive emotion and approach motivation. Interestingly, although Psychoticism correlated .29 with ATQ-Avoid, its correlations with the BIS and FFFS were close to zero. This suggests that despite the notably high correlations between the BIS and ATQ-Avoid, the type of withdrawal measured in ATQ-Avoid is different than that measured by the BIS and FFFS and may be more common in schizophrenia and other psychological disorders. Additionally, as these correlations between the PID-5 and measures of approach and withdrawal were the first of their kind, they are of particular importance. Future research comparing these approach/withdrawal measures should take note of this, as it is possible that each scale could be a better predictor of certain types of psychological disorders than others.

The remaining predictions from Hypothesis 6 regarding the PID-5 domain of Detachment and the PID-5 facets were also supported. The PID-5 domain of Detachment demonstrated positive correlations with measures of withdrawal and negative correlations with approach measures, while fewer PID-5 facets positively correlated with approach motivation than withdrawal motivation. PID-5 Antagonism and Disinhibition showed more varied correlations with the mediator scales, which is likely a reflection of the competing withdrawal and approach motivations that comprise each domain. These results are a reminder that although approach motivation typically has more positive connotations due to its associations with Extraversion and positive affect in the literature, it can still be maladaptive at times and could lead to externalizing behavior. For instance, Antagonism's significant positive associations with two of the three BAS subscales is easy to understand in light of the research on the approach-related emotions of anger and hostility.

Finally, it is important to keep in mind that the majority of individuals who scored highly on the PID-5 domains in the current study are at a subclinical level. Researchers studying handedness and psychopathology should consider including measures of approach/withdrawal in future studies to test whether these same relationships generalize to a clinical population. It may even be easier to accurately detect handedness differences in a population of individuals with psychological disorders (e.g., Harmon-Jones et al., 2010). Since approach and withdrawal motivation are interrelated with the PID-5, individuals with high scores on the PID-5 may consequently exhibit more extreme approach/withdrawal biases and frontal asymmetries, which in turn could amplify otherwise subtle differences between handedness groups.

Relationships Between Handedness, Approach-Withdrawal Motivation, and Political Ideology

Political ideology and handedness. Familial NRH was positively associated with RWA and negatively associated with two measures of liberalism (Self-Report Democrat and MFQ Progressivism) in the MTurk dataset only. There were no other associations between political ideology and degree or direction of handedness in either the REP or MTurk datasets, with the exception of a trend that was significant at the .05 level in the combined dataset for consistent-handers to favor the Democratic party more. As Hypothesis 4 was nondirectional and solely predicted relationships between conservative and liberal ideology and handedness, it was supported, albeit to a lesser degree given the lack of other significant findings. Research on approach and withdrawal motivation and political ideology aligns with the current study's findings as it supports an association between conservatism and withdrawal motivation. Given my original hypothesis that non-right-handers are higher in withdrawal motivation, previous work in political psychology could be used to explain the observed connection between lower levels of liberalism and Familial NRH. However, while past research on handedness and political ideology is sparse, for the most part it disagrees with these conclusions. Understanding the implications of these results therefore requires comparing research across domains, an inherently challenging task.

The three studies I found that measured handedness and political ideology all reported positive associations between consistent-handedness and conservatism (Christman, 2014; Lyle & Grillo, 2014; Chan, 2018). A number of critiques regarding the methodology behind these studies were discussed earlier in this paper, such as too few left-handers for analyses, failures to measure direction as well as degree of handedness, and generalizability concerns due to the lack of other measures such as SDO. Following the discussion of PROCESS and mediation analyses in the previous section of this paper, an additional critique can now be addressed. Chan's (2018) mediation analyses were conducted using the identical process and parameters as the analyses in the present study (Model 4, 99% CI for indirect effect tests, 5000 bootstrapped samples, etc.). When reporting the key finding of the paper – the significant mediation effect of RWA on the relationship between consistent-handedness and religiosity – Chan appears to misinterpret the significance of the indirect effect. The bootstrapped estimate of the indirect effect as reported in the paper is -0.30 to 0.72, a range that includes zero and should not be considered significant. However, Chan concludes that this is evidence of a significant indirect mediation effect of RWA while stating that another variable (susceptibility to the Barnum Effect) is not a significant mediator, although the bootstrapped CI range for that mediation does not include zero. Although this does not invalidate Chan's preliminary finding that consistent-handers scored higher on RWA than inconsistent-handers, it calls into question the accuracy of the overall conclusion that RWA mediates handedness relationships.

Political ideology and approach/withdrawal motivation. Although each study has its respective weaknesses, all three converge on similar findings that disagree with the current study's. One justification for the discrepancy could be that Familial NRH relates to political ideology in a different way than individual handedness. Although this could be true, it does not explain the lack of any positive associations between conservatism/RWA or the fact that the only trending association with individual handedness was in the opposite direction. In addition, the findings from these studies are hard to reconcile with those of Corr et al. (2013) and the associations between political ideology and approach/withdrawal motivation in the present study. Corr et al. found that SDO correlated with approach but not withdrawal measures, while RWA also correlated with approach measures as well as with the FFFS. Similarly, Nicol and DeFrance (2016) found positive associations between the approach-related trait of Extraversion and SDO and RWA. In the present study the two measures of liberalism were positively correlated with withdrawal measures (BIS, FFFS, ATQ-Avoid) while RWA, SDO, and measures of conservatism correlated negatively with those same withdrawal measures. As these results demonstrate clear connections between approach/withdrawal motivation, they provide strong evidence in favor of the nondirectional Hypothesis 7. However, the critical finding that complicates interpretation of these results is that in my study, withdrawal measures were associated with consistent-handedness as well as liberalism. At first glance, this seems to fit with the findings of Corr et al. (2013), which would predict that approach measures would be associated with conservatism and potentially, by extension, with inconsistent-handedness in my study. However, the results directly contradict the consistent-handed-conservatism link established by Christman (2014), Lyle and Grillo (2014), and Chan (2018). Moreover, the present study failed to detect any positive correlations between conservatism and approach measures; in fact, SDO exhibited negative correlations with BAS-RR and ATQ-Approach.

If these patterns were not complicated enough, a foray into the political psychology literature leads to additional confusion. As discussed earlier in this paper, research on the psychological processes responsible for political conservatism has concluded that conservatives tend to be more motivated by fear, threat, and disgust than liberals – all emotions which closely relate to withdrawal motivation. For example, Mikulincer and Shaver (2001) found in an experiment that reducing participants' fear and priming them to feel more comfortable socially led to increases in liberal attitudes. Other political researchers have employed tasks that sound remarkably similar to those used in studies of withdrawal motivation: Vigil (2010) reported that conservatives rated ambiguous faces as more threatening compared to liberals, and Oxley et al. (2008) found that conservatives responded to threatening images with increased skin conductance and more startle-related eye blinks. Shook and Fazio's (2009) report of liberals' and conservatives' performance on the BeanFest task even uses the terms approach and avoidance in their descriptions of how liberals approached more good and bad beans overall while conservatives avoided more beans. Although this theory has encountered criticism, it is nevertheless widely accepted that conservatism is associated with a stronger tendency to withdraw from threatening or negative stimuli.

Correlations between the BFAS and political ideology in the current study further reinforce this theory that liberalism is associated with approach-related traits and conservatism with withdrawal-oriented ones. The approach-related Compassion aspect of Agreeableness was positively correlated with liberalism and negatively with conservatism, in accordance with Hirsh et al. (2010) and Osborne et al. (2013). Many researchers including Carney et al. (2008) and Gerber et al. (2010) have reported that Openness and Intellect are strongly positively correlated with liberalism and negatively with conservatism, and this finding was replicated in the present study as well. The withdrawal-associated Orderliness aspect and Conscientiousness overall were also higher in conservatives than liberals, a result previously reported by Hirsh et al. (2010) and Gerber et al. (2010). However, the results diverged somewhat from Hirsh et al. who stated that the association between conservatism and Conscientiousness was largely driven by Orderliness, while the present study's results also demonstrated a positive correlation between Industriousness and conservatism and a negative association with Self-Report Democrat. Additionally, although Hirsh et al. had previously shown a positive association between conservatism and the Politeness aspect, conservatism as measured by the SWB index in the current study was negatively associated with Politeness, as were RWA and SDO (a less surprising finding). MFQ-Progressivism, on the other hand, was positively correlated with Politeness. These differences between the current study and previous work could be due to the decreased representativeness of my samples. Both the MTurk and REP samples were more liberal than the general population, which could have biased the results. For example, conservatives who are members of a more liberal group (such as University of Minnesota college students) may theoretically identify more strongly as outgroup members, causing them to be less polite towards "ingroup" members and leading to a gradual downward shift in Politeness over time. Regardless of these relatively minor disagreements, however, the BFAS and political ideology correlations only serve to strengthen connections between conservatism and withdrawal motivation and liberalism and approach motivation.

It is difficult to reconcile this theory with studies that have, for example, reported that conservatives are higher than liberals in approach-related traits such as positive affect or Extraversion (e.g., Caprara et al., 1999; Nicol & DeFrance, 2016). Additionally, while the majority of withdrawal measures in my study correlated positively with liberalism and negatively with conservatism, the MM-Avoid and MM-Approach mediators exhibited the opposite pattern. Without a single exception, MM-Avoid correlated positively with conservatism, including RWA and SDO, and negatively with liberalism, while MM-Approach displayed positive correlations with liberalism and negative with conservatism. As mentioned previously, this is almost certainly due to the high degree of political content associated with these two scales. Although they were designed to measure moral motives and their respective approach/withdrawal associations, they could almost be considered proxy measures of political orientation due to their relatively high and consistent correlations with the other political measures. However, comparing these measures to the other withdrawal measures such as the BIS, FFFS, and ATQ-Avoid suggests one explanation for at least some of the discrepancies between Corr et al.'s findings, the findings from the present study, and previous work on the motivations behind political ideology. As I have discussed in this paper, many researchers claim that the BIS measures response inhibition or a closely-related construct, while the FFFS is more akin to active withdrawal. The MM-Avoid scale contains many politically-related items but it also includes items relating to self-restraint, resisting temptation, and self-control that seem to be at least loosely related to inhibiting a response. While these questions may seem superficially similar to those in the other measures, the BIS and FFFS items contain undertones of anxiety and fear whereas the MM-Avoid items do not, and these differences could explain their opposite associations. Additionally, it could be the case that the MM-Avoid and MM-Approach scales are so strongly politicized that participants' answers to approach or avoidance items in the scales are overwhelmed by their political leanings and answers to the political questions, leading to the discrepancies with the other measures.

Withdrawal and the jingle fallacy. While these possibilities present one explanation, they do not explain why the BIS, FFFS, and ATQ-Avoid would correlate with liberalism in the first place. I hypothesize that this is likely because when political psychology researchers are ostensibly measuring and discussing withdrawal or avoidance, they are discussing a construct dissimilar to that measured by the ATQ-Avoid or BIS. In terms of jingle-jangle fallacies, this would be considered a jingle fallacy as it involves the assumption that two scales with similar names are measuring similar constructs. There are a number of reasons why this fallacy may be complicating interpretations of withdrawal/avoidance motivation across domains. First, as far as I am aware, Corr et al. (2013) have been the only researchers to incorporate the BIS/BAS in a study of political ideology. This is somewhat surprising given the emphasis political researchers have placed on conservatism and withdrawal/avoidance in recent years, although understandable since the BIS/BAS has its origins in cognitive and personality psychology. As a consequence, two scales such as ATQ-Avoid and MM-Avoid may sound conceptually similar but have limited overlap, making them challenging to compare. Second, political approach/avoid measures often involve questions about others beyond the self, whereas most approach/avoid questionnaires such as the BIS/BAS focus almost exclusively on internal thoughts and individual actions. Third, and perhaps most importantly, political researchers and researchers who study approach/withdrawal motivation seem to rely on different methodologies. The BIS/BAS and similar scales are commonly used to measure approach and withdrawal motivation in the personality and cognition literature, while in many of the political psychology studies cited here, the researchers relied on behavioral measures (BeanFest, displays of threatening pictures, mortality salience induction, priming) to measure general approach and avoidance tendencies. This may have the unintended effect of eliciting substantially different types of withdrawal or approach motivation. Sometimes these measures may not even correlate with one another, as Smillie and Jackson (2005) reported. For example, their experimental task that involved participants pressing keys to earn points or avoid losing points did not correlate at all with the BIS/BAS despite its evident associations with approach and withdrawal motivation.

In the case of self-report measures such as the BIS, the respondent has to consider their reactions to potentially fearful stimuli, their anxiety in uncertain situations, or whether they are more hesitant or excited when pursuing a goal. All of these decisions involve weighing multiple response options and thinking back to times when they felt conflicted or uncertain. Particularly in the case of the BIS, this weighing of multiple response options could hypothetically result in liberals, with their lower need for cognitive closure and greater tolerance of ambiguity (Jost et al., 2003), answering BIS items in a way that reflects this higher level of uncertainty and cognitive flexibility. In other words, the BIS and other similar withdrawal measures could show an association with liberalism because scoring highly on the BIS requires recalling times when one was conflicted or uncertain, a cognitive process that liberals may engage in more strongly than conservatives. Evidence of an association between liberalism and the ACC (Kanai et al., 2011; Amodio et al., 2007) with its role in conflict detection further supports this interpretation, as does a literature review by Jost and Amodio (2012). Meanwhile, scoring high on the BAS requires thinking of times when one approached a goal, took a risk, received a reward, etc., a process that does not require cognitive flexibility or judging between multiple options and seems more amenable to unambiguous interpretations of events. This could provide one explanation for Corr et al.'s (2013) finding that individuals high in SDO and RWA, who tend to exhibit a more dogmatic, inflexible view of the world, also score higher on the BAS and similar approach measures.

By comparison, the types of behavioral measures used in many political psychology studies of withdrawal motivation employ more immediate, visceral stimuli that evoke feelings of threat, loss, or disgust, or have overtly political connotations. These types of stimuli often do not require the participant to choose between competing response options or detect conflict, and therefore are less likely to show an association with liberalism. In contrast, they either require a direct, unambiguous response, such as withdrawing from the threat or the disgusting stimulus, or they elicit approach-related emotions such as anger. These types of responses should theoretically be associated more strongly with conservatism, particularly with RWA and SDO given their respective associations with anger and fear (e.g., Kossowska et al., 2008). In summary, while much of this is speculative and would need experimental confirmation, it is possible that broadly speaking, the associations between liberalism and the BIS, ATQ-Avoid and other withdrawal measures observed in this study are due to a more cognitive form of withdrawal motivation or inhibition, driven in part by openness and conflict detection. Conversely, associations between conservatism and withdrawal behavior in political studies could stem from a more immediate, visceral type of behavioral withdrawal that contains elements of approach motivation as well. If true, this distinction between the types of motivation measured in questionnaire and behavioral measures would extend to research beyond the political domain and confirm the importance of including both questionnaire and behavioral measures in studies of approach and withdrawal.

While this hypothesis does not necessarily explain the observed association between Familial NRH and conservatism, it does suggest that conflicting findings on handedness and political ideology could be partly due to the varying associations between ideology and approach/withdrawal. If liberalism is related to approach motivation through its associations with cognitive exploration and to withdrawal motivation due to its associations with conflict detection and uncertainty, it could exhibit inconsistent or unreliable correlations with handedness. In a similar vein, if conservatism is associated with approach motivation through anger and with withdrawal motivation because of heightened sensitivity to threat and disgusting stimuli, it too may demonstrate variable relationships with handedness and other variables related to approach/withdrawal. Withdrawal and approach motivation are clearly diverse constructs that interact with variables in complex ways. Furthermore, just as an individual can score highly on both the BIS and the BAS, many political ideology measures likely contain elements of both approach and withdrawal.

Approach/Withdrawal Motivation as a Mediator Variable

Although each of the seven hypotheses discussed above helped to partially answer my primary research question—whether approach and withdrawal motivation influence the relationship between handedness and personality/political ideology—tests of the mediation models outlined in Hypothesis 8 provided the most comprehensive answer. BAS-RR was found to explain part of the positive relationships between LQ-Abs and BFAS Compassion and between LQ-Abs and BFAS Agreeableness. In addition, MM-Avoid significantly mediated the negative relationship between Familial NRH and MFQ-Progressivism and the positive relationship between Familial NRH and RWA. Although both MM-Avoid and BAS-RR have complicated relationships with other mediators and MM-Avoid correlates highly with political ideology measures as well, BAS-RR is nevertheless strongly related to approach measures and MM-Avoid to withdrawal measures. These mediation analyses can be taken as weak evidence that both approach and withdrawal measures mediated handedness-personality and handedness-political ideology relationships in the predicted directions. However, as mentioned previously, the mediation effects were not particularly large, particularly in the case of BAS-RR, and the MM-Avoid mediation effects were only detected in the smaller MTurk dataset. Moreover, complicated correlations between handedness and approach/withdrawal motivation also led to many significant mediation effects in the opposite direction between consistent-handedness, measures of withdrawal motivation, and BFAS and PID-5 measures. Potential explanations for this likely stem back to the initial associations between handedness and approach/withdrawal motivation, which may have occurred for a number of reasons including sampling error, undetected differences in lateralization among individuals with varying degrees of handedness, or response biases on the EHI. The mediator-criterion paths in the mediator analyses, however, are more strongly supported by other evidence in the current study and should be considered more reliable.

Although the findings from the hypothesized mediation analyses and the exploratory mediation analyses are somewhat contradictory due to their opposing relationships with handedness, this does not mean they are not useful or important. On the contrary, the existence of these significant mediation relationships is noteworthy for a number of reasons, assuming that they are valid findings and not attributable solely to sampling error or other confounds. First, the number of significant mediation analyses reported in the current study (four significant hypothesized mediation analyses, 24 significant exploratory analyses) supports the claim that approach and withdrawal motivation at least partially account for the relationships between handedness and personality and handedness and political ideology. Although these relationships may not have been in the direction predicted a priori, they nevertheless are evidence of the key role that approach and withdrawal motivation play in relationships between handedness and other variables. To the best of my knowledge, no other study has demonstrated this connection before. Second, now that the current study has established that approach/withdrawal motivation may act as a mediator in these instances, future research can more directly test the parameters of these relationships, whether they generalize to other populations, and whether they are connected to hemispheric lateralization.

Third, these findings show that while approach and withdrawal motivation do act as mediators, they only weakly mediate the relationship between handedness and personality/political ideology. Therefore, future research can focus on identifying other candidate mediators and moderators in order to develop more comprehensive models of these complex relationships. Additionally, while the causal direction implied in the current study from handedness/hemispheric lateralization to asymmetries in approach/withdrawal motivation to personality or political ideology is supported by research on these constructs, other causal models could be tested to rule out alternative explanations. For example, one could first experimentally manipulate a variable, perhaps by priming participants to induce greater liberalism or conservatism, and then test whether that results in changes in participants' approach or withdrawal motivation. Lastly, the mediation analyses tested in the current study demonstrate the potential value of including handedness measures in studies of approach/withdrawal, personality, political ideology, and related variables. Although handedness may only appear to exhibit weak initial correlations with variables such as the BFAS or political ideology measures, these results suggest that those weak correlations may be masking more complicated mediation relationships that could have theoretical and practical implications.

Methodological Limitations

In addition to the issues with the sample discussed already such as the lack of consistent left-handers and the differences between the MTurk and REP samples, the current study was also subject to methodological limitations. First, the only handedness measures used in the study were the EHI and one self-report handedness item, so I was unable to confirm the results of the EHI with a supplementary handedness measure. This decision was made due to the online data collection method and length of the study; however, I would recommend incorporating a secondary handedness measure in future studies of this nature for multiple reasons. The EHI, while the most commonly used handedness inventory, can be challenging to understand. Fazio, Coenen, and Denny (2012) reported that more than half of participants misunderstood at least some aspect of the instructions or response options for the EHI. Although I tried to simplify the scale's response options when creating the online version, the instructions used were the original ones and could have potentially led to similar comprehension issues.

Incorporating a performance measure of handedness in future studies would also be a good decision as it would both provide a secondary measure of handedness while potentially increasing the predictive power of handedness. For example, Nicholls et al. (2010) found stronger results for a performance measure of handedness than a questionnaire measure when investigating general cognitive ability. In addition, since Williams (1991) found that the EHI's structure and question wording artificially increased the number of participants categorized as inconsistent-handed, including a performance measure could reduce this bias. Common performance measures of handedness include finger tapping and dot-filling, both of which would have to be adapted for use in an online study. Including a performance measure, such as one that required participants to type with either their left or right hand, could also help answer questions about handedness that cannot be addressed through a questionnaire alone. For example, the MTurk sample may have contained more inconsistent-handers not solely due to response bias, but also because their frequent keyboard use on MTurk requiring both hands results in a higher level of ambidexterity. Anecdotal reports by MTurk workers describe how they become quicker and more adept at keyboard and mouse responses due to the daily online tasks that require fast response times, so it would be worthwhile to investigate if a similar effect occurs for handedness. A modernized performance measure or questionnaire with questions about handedness for phone use and mouse/trackpad use could also be beneficial, particularly as the EHI contains an item that might be less predictive for younger participants (striking a match).

Another potential limitation of the study was its length. Participants may have been bored or less attentive by the conclusion of the study as it took most participants an hour or more to complete. Attention checks were used to mitigate this effect, but the large number of measures included in the study could have led to diminished response quality nonetheless, especially in the latter half of the study. MTurk participants are also accustomed to attention checks and may have completed them correctly while still responding at random to other questions.

The last major limitation of the current study was the failure of the mushroom AAT to significantly correlate with other measures. One possible explanation for this was that the sample size for the mushroom AAT data was almost 70 participants less than the sample size for the other questionnaire measures. This occurred because of technological issues with their browsers that happened when participants would be routed to Inquisit from Qualtrics and then back to Qualtrics for the final two questions of the study about their experience and liking of mushrooms. In other cases, participants had neglected to download Inquisit before the start of the study per the instructions and then had difficulty installing it and were forced to quit the study early. In still other cases, as I learned from screenshots that participants sent, Inquisit would occasionally malfunction or freeze.

While these difficulties are to be expected in an online study, Inquisit seemed to have a particularly high rate of these incidents and the issues did not solely affect sample size. Through communication with participants I learned that sometimes in the middle of a trial, the cursor which participants used to pull or push the mushrooms would freeze or would only allow them to move it to the top or bottom of the screen. Although only 20 or so participants reported these glitches, there were likely more who experienced them but did not report it, and this could have had a serious effect on the results. A trial labeled as an error may have actually been due to a glitch, or slow reaction times on certain trials may have been caused by a temporarily frozen cursor. If I were to conduct a similar online study in the future, I would likely choose a different program other than Inquisit, although there are few if any viable alternatives that also record reaction time. Conducting the study in person would be another option, although that would potentially restrict the diversity of the sample. However, that cost could be outweighed by the ability to design a more reliable approach/withdrawal task that would not be subject to the same liabilities as the one in the current study.

Technological issues likely limited the validity of the mushroom AAT, but there is also the possibility that the task itself did not adequately capture variance in approach and withdrawal. The task may not have felt realistic enough to participants to trigger high levels of approach and withdrawal motivation, or they may not have been interested enough in the task to give it their full attention. Including an additional two questions at the end of the study asking participants whether they felt engaged in the task and whether they were motivated to correctly approach or avoid the mushrooms would have helped ensure that the task was working as expected. Anecdotal evidence suggested that MTurk workers, at least, may have been less motivated to do the task. From browsing MTurk forums, speaking to others who had used Inquisit before, and receiving emails from my participants I learned that MTurk workers have had prior experiences with Inquisit and strongly dislike it due to its technological issues. Their previously established dislike of Inquisit may have reduced their motivation to perform well on the task and their engagement with it, ultimately affecting the results.

Introducing approach/withdrawal measures both before and after participants completed the behavioral task would be more effective and would simultaneously allow me to test for effects in line with the Capability Model (Coan et al., 2006). Although impractical in a study with as many approach/withdrawal measures as the present one, it could work with one or two measures. Participants would first complete a measure such as the BIS/BAS before beginning the task, which would serve as a baseline measure of their motivational state. After finishing the behavioral task designed to elicit approach/withdrawal behavior, they would then complete a highly similar approach/withdrawal measure afterward to detect any changes in motivation. As the Capability Model suggests that engaging in an approach-related or withdrawal-related task elicits the corresponding motivation, this repeated-measures design could detect any divergences from baseline while simultaneously providing an additional measure of approach/withdrawal as measured by the task itself. Another alternative to a repeated-measures design would be to administer the questionnaire measure(s) of approach/withdrawal following the behavioral task. This would increase the construct validity of the self-report measurements as the task would theoretically elicit stronger levels of approach/withdrawal motivation which would then be captured by the questionnaire.

Future Directions

Recruiting more consistent left-handers, incorporating additional measures of handedness, and refining the behavioral approach/withdrawal task would all be beneficial improvements for future studies. Incorporating a method that allows the researcher to measure changes in approach/withdrawal motivation before and after a motivating task would also help, as evidence is accumulating that motivational asymmetries are often absent or difficult to detect at rest (e.g., Beeney et al., 2014). Another key recommendation for handedness research is to recruit a diverse sample. Although the proportions of consistent- and inconsistent-handers should theoretically be evenly distributed throughout the population, in practice samples can vary widely in laterality, as shown by the differences in the MTurk and REP samples in the current study.

These suggested methodological improvements are only a starting point as the current study introduces many questions that merit further exploration. To begin, handedness and its relationship with motivational hemispheric asymmetries deserve additional research. Although researchers have linked inconsistent-handedness to interhemispheric communication and larger corpora callosa (e.g., Prichard et al., 2013; Luders et al., 2010), others such as Westerhausen et al. (2004) have found evidence in favor of larger corpora callosa in left-handers while a minority have found no handedness differences (e.g., Clarke & Zaidel, 1994). Far fewer researchers have studied associations between handedness and frontal asymmetries directly, although Propper et al. (2012) did report increased right-frontal activity in inconsistent-handers. This means that although many handedness studies employ the same model connecting increased right-hemisphere activity with left- and inconsistent-handedness and increased left-hemisphere activity with right- and consistent-handedness, the research underlying this assumption is not as strong as it should be. In addition, most studies on frontal motivational asymmetries have used EEG and therefore report only broad patterns of activity in left and right frontal areas. It would be beneficial if research could more accurately pinpoint exactly which frontal areas are most prominently involved in motivational processing in each hemisphere.

While using handedness as a proxy for hemispheric asymmetries as I did in the current study is a widespread practice among handedness researchers, that does not mean it is ideal. Adequately powered studies with diverse samples consisting of equal numbers of inconsistent and consistent right- and left-handers, designed for the sole purposes of measuring structural asymmetries and baseline frontal activity, would be an invaluable asset to the field of handedness research. These studies could also help resolve the ongoing debates in the literature about whether left-handers' neural structure is more similar to that of inconsistent-handers or consistent right-handers. In addition, they could help determine the range of laterality quotients within which participants' brains on average start to look like those of either typical left-handers, right-handers, or inconsistent-handers. After testing for handedness-based differences in frontal asymmetries, the next step should be to confirm whether those frontal asymmetries are also associated with measures of approach and withdrawal motivation besides the BIS/BAS as well as with personality and political criteria measures. Although handedness may be confirmed as an excellent proxy for hemispheric lateralization, highly correlated variables can still differ in their relationships with a third variable, making these additional steps crucial. Following that, neuroscientific research on handedness could expand to testing whether other brain areas involved in motivational processing also show handedness-based differences, such as those outlined by Spielberg et al. (2008). A solid foundation of evidence regarding handedness' relationship to neural structure and frontal activity would allow researchers to more confidently use handedness as a substitute for hemispheric asymmetries and enable them to formulate clearer and better-supported models of the relationships between handedness and other variables.

Questions about how handedness may both affect and be affected by response biases may also be of interest to future researchers. This topic was addressed throughout the current paper and it seems to play a significant role in handedness research, whether researchers are aware of it or not. As handedness was found to be associated with the only response bias that was systematically examined in the current study (extreme response bias), it is plausible that a more thorough investigation would unearth other response biases that may differ between inconsistent- and consistent- or right- and left-handers. For instance, research on memory and handedness has highlighted numerous associations that could theoretically have an effect on responses to questionnaires (e.g., Christman et al., 2004). More research is also needed on how people interpret handedness questionnaires and whether those biases lead to individuals being erroneously classified as inconsistent- or consistent-handers. Although these biases have mainly been identified in the context of magical ideation (Badzakova-Trajkov et al., 2011), such response tendencies would likely generalize to other personality measures. Finally, developing better and more complex handedness performance measures should be an immediate goal of handedness researchers. The current performance measures, such as finger tapping, have been criticized as too simple, while others are difficult to transfer to a computer and as such could not be used online. A well-validated performance measure of handedness used by multiple researchers in the field would also make it easier to compare results across studies, another admirable goal given the acknowledged issues with the EHI (e.g., Edlin et al., 2015).

The observed associations between approach and withdrawal motivation and personality and political ideology measures in the current study should also provide fertile ground for future research. The correlations between the PID-5 facets and the other mediator and criterion variables alone should be of interest to researchers as to the best of my knowledge, many have never been studied in conjunction before. Another promising avenue for future research could involve replicating the correlations between the PID-5 and political measures in the current study and determining whether the PID-5 domains and aspects also predict other politically relevant variables such as political participation or voting behavior. In addition, the use of PID-5 measures could provide another means of testing some of the claims from the expanding political psychology literature on conservatism and its associated cognitive processes related to threat (e.g., Jost et al., 2003). As PID-5 measures capture a more extreme, clinical version of some personality traits that have been hypothesized to relate to conservatism (e.g., Hostility, Suspiciousness, and Withdrawal, all of which showed associations with SDO in the current study), introducing them would expand the construct space and provide a more rigorous assessment of the hypothesized associations. The ability to forge connections such as these across different research domains is a valuable feature of the current study and one that justifies including such a wide array of measures.

A more in-depth exploration of why aspect-level and factor-level measures of the Big Five correlated differently with the various approach and withdrawal measures could provide information about the respective approach and withdrawal components of the aspects. Moreover, examining those same correlations could help answer questions about whether "withdrawal" measures are measuring withdrawal, inhibition, avoidance, or some combination of the three based on the strength of their associations with different aspects or factors. Although many researchers tend to use only one approach/withdrawal scale in a study, the present study highlights the unique contributions of each of these scales and demonstrates how each exhibits different relationships with the criteria variables. Extending these findings to other measures of the Big Five would also ensure that the results observed here with the BFAS are reliable.

A profitable idea for future research would be to include BFAS, PID-5, and political ideology measures in studies that also incorporate behavioral measures of approach/withdrawal motivation. Although the behavioral task in the current study failed to exhibit correlations with these variables, likely due to the reasons discussed earlier, testing for those correlations should be one of the chief goals of approach/withdrawal researchers who are also interested in either the Big Five or political psychology. While this study and some others have found correlations between these variables and questionnaire measures of approach/withdrawal such as the BIS/BAS, few if any have tested for associations with behavioral measures designed to emulate real-world situations. As behavioral tasks and questionnaires seem to encapsulate different elements of approach and withdrawal, such a study could produce surprising results.

The broad scope of the current study encompassed numerous measures, research questions, and hypotheses. Even so, this brief summary of future research directions shows there is still much left to explore. While not all of my hypotheses were supported and methodological limitations prevented overly strong conclusions, the current study contributed to knowledge in multiple research domains. Relationships between handedness and approach/withdrawal motivation, between handedness and personality/political ideology, and between approach/withdrawal motivation and personality/political ideology were all tested, some for the first time. Mediation analyses suggested that approach and withdrawal motivation may at least partially explain relationships between handedness and personality/political ideology, although not always in the expected way. Additionally, the study provided novel insights into relationships between variables such as the PID-5 and political ideology and showed how handedness measurements can be influenced by numerous factors. In conclusion, the present study demonstrated that although handedness may only have small effects on variables, those effects are pervasive, worthy of future study, and potentially explained by the complex, multifaceted constructs of approach and withdrawal motivation.

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Table 1

Hypothesized Roles of All Variables in Study

Predictors		Mediators			Criteria	
Continuous	Dichotomous	Approach	Withdrawal	Combined Approach/Withdrawal	Personality	Political Ideology
LQ	Reported Handedness[a]	BAS	BIS	DiffScore-RT	BFAS Neuroticism	MFQ Progressivism
LQ-Abs		BAS-FS	BIS-A	DiffScore-Error	BFAS Withdrawal	SWB
Familial NRH		BAS-RR	FFFS		BFAS Volatility	RWA
		BAS-D	ATQ-Avoid		BFAS Agreeableness	SDO
		ATQ-App	NA		BFAS Compassion	Self Report Democrat
		PA	MM-Avoid		BFAS Politeness	Self Report Republican
		MM-App			BFAS Conscientiousness	Political Spectrum Rank
					BFAS Industriousness	
					BFAS Orderliness	
					BFAS Extraversion	
					BFAS Enthusiasm	
					BFAS Assertiveness	
					BFAS Openness/Intellect	
					BFAS Openness	
					BFAS Intellect	
					PID-5 Negative Affect	
					PID-5 Detachment	
					PID-5 Antagonism	
					PID-5 Disinhibition	
					PID-5 Psychoticism	
					PID-5 Facet Scales	

Note. LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handednes; BAS = Behavioral Activation System; BAS-FS = BAS Fun Seeking; BAS-RR = BAS Reward Responsiveness; BAS-D = BAS Drive; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ-Avoid = Approach-Avoidance Temperament Questionnnaire - Avoidance; ATQ-App = Approach-Avoidance Temperament Questionnnaire - Approach; PA = Positive and Negative Affect Scale-Positive Affect; NA = Positive and Negative Affect Scale-Negative Affect; MM-App = Moral Motives Approach; MM-Avoid=Moral Motives Avoidance; DiffScore-RT = Difference between push and pull reaction times on mushroom task; DiffScore-Error = Difference in push and pull error rates on mushroom task; BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

a. Reported handedness was used as a manipulation check for the predictors and in tests comparing the different measures of handedness, but was not used in any regressions or mediation analyses.

Table 2

Means and Standard Deviations of All Variables in Combined, REP, and MTurk Datatsets

Measure	Hypothesized Role	Combined Dataset			REP Dataset			MTurk Dataset		
		N	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*
LQ	Predictor	499	50.59	53.14	347	57.95	49.00	152	33.77	58.34
LQ-Abs	Predictor	499	66.25	31.46	347	69.74	29.85	152	58.28	33.65
Familial NRH	Predictor	499	11.66	17.53	347	10.84	15.89	152	13.52	20.73
Reported Handedness	Predictor[a]	496	1.09	0.29	346	1.09	0.29	150	1.09	0.28
BAS	Mediator	499	38.21	6.01	347	39.07	5.18	152	36.23	7.22
BAS-FS	Mediator	499	11.11	2.51	347	11.60	2.17	152	9.99	2.85
BAS-RR	Mediator	499	16.36	2.52	347	16.71	2.09	152	15.56	3.18
BAS-D	Mediator	499	10.74	2.55	347	10.76	2.29	152	10.68	3.06
BIS	Mediator	499	21.39	4.15	347	22.28	3.36	152	19.36	4.99
BIS-A	Mediator	499	12.75	2.58	347	13.27	2.04	152	11.56	3.21
FFFS	Mediator	499	8.64	2.02	347	9.01	1.84	152	7.80	2.16
ATQ-App	Mediator	499	29.85	6.713	347	31.47	5.35	152	26.14	7.95
ATQ-Avoid	Mediator	499	25.35	8.748	347	26.58	7.91	152	22.53	9.88
PA	Mediator	499	33.48	8.37	347	35.07	7.27	152	29.86	9.53
NA	Mediator	499	20.66	7.92	347	22.90	7.25	152	15.56	6.99
MM-Avoid	Mediator	499	3.95	0.82	347	3.87	0.70	152	4.13	1.03
MM-App	Mediator	499	5.29	0.86	347	5.35	0.78	152	5.14	1.00
DiffScore-RT	Mediator	430	-54.05	289.24	305	-63.03	271.66	125	-32.16	328.37
DiffScore-Error	Mediator	432	0.00	0.19	306	-0.03	0.17	126	0.05	0.21

BFAS Neuroticism	Criterion	499	2.88	0.76	347	3.01	0.68	152	2.60	0.86
BFAS Withdrawal	Criterion	499	3.01	0.84	347	3.16	0.73	152	2.69	0.97
BFAS Volatility	Criterion	499	2.75	0.83	347	2.86	0.79	152	2.51	0.88
BFAS Agreeableness	Criterion	499	3.95	0.60	347	4.03	0.48	152	3.76	0.79
BFAS Compassion	Criterion	499	4.03	0.76	347	4.18	0.59	152	3.68	0.98
BFAS Politeness	Criterion	499	3.87	0.61	347	3.89	0.53	152	3.84	0.77
BFAS Conscientiousness	Criterion	499	3.53	0.58	347	3.48	0.54	152	3.65	0.63
BFAS Industriousness	Criterion	499	3.41	0.70	347	3.29	0.64	152	3.70	0.75
BFAS Orderliness	Criterion	499	3.65	0.67	347	3.67	0.62	152	3.61	0.77
BFAS Extraversion	Criterion	499	3.42	0.66	347	3.53	0.59	152	3.18	0.75
BFAS Enthusiasm	Criterion	499	3.52	0.77	347	3.66	0.69	152	3.20	0.86
BFAS Assertiveness	Criterion	499	3.33	0.77	347	3.40	0.70	152	3.16	0.89
BFAS Openness/Intellect	Criterion	499	3.72	0.56	347	3.69	0.51	152	3.78	0.66
BFAS Openness	Criterion	499	3.75	0.70	347	3.75	0.67	152	3.73	0.78
BFAS Intellect	Criterion	499	3.69	0.64	347	3.63	0.59	152	3.84	0.74
PID-5 Negative Affect	Criterion	499	2.16	0.61	347	2.25	0.57	152	1.94	0.64
PID-5 Detachment	Criterion	499	1.85	0.58	347	1.76	0.51	152	2.05	0.69
PID-5 Antagonism	Criterion	499	1.77	0.53	347	1.78	0.49	152	1.75	0.60
PID-5 Disinhibition	Criterion	499	1.73	0.50	347	1.77	0.48	152	1.65	0.53
PID-5 Psychoticism	Criterion	499	1.68	0.51	347	1.68	0.48	152	1.69	0.57
MFQ Progressivism	Criterion	499	-0.08	2.88	347	-0.03	2.55	152	-0.20	3.53
SWB	Criterion	499	-3.85	6.09	347	-4.55	5.57	152	-2.26	6.91
RWA	Criterion	499	65.18	33.00	347	61.33	29.75	152	73.97	38.11
SDO	Criterion	499	38.57	19.30	347	37.79	17.76	152	40.34	22.38
Self Report Democrat	Criterion	491	3.45	1.40	340	3.65	1.27	151	2.99	1.56
Self Report Republican	Criterion	486	2.37	1.37	334	2.37	1.31	152	2.39	1.51

Political Spectrum Rank	Criterion	499	41.45	27.39	347	39.41	26.27	152	46.12	29.34

Note. Emphasized variables significantly differed between REP and MTurk samples at $p < .01$. LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handednes; BAS = Behavioral Activation System; BAS-FS = BAS Fun Seeking; BAS-RR = BAS Reward Responsiveness; BAS-D = BAS Drive; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ-Avoid = Approach-Avoidance Temperament Questionnnaire - Avoidance; ATQ-App = Approach-Avoidance Temperament Questionnnaire - Approach; PA = Positive and Negative Affect Scale-Positive Affect; NA = Positive and Negative Affect Scale-Negative Affect; MM-App = Moral Motives Approach; MM-Avoid=Moral Motives Avoidance; DiffScore-RT = Difference between push and pull reaction times on mushroom task; DiffScore-Error = Difference in push and pull error rates on mushroom task; BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

a. Reported handedness was used as a manipulation check for the predictors and in tests comparing the different measures of handedness, but was not used in any regressions or mediation analyses.

Table 3

Means and Standard Deviations of the PID-5 Facet Scales for Combined, REP, and MTurk Datasets

	Combined Dataset			REP Dataset			MTurk Dataset		
Measure	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*
Anhedonia	499	1.92	0.67	347	1.86	0.62	152	2.06	0.76
Anxiousness	499	2.42	0.78	347	2.53	0.74	152	2.18	0.82
Attention Seeking	499	1.95	0.70	347	2.08	0.67	152	1.64	0.67
Callousness	499	1.40	0.48	347	1.33	0.36	152	1.57	0.64
Deceitfulness	496	1.74	0.57	347	1.76	0.53	152	1.71	0.65
Depressivity	499	1.66	0.64	347	1.63	0.60	152	1.73	0.73
Distractability	499	1.95	0.66	347	2.02	0.65	152	1.78	0.65
Eccentricity	499	1.90	0.72	347	1.90	0.69	152	1.90	0.78
Emotional Lability	499	2.06	0.74	347	2.16	0.70	152	1.83	0.79
Grandiosity	499	1.67	0.60	347	1.67	0.56	152	1.67	0.68
Hostility	499	1.88	0.56	347	1.87	0.52	152	1.90	0.64
Impulsivity	499	1.74	0.65	347	1.79	0.65	152	1.60	0.63
Intimacy Avoidance	499	1.62	0.65	347	1.56	0.57	152	1.76	0.79
Irresponsibility	499	1.51	0.49	347	1.48	0.45	152	1.58	0.56
Manipulativeness	499	1.91	0.66	347	1.93	0.64	152	1.87	0.71
Perceptual Dysregulation	499	1.60	0.49	347	1.61	0.46	152	1.58	0.56
Perseveration	499	1.95	0.58	347	1.99	0.56	152	1.84	0.62
Restricted Affectivity	499	1.92	0.68	347	1.88	0.64	152	2.01	0.75
Rigid Perfectionism	430	2.16	0.69	347	2.19	0.67	152	2.07	0.74
Risk Taking	432	2.17	0.56	347	2.25	0.51	152	1.99	0.62
Separation Insecurity	499	1.99	0.66	347	2.06	0.63	152	1.83	0.69
Submissiveness	499	2.36	0.69	347	2.48	0.64	152	2.07	0.71

Suspiciousness	499	1.98	0.55	347	1.92	0.52	152	2.11	0.58
Unusual Beliefs	499	1.54	0.53	347	1.53	0.50	152	1.58	0.60
Withdrawal	499	2.01	0.73	347	1.87	0.64	152	2.32	0.83

Note. The PID-5 Facet Scales were included in supplementary analyses but were not criterion variables as any associations were considered exploratory. Emphasized variables significantly differed between REP and MTurk samples at $p < .01$. PID-5 = Personality Inventory for DSM-5.

Table 4

Cronbach's α for Predictors, Mediators and Criteria

Measure	α
EHI-Right	.90
EHI-Left	.94
BAS	.85
BAS-FS	.75
BAS-RR	.81
BAS-D	.78
BIS	.83
BIS-A	.80
FFFS	.65
ATQ-App	.87
ATQ-Avoid	.89
PA	.91
NA	.90
MM-Avoid	.73
MM-App	.81
BFAS Neuroticism	.93
BFAS Withdrawal	.89
BFAS Volatility	.91
BFAS Agreeableness	.90
BFAS Compassion	.92
BFAS Politeness	.80
BFAS Conscientiousness	.88
BFAS Industriousness	.86

BFAS Orderliness	.84
BFAS Extraversion	.91
BFAS Enthusiasm	.88
BFAS Assertiveness	.89
BFAS Openness/Intellect	.86
BFAS Openness	.84
BFAS Intellect	.83
PID-5 Negative Affect	.94
PID-5 Detachment	.94
PID-5 Antagonism	.92
PID-5 Disinhibition	.92
PID-5 Psychoticism	.95
MFQ Progressivism	.84
SWB	.75
RWA	.95
SDO	.95

Note. EHI-Right = Edinburgh Handedness Inventory right-handed questions; EHI-Left = Edinburgh Handedness Inventory left-handed questions; BAS = Behavioral Activation System; BAS-FS = BAS Fun Seeking; BAS-RR = BAS Reward Responsiveness; BAS-D = BAS Drive; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ = Approach-Avoidance Temperament Questionnnaire; PANAS-PA = Positive and Negative Affect Scale-Positive Affect; PANAS-NA = Positive and Negative Affect Scale-Negative Affect; MM = Moral Motives; DiffScore-RT = Difference between push and pull reaction times on mushroom task; DiffScore-Error = Difference in push and pull error rates on mushroom task. BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 5

Intercorrelations for the Predictor Variables in the Combined Dataset

Predictor	1	2	3
1. LQ	–	***.74***	***-.18***
2. LQ-Abs	***.74***	–	***-.18***
3. Familial NRH	***-.18***	***-.18***	–

Note. $N = 499$. Emphasized values are significant at $p < .01$. LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handedness.

Table 6

Intercorrelations for the Predictor Variables in the REP Dataset

Predictor	Predictor 1	2	3
1. LQ	–	***.75***	-.14
2. LQ-Abs	***.75***	–	-.10
3. Familial NRH	-.14	-.10	–

Note. $N = 347$. Emphasized values are significant at $p < .01$. LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handedness.

Table 7

Intercorrelations for the Predictor Variables in the MTurk Dataset

	Predictor		
Predictor	1	2	3
1. LQ	–	***.70***	***-.23***
2. LQ-Abs	***.70***	–	***-.27***
3. Familial NRH	***-.23***	***-.27***	–

Note. $N = 152$. Emphasized values are significant at $p < .01$. LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handedness.

Table 8

Correlations Between Predictor and Mediator Variables in the Combined Dataset

	Predictor		
Mediator	LQ	LQ-Abs	FamilialNRH
BAS	.02	.04	.03
BAS-FS	.00	-.02	.01
BAS-RR	.09	***.13***	-.02
BAS-D	-.03	-.02	.08
BIS	***.16***	***.21***	.01
BIS-A	***.12***	***.19***	.02
FFFS	***.17***	***.18***	-.02
NA	***.16***	.09	-.03
PA	-.02	-.02	.04
ATQ-Avoid	***.14***	***.16***	.02
ATQ-App	.04	.09	.02
MM-App	-.03	.00	.01
MM-Avoid	-.10	-.11	***.12***
DiffScore-RT	-.11	-.09	.05
DiffScore-Error	-.04	-.01	-.04

Note. $N = 499$, except for DiffScore-RT ($N = 430$) and DiffScore-Error ($N = 432$). Emphasized values are significant at $p < .01$. LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handedness; BAS = Behavioral Activation System; BAS-FS = BAS Fun Seeking; BAS-RR = BAS Reward Responsiveness; BAS-D = BAS Drive; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ-Avoid = Approach-Avoidance Temperament Questionnnaire - Avoidance; ATQ-App = Approach-Avoidance Temperament Questionnnaire - Approach; PA = Positive and Negative Affect Scale-Positive Affect; NA = Positive and Negative Affect Scale-Negative Affect; MM-App = Moral Motives Approach; MM-Avoid=Moral Motives Avoidance; DiffScore-RT = Difference between push and pull reaction times on mushroom task; DiffScore-Error = Difference in push and pull error rates on mushroom task.

Table 9

Correlations Between Predictor and Mediator Variables in the REP Dataset

	Predictor		
Mediator	LQ	LQ-Abs	FamilialNRH
BAS	.06	.07	.00
BAS-FS	.00	-.02	-.01
BAS-RR	.10	***.15***	-.02
BAS-D	.05	.04	.03
BIS	.11	***.15***	.03
BIS-A	.09	***.16***	.04
FFFS	.10	.10	.01
NA	.12	.04	-.05
PA	-.06	-.04	.05
ATQ-Avoid	.11	.10	.00
ATQ-App	-.04	.03	.02
MM-App	-.07	-.03	.00
MM-Avoid	-.05	-.06	-.08
DiffScore-RT	-.12	-.10	.10
DiffScore-Error	-.03	.02	-.04

Note. N = 347, except for DiffScore-RT (N = 305) and DiffScore-Error (N = 306). Emphasized values are significant at $p < .01$. LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handedness; BAS = Behavioral Activation System; BAS-FS = BAS Fun Seeking; BAS-RR = BAS Reward Responsiveness; BAS-D = BAS Drive; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ-Avoid = Approach-Avoidance Temperament Questionnaire - Avoidance; ATQ-App = Approach-Avoidance Temperament Questionnaire - Approach; PA = Positive and Negative Affect Scale-Positive Affect; NA = Positive and Negative Affect Scale-Negative Affect; MM-App = Moral Motives Approach; MM-Avoid=Moral Motives Avoidance; DiffScore-RT = Difference between push and pull reaction times on mushroom task; DiffScore-Error = Difference in push and pull error rates on mushroom task.

Table 10

Correlations Between Predictor and Mediator Variables in the Combined Dataset

	Predictor		
Mediator	LQ	LQ-Abs	FamilialNRH
BAS	-.14	-.11	.10
BAS-FS	-.16	-.17	.08
BAS-RR	-.02	.04	.01
BAS-D	-.15	-.13	.15
BIS	.09	.19	.03
BIS-A	.04	.15	.05
FFFS	.15	***.23***	.00
NA	.02	-.02	.10
PA	-.14	-.13	.08
ATQ-Avoid	.08	.17	.08
ATQ-App	-.05	.04	.10
MM-App	-.03	.00	.05
MM-Avoid	-.10	-.13	***.33***
DiffScore-RT	-.08	-.07	-.03
DiffScore-Error	.03	.01	-.04

Note. $N = 152$, except for DiffScore-RT ($N = 125$) and DiffScore-Error ($N = 126$). Emphasized values are significant at $p < .01$. LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handedness; BAS = Behavioral Activation System; BAS-FS = BAS Fun Seeking; BAS-RR = BAS Reward Responsiveness; BAS-D = BAS Drive; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ-Avoid = Approach-Avoidance Temperament Questionnnaire - Avoidance; ATQ-App = Approach-Avoidance Temperament Questionnnaire - Approach; PA = Positive and Negative Affect Scale-Positive Affect; NA = Positive and Negative Affect Scale-Negative Affect; MM-App = Moral Motives Approach; MM-Avoid=Moral Motives Avoidance; DiffScore-RT = Difference between push and pull reaction times on mushroom task; DiffScore-Error = Difference in push and pull error rates on mushroom task.

Table 11

Correlations Between Predictor and Criterion Variables in the Combined Dataset

Criterion	Predictor		
	LQ	LQ-Abs	FamilialNRH
BFAS Neuroticism	***.15***	***.13***	-.01
BFAS Withdrawal	***.15***	***.14***	-.02
BFAS Volatility	***.13***	.09	.01
BFAS Agreeableness	.08	***.15***	-.05
BFAS Compassion	***.13***	***.17***	-.07
BFAS Politeness	-.01	.08	.00
BFAS Conscientiousness	-.01	.01	.06
BFAS Industriousness	-.09	-.06	.06
BFAS Orderliness	.07	.09	.04
BFAS Extraversion	.01	-.01	.02
BFAS Enthusiasm	.02	.03	-.01
BFAS Assertiveness	-.01	-.04	.04
BFAS Openness/Intellect	-.11	-.10	-.02
BFAS Openness	-.08	-.06	.00
BFAS Intellect	-.10	-.10	-.03
PID-5 NegativeAffect	***.17***	***.14***	.01
PID-5 Detachment	-.01	-.03	.03
PID-5 Antagonism	.00	-.06	.06
PID-5 Disinhibition	.06	.01	.03
PID-5 Psychoticism	-.06	-.10	***.13***
MFQ Progressivism	-.03	.00	-.11

SWB	-.03	-.06	.04
RWA	-.02	-.04	.07
SDO	.03	-.01	.06
Self Report Democrat	.08	.10	-.09
Self Report Republican	.00	-.02	.03
Political Spectrum Rank	-.03	-.06	.04

Note. N = 499, except for Self Report Democrat (N = 491) and Self Report Republican (N = 486). Emphasized values are significant at $p < .01$. LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handednes; BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 12

Correlations Between Predictor and Criterion Variables in the REP Dataset

	Predictor		
Criterion	LQ	LQ-Abs	FamilialNRH
BFAS Neuroticism	.12	.10	-.01
BFAS Withdrawal	.12	.10	-.02
BFAS Volatility	.10	.08	.00
BFAS Agreeableness	.00	.08	.00
BFAS Compassion	.06	.09	-.02
BFAS Politeness	-.07	.03	.02
BFAS Conscientiousness	.04	.06	.03
BFAS Industriousness	-.03	.00	.01
BFAS Orderliness	.09	.11	.03
BFAS Extraversion	.02	.00	.01
BFAS Enthusiasm	-.02	.01	.00
BFAS Assertiveness	.06	.00	.02
BFAS Openness/Intellect	-.10	-.11	-.03
BFAS Openness	-.09	-.08	.00
BFAS Intellect	-.08	-.09	-.06
PID-5 NegativeAffect	***.17***	.12	.00
PID-5 Detachment	.04	.02	-.03
PID-5 Antagonism	.06	-.01	.07
PID-5 Disinhibition	.09	.04	-.01
PID-5 Psychoticism	.01	-.06	.04
MFQ Progressivism	-.03	.00	.00

SWB	-.01	-.04	-.01
RWA	.03	.01	-.06
SDO	.03	-.02	.00
Self Report Democrat	.02	.03	.02
Self Report Republican	.01	.01	-.02
Political Spectrum Rank	-.01	-.02	-.05

Note. N = 347, except for Self Report Democrat (N = 340) and Self Report Republican (N = 334). Emphasized values are significant at $p <$ .01.LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handednes; BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 13

Correlations Between Predictor and Criterion Variables in the MTurk Dataset

	Predictor		
Criterion	LQ	LQ-Abs	FamilialNR H
BFAS Neuroticism	.09	.07	.05
BFAS Withdrawal	.08	.11	.02
BFAS Volatility	.09	.03	.07
BFAS Agreeableness	.09	.17	-.07
BFAS Compassion	.10	.18	-.09
BFAS Politeness	.06	.13	-.02
BFAS Conscientiousness	-.02	-.01	.09
BFAS Industriousness	-.04	-.06	.08
BFAS Orderliness	.01	.04	.06
BFAS Extraversion	-.15	-.14	.07
BFAS Enthusiasm	-.07	-.07	.02
BFAS Assertiveness	-.19	-.17	.10
BFAS Openness/Intellect	-.09	-.05	-.01
BFAS Openness	-.09	-.05	.01
BFAS Intellect	-.07	-.05	-.02
PID-5 NegativeAffect	.05	.07	.08
PID-5 Detachment	.03	.00	.06
PID-5 Antagonism	-.12	-.14	.05
PID-5 Disinhibition	-.07	-.11	.11
PID-5 Psychoticism	-.15	-.18	***.26***
MFQ Progressivism	-.04	-.01	***-.24***

SWB	.03	-.01	.07
RWA	.00	-.03	***.22***
SDO	.07	.03	.13
Self Report Democrat	.07	.12	***-.21***
Self Report Republican	-.01	-.06	.10
Political Spectrum Rank	-.01	-.07	.17

Note. $N = 152$, except for Self Report Democrat ($N = 151$). Emphasized values are significant at $p < .01$. LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handednes; BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 14

Correlations Between Predictors and PID-5 Facets in the Combined Dataset

PID-5 Aspect	Predictor LQ	 LQ-Abs	 FamilialNRH
Anhedonia	.03	.00	.00
Anxiousness	.11	.11	-.03
Attention Seeking	.09	.05	.00
Callousness	-.07	***-.12***	.08
Deceitfulness	.00	-.02	.06
Depressivity	.07	.04	-.01
Distractability	.06	.02	.02
Eccentricity	-.05	-.09	***.12***
Emotional Lability	***.15***	.11	.01
Grandiosity	.00	-.04	.05
Hostility	.09	.02	.02
Impulsivity	.07	.02	.02
Intimacy Avoidance	-.03	-.02	.02
Irresponsibility	.00	-.04	.04
Manipulativeness	-.01	-.07	.04
Perceptual Dysregulation	-.04	-.06	.08
Perseveration	.08	.06	.05
Restricted Affectivity	-.05	-.08	.05
Rigid Perfectionism	.10	.09	.06
Risk Taking	-.06	-.08	.05
Separation Insecurity	***.16***	***.14***	.05

Submissiveness	***.15***	***.17***	.03
Suspiciousness	-.04	-.07	-.01
Unusual Beliefs	-.06	-.11	***.14***
Withdrawal	-.03	-.05	.05

Note. $N = 499$.. Emphasized values are significant at $p < .01$. LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handedness; PID-5 = Personality Inventory for DSM-5.

Table 15

Correlations Between Mediator and Criterion Variables in the Combined Dataset

	Mediator														
Criterion	BAS	BAS-FS	BAS-RR	BAS-D	BIS	BIS-A	FFFS	NA	PA	ATQ-Avoid	ATQ-App	MM-App	MM-Avoid	DS-RT	DS-E
BFAS Neuroticism	.00	-.03	***.12***	-.10	***.67***	***.57***	***.64***	***.64***	***-.33***	***.75***	-.07	***-.12***	-.11	-.06	-.06
BFAS Withdrawal	-.08	-.08	.08	***-.20***	***.73***	***.64***	***.68***	***.64***	***-.39***	***.80***	-.10	-.08	-.11	-.07	-.03
BFAS Volatility	.08	.03	***.13***	.03	***.49***	***.40***	***.49***	***.52***	***-.22***	***.58***	-.02	***-.15***	-.09	-.04	-.08
BFAS Agreeableness	***.13***	.09	***.35***	***-.12***	***.33***	***.35***	***.23***	-.02	***.16***	***.14***	***.27***	***.44***	-.06	-.03	.02
BFAS Compassion	***.26***	***.21***	***.40***	.01	***.29***	***.30***	***.20***	.04	***.27***	***.12***	***.35***	***.46***	-.09	-.02	-.02
BFAS Politeness	-.06	-.09	***.20***	***-.25***	***.29***	***.31***	***.20***	-.09	-.02	***.12***	.09	***.30***	-.01	-.03	.06
BFAS Conscientiousness	.03	***-.22***	***.13***	***.16***	-.05	-.01	-.09	***-.31***	***.24***	***-.20***	***.17***	***.12***	***.23***	-.05	-.05
BFAS Industriousness	.06	***-.14***	.06	***.22***	***-.32***	***-.25***	***-.33***	***-.47***	***.35***	***-.43***	***.18***	***.20***	***.20***	-.01	-.02
BFAS Orderliness	-.01	***-.23***	***.16***	.04	***.25***	***.25***	***.19***	-.04	.05	.12	.10	.00	***.18***	-.07	-.06
BFAS Extraversion	***.52***	***.43***	***.37***	***.43***	***-.17***	***-.12***	***-.19***	-.10	***.60***	***-.21***	***.55***	***.29***	.06	.04	-.12
BFAS Enthusiasm	***.41***	***.38***	***.34***	***.25***	-.03	.00	-.07	***-.12***	***.53***	***-.16***	***.53***	***.31***	.00	.02	-.09
BFAS Assertiveness	***.48***	***.37***	***.29***	***.50***	***-.26***	***-.21***	***-.27***	-.05	***.51***	***-.21***	***.42***	***.18***	.10	.06	-.11
BFAS Openness/Intellect	***.21***	***.15***	***.17***	***.18***	***-.12***	-.07	***-.15***	***-.12***	***.21***	-.08	***.18***	***.38***	***-.16***	-.06	.02
BFAS Openness	***.18***	***.17***	***.19***	.07	.04	.06	.01	.04	***.12***	.09	***.13***	***.32***	***-.17***	-.07	.07
BFAS Intellect	***.17***	.07	.09	***.24***	***-.25***	***-.19***	***-.27***	***-.25***	***.24***	***-.25***	***.17***	***.32***	-.09	-.04	-.04
PID-5 NegativeAffect	.08	.06	***.14***	-.02	***.57***	***.51***	***.53***	***.66***	***-.22***	***.76***	.04	-.04	-.06	-.05	-.03
PID-5 Detachment	***-.31***	***-.26***	***-.29***	***-.19***	.10	.07	***.13***	***.33***	***-.52***	***.34***	***-.48***	***-.32***	.00	-.01	.06
PID-5 Antagonism	***.24***	***.21***	.01	***.33***	***-.19***	***-.19***	***-.15***	***.20***	.10	.02	.11	***-.22***	.07	.07	-.06
PID-5 Disinhibition	***.17***	***.34***	-.03	.09	.07	.05	.08	***.42***	***-.16***	***.28***	-.06	***-.24***	-.07	.06	-.02
PID-5 Psychoticism	.10	***.17***	-.07	***.13***	-.01	-.02	.00	***.38***	***-.13***	***.29***	-.06	***-.21***	.03	.01	.01
MFQ Progressivism	-.09	-.06	-.03	***-.12***	.09	.06	.11	.04	***-.15***	***.13***	-.06	***.37***	***-.57***	-.03	.06

SWB	-.04	-.08	-.06	.04	***-.12***	-.11	-.10	-.08	-.04	-.11	-.10	***-.45***	***.36***	.03	.01
RWA	-.03	-.05	-.08	.04	***-.17***	***-.15***	***-.16***	***-.15***	.04	***-.20***	-.07	***-.40***	***.57***	.02	-.05
SDO	-.10	-.06	***-.18***	.01	***-.16***	***-.14***	***-.15***	.03	-.07	-.10	***-.16***	***-.54***	***.32***	.04	-.04
Self Report Democrat	.01	.04	.04	-.06	***.16***	***.14***	***.15***	***.18***	.00	***.18***	.06	***.31***	***-.27***	.09	.08
Self Report Republican	.01	.02	-.03	.03	-.07	-.05	-.09	-.06	.09	***-.15***	.03	***-.36***	***.30***	-.02	-.05
Political Spectrum Rank	-.03	-.04	-.05	.02	***-.13***	-.10	***-.14***	***-.14***	.08	***-.19***	-.06	***-.30***	***.33***	-.02	-.07

Note. N = 499, except for DiffScore-RT (N = 430), DiffScore-Error (N = 432), Self Report Democrat (N = 491), and Self Report Republican (N = 486). Emphasized values are significant at $p < .01$. BAS = Behavioral Activation System; BAS-FS = BAS Fun Seeking; BAS-RR = BAS Reward Responsiveness; BAS-D = BAS Drive; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ-Avoid = Approach-Avoidance Temperament Questionnnaire - Avoidance; ATQ-App = Approach-Avoidance Temperament Questionnnaire - Approach; PA = Positive and Negative Affect Scale-Positive Affect; NA = Positive and Negative Affect Scale-Negative Affect; MM-App = Moral Motives Approach; MM-Avoid=Moral Motives Avoidance; DS-RT = Difference between push and pull reaction times on mushroom task; DS-E = Difference in push and pull error rates on mushroom task; BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 16

Correlations Between Mediator and Criterion Variables in the REP Dataset

Criterion	Mediator														
	BAS	BAS-FS	BAS-RR	BAS-D	BIS	BIS-A	FFFS	NA	PA	ATQ-Avoid	ATQ-App	MM-App	MM-Avoid	DS-RT	DS-E
BFAS Neuroticism	-.06	-.13	.03	-.04	***.62***	***.49***	***.58***	***.65***	***-.46***	***.70***	***-.19***	-.12	-.13	-.01	-.02
BFAS Withdrawal	***-.18***	***-.20***	-.04	***-.18***	***.69***	***.58***	***.61***	***.65***	***-.54***	***.75***	***-.24***	-.06	-.13	-.01	.02
BFAS Volatility	.06	-.03	.08	.09	***.43***	***.31***	***.44***	***.51***	***-.30***	***.51***	-.10	***-.15***	-.10	.00	-.06
BFAS Agreeableness	.06	.08	***.23***	***-.15***	***.27***	***.30***	***.15***	-.06	.09	.12	***.23***	***.46***	***-.14***	-.03	.07
BFAS Compassion	***.19***	***.18***	***.31***	-.01	***.22***	***.23***	***.14***	-.02	***.14***	.12	***.28***	***.44***	***-.20***	-.04	.05
BFAS Politeness	-.11	-.06	.08	***-.26***	***.24***	***.29***	.12	-.08	.00	.09	.10	***.34***	-.04	-.01	.07
BFAS Conscientiousness	.06	***-.21***	***.17***	***.17***	.00	.01	-.01	***-.24***	***.34***	***-.15***	***.31***	.12	***.24***	-.12	-.05
BFAS Industriousness	.10	-.11	.14	***.21***	***-.21***	***-.17***	***-.19***	***-.38***	***.52***	***-.34***	***.36***	***.19***	***.22***	-.08	-.06
BFAS Orderliness	.00	***-.25***	***.16***	.09	***.22***	***.19***	***.19***	-.03	.06	.09	***.16***	.01	***.19***	-.13	-.03
BFAS Extraversion	***.50***	***.37***	***.41***	***.41***	***-.15***	-.12	***-.14***	***-.16***	***.53***	***-.15***	***.53***	***.23***	.03	-.04	-.09
BFAS Enthusiasm	***.38***	***.34***	***.36***	***.21***	-.05	-.02	-.08	***-.22***	***.44***	***-.14***	***.50***	***.25***	-.05	-.03	-.03
BFAS Assertiveness	***.47***	***.30***	***.34***	***.48***	***-.20***	***-.18***	***-.17***	-.05	***.46***	-.11	***.41***	***.15***	.09	-.03	-.13
BFAS Openness/Intellect	***.20***	***.21***	***.16***	.12	-.04	-.02	-.05	-.01	***.21***	.01	***.22***	***.40***	***-.25***	-.14	.03
BFAS Openness	.12	***.20***	.11	-.01	.08	.07	.07	.13	.03	***.17***	.11	***.32***	***-.23***	-.09	.08
BFAS Intellect	***.21***	***.14***	***.14***	***.22***	***-.16***	-.12	***-.17***	***-.16***	***.32***	***-.18***	***.26***	***.32***	***-.16***	-.14	-.04
PID-5 NegativeAffect	.05	-.03	***.15***	.02	***.55***	***.49***	***.47***	***.64***	***-.35***	***.75***	-.03	.01	-.03	-.01	.00
PID-5 Detachment	***-.22***	***-.19***	***-.25***	-.10	***.14***	.12	.12	***.47***	***-.52***	***.37***	***-.44***	***-.24***	.05	.08	-.01
PID-5 Antagonism	***.26***	***.16***	.12	***.32***	***-.14***	-.13	-.12	***.20***	.07	.03	.06	***-.23***	***.17***	.05	-.09
PID-5 Disinhibition	***.22***	***.36***	.02	.14	.02	.02	.01	***.39***	***-.29***	***.25***	***-.14***	***-.20***	-.10	.07	.00
PID-5 Psychoticism	.11	***.16***	-.04	.14	-.01	.00	-.01	***.43***	***-.23***	***.30***	-.11	***-.19***	.02	.04	-.01
MFQ Progressivism	-.10	.00	-.02	***-.21***	***.23***	***.20***	***.19***	.11	***-.16***	***.26***	-.04	***.44***	***-.54***	-.01	.09

SWB	.05	-.04	.02	***.14***	***-.17***	***-.17***	-.13	-.09	.09	***-.16***	.00	***-.44***	***.35***	-.01	.00
RWA	.01	-.07	-.02	.11	***-.22***	***-.22***	***-.16***	***-.14***	***.16***	***-.23***	.01	***-.44***	***.53***	-.02	-.13
SDO	-.01	-.04	-.13	.12	***-.25***	***-.21***	***-.21***	-.06	.03	***-.20***	-.11	***-.52***	***.35***	.03	-.08
Self Report Democrat	-.04	.01	.03	-.12	***.21***	***.21***	***.15***	.12	***-.17***	***.22***	-.04	***.35***	***-.26***	.12	.14
Self Report Republican	.06	.01	.01	.12	***-.17***	***-.15***	-.14	-.13	***.24***	***-.23***	.10	***-.35***	***.34***	-.04	-.06
Political Spectrum Rank	.05	.00	-.01	.13	***-.21***	***-.20***	***-.16***	-.14	***.20***	***-.23***	.06	***-.30***	***.32***	-.06	-.11

Note. N = 347, except for DiffScore-RT (N = 305), DiffScore-Error (N = 306), Self Report Democrat (N = 340), and Self Report Republican (N = 334). Emphasized values are significant at $p < .01$. BAS = Behavioral Activation System; BAS-FS = BAS Fun Seeking; BAS-RR = BAS Reward Responsiveness; BAS-D = BAS Drive; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ-Avoid = Approach-Avoidance Temperament Questionnnaire - Avoidance; ATQ-App = Approach-Avoidance Temperament Questionnnaire - Approach; PA = Positive and Negative Affect Scale-Positive Affect; NA = Positive and Negative Affect Scale-Negative Affect; MM-App = Moral Motives Approach; MM-Avoid=Moral Motives Avoidance; DS-RT = Difference between push and pull reaction times on mushroom task; DS-E = Difference in push and pull error rates on mushroom task; BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 17

Correlations Between Mediator and Criterion Variables in the MTurk Dataset

	Mediator														
Criterion	BAS	BAS-FS	BAS-RR	BAS-D	BIS	BIS-A	FFFS	NA	PA	ATQ-Avoid	ATQ-App	MM-App	MM-Avoid	DS-RT	DS-E
BFAS Neuroticism	-.06	-.08	.12	-.18	***.67***	***.59***	***.66***	***.55***	***-.39***	***.79***	-.16	-.21	-.02	-.12	.01
BFAS Withdrawal	-.11	-.12	.10	***-.25***	***.72***	***.64***	***.72***	***.56***	***-.45***	***.83***	-.18	-.18	-.02	-.13	.02
BFAS Volatility	.01	-.02	.12	-.09	***.52***	***.46***	***.51***	***.47***	***-.28***	***.63***	-.10	-.21	-.02	-.09	.00
BFAS Agreeableness	.13	-.03	***.41***	-.10	***.30***	***.32***	***.22***	***-.23***	.14	.07	.20	***.41***	.07	-.01	.03
BFAS Compassion	***.22***	.09	***.40***	.03	.20	***.23***	.12	***-.24***	***.27***	.00	***.28***	***.45***	.09	.03	.01
BFAS Politeness	-.03	-.17	***.32***	***-.24***	***.36***	***.35***	***.30***	-.17	-.07	.14	.06	***.26***	.03	-.06	.05
BFAS Conscientiousness	.07	-.15	.16	.14	.00	.08	-.13	***-.34***	***.23***	-.21	.16	.17	.18	.06	-.12
BFAS Industriousness	.17	.01	.11	***.27***	***-.31***	-.21	***-.41***	***-.46***	***.37***	***-.49***	***.25***	***.32***	.11	.07	-.11
BFAS Orderliness	-.05	***-.25***	.15	-.03	***.29***	***.33***	.18	-.12	.02	.14	.02	-.03	.19	.03	-.09
BFAS Extraversion	***.48***	***.42***	***.25***	***.49***	***-.41***	***-.32***	***-.49***	***-.35***	***.63***	***-.47***	***.49***	***.32***	.19	.20	-.07
BFAS Enthusiasm	***.37***	***.31***	***.25***	***.32***	***-.22***	-.16	***-.27***	***-.36***	***.55***	***-.35***	***.46***	***.36***	.15	.13	-.10
BFAS Assertiveness	***.46***	***.41***	.18	***.52***	***-.48***	***-.38***	***-.56***	***-.25***	***.54***	***-.45***	***.38***	.20	.17	.21	-.03
BFAS Openness/Intellect	***.27***	.13	***.23***	***.27***	-.17	-.09	***-.26***	***-.25***	***.30***	-.17	***.22***	***.39***	-.09	.04	-.04
BFAS Openness	***.27***	.14	***.30***	.20	-.03	.04	-.12	-.15	***.26***	-.03	.18	***.31***	-.10	-.04	.04
BFAS Intellect	.20	.09	.11	***.28***	***-.27***	-.19	***-.35***	***-.29***	***.27***	***-.28***	***.22***	***.38***	-.06	.11	-.10
PID-5 NegativeAffect	-.01	.03	.03	-.07	***.55***	***.47***	***.56***	***.64***	***-.25***	***.74***	-.07	-.20	-.02	-.09	.04
PID-5 Detachment	***-.34***	***-.23***	***-.27***	***-.31***	***.25***	.18	***.31***	***.55***	***-.46***	***.46***	***-.45***	***-.38***	-.14	-.16	.07
PID-5 Antagonism	.20	***.30***	-.13	***.35***	***-.30***	***-.31***	***-.25***	***.22***	.13	.00	.16	***-.22***	-.04	.11	.02
PID-5 Disinhibition	.06	***.29***	-.15	.02	.07	.02	.12	***.48***	-.07	***.28***	-.06	***-.35***	.00	.06	.01
PID-5 Psychoticism	.09	***.21***	-.11	.12	-.02	-.04	.02	***.42***	.01	***.30***	.01	***-.23***	.04	-.03	.05
MFQ Progressivism	-.10	-.16	-.06	-.02	-.06	-.10	.00	-.10	-.16	-.04	-.11	***.27***	***-.60***	-.05	.05

SWB	-.08	-.02	-.07	-.10	.07	.07	.04	.14	-.09	.04	-.10	***-.45***	***.34***	.08	-.06
RWA	.00	.11	-.06	-.04	-.01	.02	-.06	.03	.01	-.08	-.03	***-.33***	***.59***	.07	.00
SDO	-.18	-.06	***-.22***	-.15	-.03	-.04	-.02	***.30***	-.18	.07	-.20	***-.56***	***.27***	.06	.03
Self Report Democrat	-.04	-.08	-.04	.02	-.04	-.09	.03	.06	.09	.04	-.01	.20	***-.23***	.08	.11
Self Report Republican	-.06	.04	-.06	-.10	.04	.08	-.02	.08	-.11	-.04	-.06	***-.38***	***.27***	.02	-.03
Political Spectrum Rank	-.08	-.01	-.04	-.14	.05	.09	-.03	-.03	-.02	-.07	-.13	***-.27***	***.32***	.02	-.06

Note. N = 152, except for DiffScore-RT (N = 125), DiffScore-Error (N = 126), and Self Report Democrat (N = 151). Emphasized values are significant at $p <$ .01. BAS = Behavioral Activation System; BAS-FS = BAS Fun Seeking; BAS-RR = BAS Reward Responsiveness; BAS-D = BAS Drive; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ-Avoid = Approach-Avoidance Temperament Questionnnaire - Avoidance; ATQ-App = Approach-Avoidance Temperament Questionnnaire - Approach; PA = Positive and Negative Affect Scale-Positive Affect; NA = Positive and Negative Affect Scale-Negative Affect; MM-App = Moral Motives Approach; MM-Avoid=Moral Motives Avoidance; DS-RT = Difference between push and pull reaction times on mushroom task; DS-E = Difference in push and pull error rates on mushroom task; BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 18

Intercorrelations Between Mediators and PID-5 Facets in the Combined Dataset

	Mediator														
PID-5 Aspect	BAS	BAS-FS	BAS-RR	BAS-D	BIS	BIS-A	FFFS	NA	PA	ATQ-Avoid	ATQ-App	MM-App	MM-Avoid	DiffScore-RT	DiffScore-Error
Anhedonia	***-.30***	***-.24***	***-.25***	***-.21***	***.22***	***.18***	***.23***	***.42***	***-.60***	***.42***	***-.50***	***-.28***	-.08	.01	.06
Anxiousness	-.02	-.05	***.12***	-.11	***.64***	***.55***	***.61***	***.67***	***-.31***	***.84***	-.04	-.03	-.10	-.06	-.02
Attention Seeking	***.40***	***.39***	***.24***	***.34***	.01	.04	-.03	***.24***	***.27***	.09	***.31***	-.01	.08	.01	-.11
Callousness	***-.13***	-.05	***-.34***	.08	***-.32***	***-.32***	***-.24***	***.12***	***-.17***	-.07	***-.31***	***-.43***	.07	.08	.00
Deceitfulness	***.12***	***.15***	-.06	***.19***	-.09	-.11	-.04	***.27***	-.08	***.14***	-.03	***-.29***	-.03	.07	-.04
Depressivity	***-.19***	-.10	***-.18***	***-.17***	***.30***	***.25***	***.30***	***.56***	***-.51***	***.51***	***-.34***	***-.20***	-.08	.01	.05
Distractability	.07	***.22***	.01	-.06	***.29***	***.25***	***.28***	***.49***	***-.29***	***.44***	-.09	***-.16***	-.10	.03	.01
Eccentricity	.07	***.12***	-.06	.10	.01	.00	.02	***.32***	***-.15***	***.25***	-.08	***-.15***	-.05	-.02	.00
Emotional Lability	***.14***	.11	***.15***	.07	***.45***	***.40***	***.41***	***.57***	***-.12***	***.62***	.07	.01	-.08	-.04	-.04
Grandiosity	***.18***	***.16***	-.01	***.29***	***-.22***	***-.21***	***-.18***	.10	***.15***	-.08	.09	***-.20***	***.14***	.01	-.07
Hostility	.08	.04	.00	***.15***	***.15***	.10	***.19***	***.42***	***-.20***	***.36***	-.09	***-.27***	.02	.03	-.04
Impulsivity	***.32***	***.47***	.05	***.24***	-.10	-.08	-.10	***.23***	.04	.06	.09	***-.19***	-.04	.08	-.02
Intimacy Avoidance	***-.17***	-.09	***-.23***	-.09	-.05	-.06	-.03	***.23***	***-.26***	***.16***	***-.30***	***-.22***	.04	.03	.06
Irresponsibility	.00	***.13***	***-.17***	.04	-.06	-.09	-.01	***.31***	***-.16***	***.16***	***-.17***	***-.28***	-.03	.05	-.06
Manipulativeness	***.29***	***.24***	.10	***.36***	***-.19***	***-.18***	***-.17***	***.15***	***.18***	.01	***.20***	-.09	.06	.09	-.04
Perceptual Dysregulation	.09	***.17***	-.06	.10	.05	.03	.06	***.45***	***-.16***	***.36***	-.05	***-.21***	.05	.03	.03
Perseveration	.02	.04	.02	-.01	***.34***	***.31***	***.30***	***.50***	***-.25***	***.51***	-.05	***-.16***	.04	.00	-.01
Restricted Affectivity	***-.20***	-.10	***-.29***	-.09	***-.18***	***-.17***	***-.15***	***.13***	***-.24***	.01	***-.29***	***-.28***	.03	.03	.00
Rigid Perfectionism	.01	***-.12***	.04	.09	***.25***	***.25***	***.21***	***.28***	-.07	***.35***	.06	***-.14***	***.12***	-.03	-.07
Risk Taking	***.44***	***.59***	***.12***	***.34***	***-.29***	***-.21***	***-.33***	.07	***.26***	***-.18***	***.25***	.01	.03	.03	-.07
Separation Insecurity	.09	.10	.09	.02	***.34***	***.31***	***.29***	***.39***	-.10	***.40***	.08	-.08	.04	-.02	-.03

Submissiveness	-.04	.01	.07	***-.19***	***.44***	***.42***	***.37***	***.25***	-.10	***.32***	.04	.02	-.06	.04	-.01
Suspiciousness	.03	.02	-.05	.10	.06	.06	.06	***.35***	***-.27***	***.28***	***-.23***	***-.31***	.07	.00	.02
Unusual Beliefs	.11	***.17***	-.06	***.15***	-.10	-.08	-.09	***.25***	-.02	***.16***	.00	***-.19***	.11	.04	.00
Withdrawal	***-.32***	***-.32***	***-.26***	***-.17***	.09	.04	***.12***	***.21***	***-.46***	***.28***	***-.42***	***-.31***	.02	-.06	.02

Note. N = 499, except for DiffScore-RT (N = 430) and DiffScore-Error (N = 432). Emphasized values are significant at p < .01. BAS = Behavioral Activation System; BAS-FS = BAS Fun Seeking; BAS-RR = BAS Reward Responsiveness; BAS-D = BAS Drive; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ-Avoid = Approach-Avoidance Temperament Questionnnaire - Avoidance; ATQ-App = Approach-Avoidance Temperament Questionnnaire - Approach; PA = Positive and Negative Affect Scale-Positive Affect; NA = Positive and Negative Affect Scale-Negative Affect; MM-App = Moral Motives Approach; MM-Avoid=Moral Motives Avoidance; DiffScore-RT = Difference between push and pull reaction times on mushroom task; DiffScore-Error = Difference in push and pull error rates on mushroom task; PID-5 = Personality Inventory for DSM-5.

Table 19

Results of Mediation Analyses in the Combined and MTurk Datasets

Combined Dataset Tested Mediation Model			Path *a*				Path *b*				Path *c* (Total Effect)				Path *c′* (Direct Effect)			Path *ab* (Indirect Effect)		
Predictor	Mediator	Criterion	*b*	*SE*	*p*	R^2	*b*	*SE*	*p*	R^2	*b*	*SE*	*p*	R^2	*b*	*SE*	*p*	ab_{cs}	*SE*	99% CI
LQ-Abs	**BAS-RR**	**BFAS Agree**	**.011**	**.004**	**.003**	**.018**	**.081**	**.010**	**<.001**	**.134**	**.003**	**.001**	**.001**	**.022**	**.002**	**.001**	**.015**	**.045**	**.018**	**.004, .101**
LQ-Abs	**BAS-RR**	**BFAS Com**	**.011**	**.004**	**.003**	**.018**	**.115**	**.013**	**<.001**	**.172**	**.004**	**.001**	**<.001**	**.030**	**.003**	**.001**	**.003**	**.051**	**.021**	**.005, .111**

MTurk Dataset Tested Mediation Model			Path *a*				Path *b*				Path *c* (Total Effect)				Path *c′* (Direct Effect)			Path *ab* (Indirect Effect)		
Predictor	Mediator	Criterion	*b*	*SE*	*p*	R^2	*b*	*SE*	*p*	R^2	*b*	*SE*	*p*	R^2	*b*	*SE*	*p*	ab_{cs}	*SE*	99% CI
FamNRH	**MMAvoid**	**MFQ-Prog**	**.017**	**.004**	**<.001**	**.110**	**-2.015**	**.237**	**<.001**	**.366**	**-.041**	**.014**	**.003**	**.057**	**-.007**	**.012**	**.536**	**-.195**	**.049**	**-.331, -.069**
FamNRH	MMAvoid	SelfDem	.017	.004	<.001	.116	-.279	.128	.031	.074	-.016	.006	.009	.045	-.011	.006	.079	-.062	.033	-.162, .015
FamNRH	**MMAvoid**	**RWA**	**.017**	**.004**	**<.001**	**.110**	**21.506**	**2.582**	**<.001**	**.351**	**.403**	**.147**	**.007**	**.048**	**.048**	**.129**	**.710**	**.193**	**.049**	**.072, .324**

Note. N = 499 in the combined dataset, 152 in the MTurk analyses that included MFQ-Prog and RWA as criterion variables, and 151 in the MTurk analysis that included SelfDem as a criterion variable. All mediation models emphasized in bold showed evidence of mediation as the CIs of the completely standardized indirect effects did not include zero and the p-values for the a, b, and c paths were all significant at p <.01. One questionable result was the LQAbs/BAS-RR/BFAS Comp model, which met these criteria but had a CI close to zero and a significant c' path at p <.01, which Barron and Kenny (1986) considered as evidence against mediation. ab_{cs} = Completely standardized indirect effect, LQ-Abs = Laterality quotient absolute value;FamNRH = Familial non-right-handedness; BAS-RR = Behavioral Activation System - Reward Responsiveness; MMAvoid = Moral Motives Avoidance Scale; BFAS Agree = Big Five Aspect Scales Agreeableness; BFAS Com = Big Five Aspect Scales Compassion; MFQ-Prog = Moral Foundations Questionnaire - Progressivism; SelfDem = Self Report Democrat; RWA = Right-Wing Authoritarianism.

Table 20

Intercorrelations Between Mediator Variables in the Combined Dataset

	Mediator														
Mediator	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. BAS	–	***.79***	***.78***	***.82***	.05	***.17***	-.12	.01	***.38***	.04	***.61***	***.27***	***.13***	-.01	-.03
2. BAS-FS	***.79***	–	***.40***	***.49***	-.03	.09	***-.16***	.07	***.28***	-.04	***.40***	***.14***	.02	.01	.01
3. BAS-RR	***.78***	***.40***	–	***.45***	***.30***	***.36***	***.14***	.04	***.30***	***.19***	***.61***	***.35***	.10	-.04	-.04
4. BAS-D	***.82***	***.49***	***.45***	–	***-.15***	-.04	***-.25***	-.07	***.31***	-.06	***.44***	***.15***	***.19***	.00	-.04
5. BIS	.05	-.03	***.30***	***-.15***	–	***.93***	***.87***	***.44***	***-.16***	***.68***	.09	***.13***	-.11	-.04	-.01
6. BIS-A	***.17***	.09	***.36***	-.04	***.93***	–	***.62***	***.34***	***-.13***	***.59***	***.13***	***.16***	-.07	-.02	-.02
7. FFFS	-.12	***-.16***	***.14***	***-.25***	***.87***	***.62***	–	***.46***	***-.17***	***.66***	.01	.07	***-.14***	-.07	-.01
8. NA	.01	.07	.04	-.07	***.44***	***.34***	***.46***	–	-.07	***.64***	.04	-.07	-.10	-.02	-.10
9. PA	***.38***	***.28***	***.30***	***.31***	***-.16***	***-.13***	***-.17***	-.07	–	***-.28***	***.56***	***.33***	***.18***	-.01	-.13
10. ATQ-Avoid	.04	-.04	***.19***	-.06	***.68***	***.59***	***.66***	***.64***	***-.28***	–	.10	.07	-.09	-.03	-.04
11. ATQ-App	***.61***	***.40***	***.61***	***.44***	.09	***.13***	.01	.04	***T***	.10	–	***.42***	.11	-.02	-.12
12. MM-App	***.27***	***.14***	***.35***	***.15***	***.13***	***.16***	.07	-.07	***.33***	.07	***.42***	–	.05	.04	.00
13. MM-Avoid	***.13***	.02	.10	***.19***	-.11	-.07	***-.14***	-.10	***.18***	-.09	.11	.05	–	.05	-.03
14. DiffScore-RT	-.01	.01	-.04	.00	-.04	-.02	-.07	-.02	-.01	-.03	-.02	.04	.05	–	***.30***
15. DiffScore-Error	-.03	.01	-.04	-.04	-.01	-.02	-.01	-.10	***-.13***	-.04	-.12	.00	-.03	***.30***	–

Note. N = 499, except for DiffScore-RT (N = 430) and DiffScore-Error (N = 432). Emphasized values are significant at $p < .01$. BAS = Behavioral Activation System; BAS-FS = BAS Fun Seeking; BAS-RR = BAS Reward Responsiveness; BAS-D = BAS Drive; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ-Avoid = Approach-Avoidance Temperament Questionnaire - Avoidance; ATQ-App = Approach-Avoidance Temperament Questionnaire - Approach; PA = Positive and Negative Affect Scale-Positive Affect; NA = Positive and Negative Affect Scale-Negative Affect; MM-App = Moral Motives Approach; MM-Avoid=Moral Motives Avoidance; DiffScore-RT = Difference between push and pull reaction times on mushroom task; DiffScore-Error = Difference in push and pull error rates on mushroom task.

Table 21

Intercorrelations Between Mediator Variables in the REP Dataset

	Mediator														
Mediator	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. BAS	–	***.77***	***.77***	***.83***	-.07	.08	***-.22***	-.03	***.35***	-.05	***.57***	***.18***	***.15***	-.10	-.02
2. BAS-FS	***.77***	–	***.36***	***.46***	***-.22***	-.07	***-.33***	-.04	***.19***	***-.15***	***.30***	.08	-.02	-.04	.08
3. BAS-RR	***.77***	***.36***	–	***.49***	***.21***	***.28***	.07	.00	***.31***	.09	***.59***	***.29***	***.17***	-.09	-.01
4. BAS-D	***.83***	***.46***	***.49***	–	***-.14***	-.02	***-.24***	-.02	***.32***	-.06	***.46***	.07	***.22***	-.10	-.11
5. BIS	-.07	***-.22***	***.21***	***-.14***	–	***.88***	***.85***	***.43***	***-.31***	***.64***	-.03	.13	***-.16***	-.03	.05
6. BIS-A	.08	-.07	***.28***	-.02	***.88***	–	***.50***	***.32***	***-.27***	***.52***	.04	***.18***	-.13	-.01	.07
7. FFFS	***-.22***	***-.33***	.07	***-.24***	***.85***	***.50***	–	***.44***	***-.26***	***.60***	-.09	.04	***-.14***	-.03	.02
8. NA	-.03	-.04	.00	-.02	***.43***	***.32***	***.44***	–	***-.27***	***.67***	***-.15***	-.07	-.05	.06	-.04
9. PA	***.35***	***.19***	***.31***	***.32***	***-.31***	***-.27***	***-.26***	***-.27***	–	***-.38***	***.59***	***.27***	***.21***	-.06	-.10
10. ATQ-Avoid	-.05	***-.15***	.09	-.06	***.64***	***.52***	***.60***	***.67***	***-.38***	–	-.02	.11	-.11	.03	.00
11. ATQ-App	***.57***	***.30***	***.59***	***.46***	-.03	.04	-.09	***-.15***	***.59***	-.02	–	***.42***	***.17***	-.04	.00
12. MM-App	***.18***	.08	***.29***	.07	.13	***.18***	.04	-.07	***.27***	.11	***.42***	–	-.07	.01	.03
13. MM-Avoid	***.15***	-.02	***.17***	***.22***	***-.16***	-.13	***-.14***	-.05	***.21***	-.11	***.17***	-.07	–	-.03	-.12
14. DiffScore-RT	-.10	-.04	-.09	-.10	-.03	-.01	-.03	.06	-.06	.03	-.04	.01	-.03	–	***.36***
15. DiffScore-Error	-.02	.08	-.01	-.11	.05	.07	.02	-.04	-.10	.00	.00	.03	-.12	***.36***	–

Note. N =347, except for DiffScore-RT (N =305) and DiffScore-Error (N = 306). Emphasized values are significant at $p < .01$. BAS = Behavioral Activation System; BAS-FS = BAS Fun Seeking; BAS-RR = BAS Reward Responsiveness; BAS-D = BAS Drive; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ-Avoid = Approach-Avoidance Temperament Questionnaire - Avoidance; ATQ-App = Approach-Avoidance Temperament Questionnaire - Approach; PA = Positive and Negative Affect Scale-Positive Affect; NA = Positive and Negative Affect Scale-Negative Affect; MM-App = Moral Motives Approach; MM-Avoid=Moral Motives Avoidance; DiffScore-RT = Difference between push and pull reaction times on mushroom task; DiffScore-Error = Difference in push and pull error rates on mushroom task.

Table 22

Intercorrelations Between Mediator Variables in the MTurk Dataset

	Mediator														
Mediator	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. BAS	–	***.79***	***.76***	***.83***	.04	.15	-.15	-.20	***.32***	.05	***.60***	***.34***	.18	.14	.04
2. BAS-FS	***.79***	–	***.36***	***.57***	-.03	.07	-.18	-.11	***.26***	-.04	***.36***	.16	.16	.11	.04
3. BAS-RR	***.76***	***.36***	–	***.42***	***.28***	***.36***	.12	-.15	.21	***.22***	***.58***	***.38***	.10	.04	.00
4. BAS-D	***.83***	***.57***	***.42***	–	-.18	-.08	***-.30***	-.21	***.31***	-.09	***.47***	***.26***	.17	.17	.06
5. BIS	.04	-.03	***.28***	-.18	–	***.95***	***.89***	***.24***	***-.25***	***.70***	-.04	.07	.02	-.04	.06
6. BIS-A	.15	.07	***.36***	-.08	***.95***	–	***.72***	.15	-.20	***.62***	.00	.08	.08	.01	.01
7. FFFS	-.15	-.18	.12	***-.30***	***.89***	***.72***	–	***.32***	***-.29***	***.69***	-.10	.03	-.06	-.10	.12
8. NA	-.20	-.11	-.15	-.21	***.24***	.15	***.32***	–	-.16	***.54***	-.13	***-.28***	-.02	-.13	.02
9. PA	***.32***	***.26***	.21	***.31***	***-.25***	-.20	***-.29***	-.16	–	***-.35***	***.42***	***.38***	***.27***	.10	-.06
10. ATQ-Avoid	.05	-.04	***.22***	-.09	***.70***	***.62***	***.69***	***.54***	***-.35***	–	.07	-.04	-.01	-.09	.02
11. ATQ-App	***.60***	***.36***	***.58***	***.47***	-.04	.00	-.10	-.13	***.42***	.07	–	***.40***	.19	.05	-.16
12. MM-App	***.34***	.16	***.38***	***.26***	.07	.08	.03	***-.28***	***.38***	-.04	***.40***	–	***.22***	.09	-.01
13. MM-Avoid	.18	.16	.10	.17	.02	.08	-.06	-.02	***.27***	-.01	.19	***.22***	–	.14	.01
14. DiffScore-RT	.14	.11	.04	.17	-.04	.01	-.10	-.13	.10	-.09	.05	.09	.14	–	.20
15. DiffScore-Error	.04	.04	.00	.06	.06	.01	.12	.02	-.06	.02	-.16	-.01	.01	.20	–

Note. N =152, except for DiffScore-RT (N =125) and DiffScore-Error (N = 126). Emphasized values are significant at $p < .01$. BAS = Behavioral Activation System; BAS-FS = BAS Fun Seeking; BAS-RR = BAS Reward Responsiveness; BAS-D = BAS Drive; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ-Avoid = Approach-Avoidance Temperament Questionnnaire - Avoidance; ATQ-App = Approach-Avoidance Temperament Questionnnaire - Approach; PA = Positive and Negative Affect Scale-Positive Affect; NA = Positive and Negative Affect Scale-Negative Affect; MM-App = Moral Motives Approach; MM-Avoid=Moral Motives Avoidance; DiffScore-RT = Difference between push and pull reaction times on mushroom task; DiffScore-Error = Difference in push and pull error rates on mushroom task.

Table 23

Intercorrelations Between the BFAS and All Criterion Variables in the Combined Dataset

Criterion	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. BFAS Neuroticism	–	***0.91***	***0.91***	-0.05	-0.01	-0.09	***-0.24***	***-0.50***	.11	***-.26***	***-.22***	***-.23***	***-.27***	-.07	***-.39***
2. BFAS Withdrawal	***0.91***	–	***0.67***	0.08	0.06	0.08	***-0.27***	***-0.54***	.10	***-.38***	***-.28***	***-.38***	***-.25***	-.02	***-.41***
3. BFAS Volatility	***0.91***	***0.67***	–	***-0.18***	-0.07	***-0.26***	***-0.17***	***-0.37***	.10	-.09	***-.12***	-.03	***-.25***	***-.12***	***-.30***
4. BFAS Agreeableness	-0.05	0.08	***-0.18***	–	***0.90***	***0.84***	0.10	0.05	***.12***	***.24***	***.45***	-.04	***.30***	***.36***	***.13***
5. BFAS Compassion	-0.01	0.06	-0.07	***0.90***	–	***0.53***	0.04	0.02	.04	***.45***	***.59***	***.18***	***.36***	***.40***	***.19***
6. BFAS Politeness	-0.09	0.08	***-0.26***	***0.84***	***0.53***	–	***0.15***	0.07	***.18***	-.09	***.14***	***-.30***	***.15***	***.22***	.02
7. BFAS Conscientiousness	***-0.24***	***-0.27***	***-0.17***	0.10	0.04	***0.15***	–	***0.85***	***.83***	***.18***	.08	***.23***	.08	***-.13***	***.29***
8. BFAS Industriousness	***-0.50***	***-0.54***	***-0.37***	0.05	0.02	0.07	***0.85***	–	***.41***	***.30***	***.16***	***.36***	***.22***	-.08	***.47***
9. BFAS Orderliness	0.11	0.10	0.10	***0.12***	0.04	***0.18***	***0.83***	***0.41***	–	.00	-.02	.02	-.09	***-.14***	.00
10. BFAS Extraversion	***-0.26***	***-0.38***	-0.09	***0.24***	***0.45***	-0.09	***0.18***	***0.30***	.00	–	***.86***	***.86***	***.35***	***.22***	***.37***
11. BFAS Enthusiasm	***-0.22***	***-0.28***	***-0.12***	***0.45***	***0.59***	***0.14***	0.08	***0.16***	-.02	***.86***	–	***.48***	***.23***	***.19***	***.19***
12. BFAS Assertiveness	***-0.23***	***-0.38***	-0.03	-0.04	***0.18***	***-0.30***	***0.23***	***0.36***	.02	***.86***	***.48***	–	***.37***	***.18***	***.45***
13. BFAS Openness/Intellect	***-0.27***	***-0.25***	***-0.25***	***0.30***	***0.36***	***0.15***	0.08	***0.22***	-.09	***.35***	***.23***	***.37***	–	***.85***	***.81***
14. BFAS Openness	-0.07	-0.02	***-0.12***	***0.36***	***0.40***	***0.22***	***-0.13***	-0.08	***-.14***	***.22***	***.19***	***.18***	***.85***	–	***.38***
15. BFAS Intellect	***-0.39***	***-0.41***	***-0.30***	***0.13***	***0.19***	0.02	***0.29***	***0.47***	.00	***.37***	***.19***	***.45***	***.81***	***.38***	–
16. PID-5 NegativeAffect	***0.77***	***0.75***	***0.65***	0.02	0.09	-0.08	***-0.24***	***-0.42***	.03	-.09	-.06	-.10	***-.15***	.01	***-.27***
17. PID-5 Detachment	***0.37***	***0.42***	***0.26***	***-0.42***	***-0.53***	***-0.16***	***-0.18***	***-0.29***	.00	***-.68***	***-.76***	***-.41***	***-.22***	***-.14***	***-.24***
18. PID-5 Antagonism	0.08	-0.03	***0.18***	***-0.53***	***-0.33***	***-0.63***	***-0.14***	-0.10	***-.13***	***.18***	.01	***.31***	-.07	-.09	-.03
19. PID-5 Disinhibition	***0.37***	***0.30***	***0.37***	***-0.29***	***-0.18***	***-0.36***	***-0.61***	***-0.62***	***-.40***	-.02	-.04	.00	***-.17***	.01	***-.30***
20. PID-5 Psychoticism	***0.25***	***0.22***	***0.24***	***-0.30***	***-0.21***	***-0.33***	***-0.28***	***-0.31***	***-.15***	-.10	***-.20***	.03	.03	***.12***	-.08
21. MFQ Progressivism	0.03	0.06	-0.01	***0.18***	***0.18***	***0.13***	***-0.14***	-0.08	***-.16***	-.05	-.03	-.05	***.38***	***.38***	***.25***

22. SWB	-0.02	-0.06	0.03	***-0.28***	***-0.30***	***-0.18***	***0.14***	0.08	***.15***	-.08	***-.12***	-.01	***-.30***	***-.33***	***-.16***
23. RWA	-0.10	***-0.14***	-0.04	***-0.21***	***-0.24***	***-0.12***	***0.18***	***0.16***	***.13***	.00	-.04	.03	***-.36***	***-.41***	***-.17***
24. SDO	0.03	-0.02	0.08	***-0.39***	***-0.39***	***-0.27***	0.02	-0.02	.06	***-.13***	***-.18***	-.05	***-.35***	***-.37***	***-.20***
25. Self-Report Democrat	***0.13***	***0.16***	0.07	***0.15***	***0.21***	0.04	***-0.18***	***-0.21***	-.09	.05	.07	.03	***.12***	***.21***	-.02
26. Self Report Republican	-0.08	-0.10	-0.05	***-0.14***	***-0.17***	-0.06	***0.15***	***0.13***	***.12***	.03	.02	.02	***-.25***	***-.31***	-.11
27. Political Spectrum Rank	***-0.12***	***-0.14***	-0.08	-0.09	***-0.13***	-0.03	***0.19***	***0.17***	***.15***	-.01	-.04	.03	***-.19***	***-.27***	-.04

Note. N = 499, except for Self-Report Democrat (N = 491) and Self Report Republican (N = 486). Emphasized values are significant at $p < .01$. BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 24

Intercorrelations Between the BFAS and All Criterion Variables in the REP Dataset

	Criterion														
Criterion	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. BFAS Neuroticism	–	***.88***	***.90***	-.11	-.04	***-.14***	***-.15***	***-.39***	***.14***	***-.20***	***-.22***	-.13	***-.16***	.00	***-.28***
2. BFAS Withdrawal	***.88***	–	***.59***	.06	.02	.08	***-.19***	***-.44***	.12	***-.37***	***-.31***	***-.32***	-.14	.08	***-.32***
3. BFAS Volatility	***.90***	***.59***	–	***-.24***	-.10	***-.32***	-.08	***-.26***	.13	-.01	-.09	.08	***-.15***	-.07	***-.18***
4. BFAS Agreeableness	-.11	.06	***-.24***	–	***.87***	***.84***	.00	.02	-.02	***.20***	***.38***	-.04	***.31***	***.34***	***.14***
5. BFAS Compassion	-.04	.02	-.10	***.87***	–	***.46***	-.04	.01	-.08	***.41***	***.52***	***.19***	***.40***	***.38***	***.25***
6. BFAS Politeness	***-.14***	.08	***-.32***	***.84***	***.46***	–	.05	.03	.06	-.11	.10	***-.28***	.12	***.19***	-.02
7. BFAS Conscientiousness	***-.15***	***-.19***	-.08	.00	-.04	.05	–	***.86***	***.85***	***.21***	.11	***.25***	-.11	***-.31***	***.16***
8. BFAS Industriousness	***-.39***	***-.44***	***-.26***	.02	.01	.03	***.86***	–	***.46***	***.32***	***.18***	***.36***	.03	***-.27***	***.35***
9. BFAS Orderliness	***.14***	.12	.13	-.02	-.08	.06	***.85***	***.46***	–	.04	.00	.07	***-.22***	***-.26***	-.08
10. BFAS Extraversion	***-.20***	***-.37***	-.01	***.20***	***.41***	-.11	***.21***	***.32***	.04	–	***.85***	***.86***	***.37***	***.16***	***.46***
11. BFAS Enthusiasm	***-.22***	***-.31***	-.09	***.38***	***.52***	.10	.11	***.18***	.00	***.85***	–	***.46***	***.25***	***.15***	***.26***
12. BFAS Assertiveness	-.13	***-.32***	.08	-.04	***.19***	***-.28***	***.25***	***.36***	.07	***.86***	***.46***	–	***.38***	.12	***.52***
13. BFAS Openness/Intellect	***-.16***	-.14	***-.15***	***.31***	***.40***	.12	-.11	.03	***-.22***	***.37***	***.25***	***.38***	–	***.83***	***.77***
14. BFAS Openness	.00	.08	-.07	***.34***	***.38***	***.19***	***-.31***	***-.27***	***-.26***	***.16***	***.15***	.12	***.83***	–	***.29***
15. BFAS Intellect	***-.28***	***-.32***	***-.18***	***.14***	***.25***	-.02	***.16***	***.35***	-.08	***.46***	***.26***	***.52***	***.77***	***.29***	–
16. PID-5 NegativeAffect	***.72***	***.71***	***.59***	.05	.11	-.03	-.12	***-.29***	.09	-.05	-.05	-.04	-.02	.10	***-.15***
17. PID-5 Detachment	***.39***	***.46***	***.24***	***-.32***	***-.43***	-.10	***-.19***	***-.32***	.00	***-.61***	***-.71***	***-.33***	***-.18***	-.06	***-.24***
18. PID-5 Antagonism	.10	-.03	***.21***	***-.49***	***-.29***	***-.57***	-.02	-.02	.00	***.18***	.01	***.30***	-.03	-.07	.03
19. PID-5 Disinhibition	***.34***	***.26***	***.34***	***-.21***	-.12	***-.25***	***-.60***	***-.63***	***-.39***	-.02	-.01	-.02	-.03	***.14***	***-.22***
20. PID-5 Psychoticism	***.24***	***.21***	***.23***	***-.27***	***-.17***	***-.29***	***-.28***	***-.32***	***-.16***	-.08	***-.19***	.05	.08	***.17***	-.05
21. MFQ Progressivism	.12	***.17***	.05	***.32***	***.35***	***.20***	***-.21***	***-.17***	***-.19***	.02	.03	-.01	***.41***	***.42***	***.23***
22. SWB	-.09	***-.15***	-.02	***-.28***	***-.30***	***-.18***	***.25***	***.19***	***.24***	.00	-.03	.02	***-.29***	***-.32***	-.12

23. RWA	***-.14***	***-.19***	-.07	***-.29***	***-.34***	***-.15***	***.26***	***.25***	***.19***	.01	-.02	.04	***-.37***	***-.43***	***-.14***
24. SDO	-.07	***-.14***	.01	***-.41***	***-.39***	***-.30***	.13	.12	.10	-.04	-.10	.02	***-.31***	***-.34***	***-.16***
25. Self-Report Democrat	***.15***	***.18***	.10	***.24***	***.28***	.13	***-.17***	***-.17***	-.12	.03	.03	.02	***.22***	***.29***	.05
26. Self Report Republican	***-.17***	***-.19***	-.11	***-.22***	***-.25***	-.11	***.21***	***.21***	***.15***	.06	.05	.05	***-.26***	***-.31***	-.09
27. Political Spectrum Rank	***-.16***	***-.20***	-.09	***-.16***	***-.17***	-.10	***.23***	***.22***	***.17***	.06	.01	.09	***-.22***	***-.30***	-.04

Note. N = 347, except for Self-Report Democrat (N = 340) and Self Report Republican (N = 334). Emphasized values are significant at $p < .01$. BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 25

Intercorrelations Between the BFAS and All Criterion Variables in the MTurk Dataset

	Criterion														
Criterion	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. BFAS Neuroticism	–	***.94***	***.93***	-.12	-.14	-.06	***-.32***	***-.59***	.04	***-.53***	***-.43***	***-.48***	***-.40***	-.21	***-.50***
2. BFAS Withdrawal	***.94***	–	***.75***	-.01	-.07	.07	***-.34***	***-.62***	.05	***-.62***	***-.46***	***-.60***	***-.37***	-.18	***-.48***
3. BFAS Volatility	***.93***	***.75***	–	***-.22***	-.20	-.20	***-.26***	***-.47***	.04	***-.36***	***-.34***	***-.28***	***-.37***	-.21	***-.45***
4. BFAS Agreeableness	-.12	-.01	***-.22***	–	***.93***	***.87***	***.29***	***.23***	***.26***	.20	***.46***	-.11	***.35***	***.42***	.20
5. BFAS Compassion	-.14	-.07	-.20	***.93***	–	***.63***	***.24***	***.25***	.16	***.40***	***.59***	.10	***.41***	***.47***	***.25***
6. BFAS Politeness	-.06	.07	-.20	***.87***	***.63***	–	***.30***	.15	***.34***	-.10	.19	***-.35***	.20	***.26***	.09
7. BFAS Conscientiousness	***-.32***	***-.34***	***-.26***	***.29***	***.24***	***.30***	–	***.83***	***.84***	***.25***	.16	***.26***	***.34***	.16	***.45***
8. BFAS Industriousness	***-.59***	***-.62***	***-.47***	***.23***	***.25***	.15	***.83***	–	***.40***	***.50***	***.35***	***.50***	***.48***	***.23***	***.62***
9. BFAS Orderliness	.04	.05	.04	***.26***	.16	***.34***	***.84***	***.40***	–	-.08	-.07	-.06	.10	.04	.13
10. BFAS Extraversion	***-.53***	***-.62***	***-.36***	.20	***.40***	-.10	***.25***	***.50***	-.08	–	***.85***	***.86***	***.39***	***.32***	***.37***
11. BFAS Enthusiasm	***-.43***	***-.46***	***-.34***	***.46***	***.59***	.19	.16	***.35***	-.07	***.85***	–	***.47***	***.27***	***.27***	.20
12. BFAS Assertiveness	***-.48***	***-.60***	***-.28***	-.11	.10	***-.35***	***.26***	***.50***	-.06	***.86***	***.47***	–	***.40***	***.28***	***.43***
13. BFAS Openness/Intellect	***-.40***	***-.37***	***-.37***	***.35***	***.41***	.20	***.34***	***.48***	.10	***.39***	***.27***	***.40***	–	***.88***	***.87***
14. BFAS Openness	-.21	-.18	-.21	***.42***	***.47***	***.26***	.16	***.23***	.04	***.32***	***.27***	***.28***	***.88***	–	***.54***
15. BFAS Intellect	***-.50***	***-.48***	***-.45***	.20	***.25***	.09	***.45***	***.62***	.13	***.37***	.20	***.43***	***.87***	***.54***	–
16. PID-5 NegativeAffect	***.81***	***.78***	***.73***	-.14	-.10	-.16	***-.37***	***-.54***	-.08	***-.33***	***-.27***	***-.29***	***-.31***	-.15	***-.40***
17. PID-5 Detachment	***.54***	***.56***	***.44***	***-.46***	***-.56***	***-.23***	***-.25***	***-.46***	.02	***-.74***	***-.80***	***-.47***	***-.33***	***-.26***	***-.33***
18. PID-5 Antagonism	.04	-.05	.14	***-.63***	***-.45***	***-.72***	***-.33***	***-.21***	***-.33***	.18	-.02	***.32***	-.13	-.13	-.10
19. PID-5 Disinhibition	***.39***	***.33***	***.39***	***-.48***	***-.37***	***-.53***	***-.62***	***-.61***	***-.42***	-.10	-.17	-.02	***-.36***	***-.23***	***-.41***
20. PID-5 Psychoticism	***.28***	***.25***	***.28***	***-.37***	***-.28***	***-.39***	***-.29***	***-.34***	-.14	-.11	***-.22***	.01	-.04	.05	-.13
21. MFQ Progressivism	-.10	-.08	-.12	.03	.01	.04	-.03	.07	-.11	-.16	-.14	-.13	***.34***	***.32***	***.28***
22. SWB	.19	.16	.20	***-.22***	***-.22***	-.17	-.09	-.20	.04	-.09	-.15	-.01	***-.37***	***-.35***	***-.29***

23. RWA	.06	.03	.08	-.07	-.06	-.07	.00	-.07	.07	.08	.05	.08	***-.38***	***-.39***	***-.28***
24. SDO	***.22***	.18	***.23***	***-.36***	***-.40***	***-.23***	-.16	***-.28***	.02	***-.23***	***-.28***	-.12	***-.40***	***-.41***	***-.30***
25. Self-Report Democrat	-.04	.01	-.08	-.03	.03	-.10	-.12	-.13	-.06	-.03	-.02	-.03	.04	.10	-.03
26. Self Report Republican	.05	.03	.06	-.05	-.09	.01	.05	-.01	.09	-.02	-.01	-.02	***-.26***	***-.29***	-.15
27. Political Spectrum Rank	.01	.01	.00	.03	-.01	.08	.08	.00	.13	-.04	-.04	-.02	-.18	-.21	-.10

Note. $N = 152$, except for Self-Report Democrat ($N = 151$). Emphasized values are significant at $p < .01$. BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 26

Intercorrelations Between the PID-5 Domains and All Criterion Variables in the Combined Dataset

	Criterion				
Criterion	16	17	18	19	20
1. BFAS Neuroticism	***.77***	***.37***	.08	***.37***	***.25***
2. BFAS Withdrawal	***.75***	***.42***	-.03	***.30***	***.22***
3. BFAS Volatility	***.65***	***.26***	***.18***	***.37***	***.24***
4. BFAS Agreeableness	.02	***-.42***	***-.53***	***-.29***	***-.30***
5. BFAS Compassion	.09	***-.53***	***-.33***	***-.18***	***-.21***
6. BFAS Politeness	-.08	***-.16***	***-.63***	***-.36***	***-.33***
7. BFAS Conscientiousness	***-.24***	***-.18***	***-.14***	***-.61***	***-.28***
8. BFAS Industriousness	***-.42***	***-.29***	-.10	***-.62***	***-.31***
9. BFAS Orderliness	.03	.00	***-.13***	***-.40***	***-.15***
10. BFAS Extraversion	-.09	***-.68***	***.18***	-.02	-.10
11. BFAS Enthusiasm	-.06	***-.76***	.01	-.04	***-.20***
12. BFAS Assertiveness	-.10	***-.41***	***.31***	.00	.03
13. BFAS Openness/Intellect	***-.15***	***-.22***	-.07	***-.17***	.03
14. BFAS Openness	.01	***-.14***	-.09	.01	***.12***
15. BFAS Intellect	***-.27***	***-.24***	-.03	***-.30***	-.08
16. PID-5 NegativeAffect	–	***.33***	***.27***	***.47***	***.44***
17. PID-5 Detachment	***.33***	–	***.21***	***.36***	***.47***
18. PID-5 Antagonism	***.27***	***.21***	–	***.52***	***.56***
19. PID-5 Disinhibition	***.47***	***.36***	***.52***	–	***.64***
20. PID-5 Psychoticism	***.44***	***.47***	***.56***	***.64***	–
21. MFQ Progressivism	.00	-.01	***-.19***	-.09	-.05

22. SWB	.00	***.13***	***.16***	.04	.04
23. RWA	-.08	.03	.10	.00	.01
24. SDO	.02	***.22***	***.30***	***.17***	***.15***
25. Self-Report Democrat	***.16***	-.03	.03	.11	.04
26. Self Report Republican	-.04	.00	.05	-.01	-.04
27. Political Spectrum Rank	-.11	-.01	-.02	-.10	-.06

Note. N = 499, except for Self-Report Democrat (N = 491) and Self Report Republican (N = 486). Emphasized values are significant at $p < .01$. BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 27

Intercorrelations Between the PID-5 Domains and All Criterion Variables in the REP Dataset

	Criterion				
Criterion	16	17	18	19	20
1. BFAS Neuroticism	***.72***	***.39***	.10	***.34***	***.24***
2. BFAS Withdrawal	***.71***	***.46***	-.03	***.26***	***.21***
3. BFAS Volatility	***.59***	***.24***	***.21***	***.34***	***.23***
4. BFAS Agreeableness	.05	***-.32***	***-.49***	***-.21***	***-.27***
5. BFAS Compassion	.11	***-.43***	***-.29***	-.12	***-.17***
6. BFAS Politeness	-.03	-.10	***-.57***	***-.25***	***-.29***
7. BFAS Conscientiousness	-.12	***-.19***	-.02	***-.60***	***-.28***
8. BFAS Industriousness	***-.29***	***-.32***	-.02	***-.63***	***-.32***
9. BFAS Orderliness	.09	.00	.00	***-.39***	***-.16***
10. BFAS Extraversion	-.05	***-.61***	***.18***	-.02	-.08
11. BFAS Enthusiasm	-.05	***-.71***	.01	-.01	***-.19***
12. BFAS Assertiveness	-.04	***-.33***	***.30***	-.02	.05
13. BFAS Openness/Intellect	-.02	***-.18***	-.03	-.03	.08
14. BFAS Openness	.10	-.06	-.07	***.14***	***.17***
15. BFAS Intellect	***-.15***	***-.24***	.03	***-.22***	-.05
16. PID-5 NegativeAffect	–	***.33***	***.25***	***.39***	***.43***
17. PID-5 Detachment	***.33***	–	***.24***	***.36***	***.51***
18. PID-5 Antagonism	***.25***	***.24***	–	***.44***	***.55***
19. PID-5 Disinhibition	***.39***	***.36***	***.44***	–	***.61***
20. PID-5 Psychoticism	***.43***	***.51***	***.55***	***.61***	–
21. MFQ Progressivism	.09	-.04	***-.23***	.00	-.02
22. SWB	-.05	.05	***.16***	-.06	.00

23. RWA	-.11	.01	***.15***	-.10	-.03
24. SDO	-.06	.13	***.31***	.04	.09
25. Self-Report Democrat	***.16***	.02	-.03	.12	.08
26. Self Report Republican	-.11	-.05	.07	-.10	-.08
27. Political Spectrum Rank	-.14	-.05	.04	***-.14***	-.10

Note. N = 347, except for Self-Report Democrat (N = 340) and Self Report Republican (N = 334). Emphasized values are significant at p < .01. BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 28

Intercorrelations Between the PID-5 Domains and All Criterion Variables in the REP Dataset

	Criterion				
Criterion	16	17	18	19	20
1. BFAS Neuroticism	***.81***	***.54***	.04	***.39***	***.28***
2. BFAS Withdrawal	***.78***	***.56***	-.05	***.33***	***.25***
3. BFAS Volatility	***.73***	***.44***	.14	***.39***	***.28***
4. BFAS Agreeableness	-.14	***-.46***	***-.63***	***-.48***	***-.37***
5. BFAS Compassion	-.10	***-.56***	***-.45***	***-.37***	***-.28***
6. BFAS Politeness	-.16	***-.23***	***-.72***	***-.53***	***-.39***
7. BFAS Conscientiousness	***-.37***	***-.25***	***-.33***	***-.62***	***-.29***
8. BFAS Industriousness	***-.54***	***-.46***	***-.21***	***-.61***	***-.34***
9. BFAS Orderliness	-.08	.02	***-.33***	***-.42***	-.14
10. BFAS Extraversion	***-.33***	***-.74***	.18	-.10	-.11
11. BFAS Enthusiasm	***-.27***	***-.80***	-.02	-.17	***-.22***
12. BFAS Assertiveness	***-.29***	***-.47***	***.32***	-.02	.01
13. BFAS Openness/Intellect	***-.31***	***-.33***	-.13	***-.36***	-.04
14. BFAS Openness	-.15	***-.26***	-.13	***-.23***	.05
15. BFAS Intellect	***-.40***	***-.33***	-.10	***-.41***	-.13
16. PID-5 NegativeAffect	–	***.51***	***.31***	***.60***	***.50***
17. PID-5 Detachment	***.51***	–	.20	***.46***	***.46***
18. PID-5 Antagonism	***.31***	.20	–	***.67***	***.57***
19. PID-5 Disinhibition	***.60***	***.46***	***.67***	–	***.69***
20. PID-5 Psychoticism	***.50***	***.46***	***.57***	***.69***	–
21. MFQ Progressivism	-.14	.03	-.13	***-.24***	-.10
22. SWB	.20	.15	.18	***.25***	.09

23. RWA	.08	-.03	.04	***.21***	.07
24. SDO	.19	***.33***	***.28***	***.39***	***.23***
25. Self-Report Democrat	.03	.02	.12	.04	.00
26. Self Report Republican	.09	.06	.02	.13	.02
27. Political Spectrum Rank	.01	.00	-.10	.01	.00

Note. N = 152, except for Self-Report Democrat (N = 151). Emphasized values are significant at $p < .01$. BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 29

Intercorrelations Between Political Ideology Measures and All Criterion Variables in the Combined Dataset

	Criterion						
Criterion	21	22	23	24	25	26	27
1. BFAS Neuroticism	.03	-.02	-.10	.03	***.13***	-.08	***-.12***
2. BFAS Withdrawal	.06	-.06	***-.14***	-.02	***.16***	-.10	***-.14***
3. BFAS Volatility	-.01	.03	-.04	.08	.07	-.05	-.08
4. BFAS Agreeableness	***.18***	***-.28***	***-.21***	***-.39***	***.15***	***-.14***	-.09
5. BFAS Compassion	***.18***	***-.30***	***-.24***	***-.39***	***.21***	***-.17***	***-.13***
6. BFAS Politeness	***.13***	***-.18***	***-.12***	***-.27***	.04	-.06	-.03
7. BFAS Conscientiousness	***-.14***	***.14***	***.18***	.02	***-.18***	***.15***	***.19***
8. BFAS Industriousness	-.08	.08	.16	-.02	***-.21***	***.13***	***.17***
9. BFAS Orderliness	***-.16***	***.15***	***.13***	.06	-.09	***.12***	***.15***
10. BFAS Extraversion	-.05	-.08	.00	***-.13***	.05	.03	-.01
11. BFAS Enthusiasm	-.03	***-.12***	-.04	***-.18***	.07	.02	-.04
12. BFAS Assertiveness	-.05	-.01	.03	-.05	.03	.02	.03
13. BFAS Openness/Intellect	***.38***	***-.30***	***-.36***	***-.35***	***.12***	***-.25***	***-.19***
14. BFAS Openness	***.38***	***-.33***	***-.41***	***-.37***	***.21***	***-.31***	***-.27***
15. BFAS Intellect	***.25***	***-.16***	***-.17***	***-.20***	-.02	-.11	-.04
16. PID-5 NegativeAffect	.00	.00	-.08	.02	***.16***	-.04	-.11
17. PID-5 Detachment	-.01	***.13***	.03	***.22***	-.03	.00	-.01
18. PID-5 Antagonism	***-.19***	***.16***	.10	***.30***	.03	.05	-.02
19. PID-5 Disinhibition	-.09	.04	.00	***.17***	.11	-.01	-.10
20. PID-5 Psychoticism	-.05	.04	.01	***.15***	.04	-.04	-.06
21. MFQ Progressivism	–	***-.63***	***-.77***	***-.56***	***.43***	***-.58***	***-.52***

22. SWB	***-.63***	–	***.67***	***.59***	***-.52***	***.61***	***.56***
23. RWA	***-.77***	***.67***	–	***.63***	***-.59***	***.66***	***.65***
24. SDO	***-.56***	***.59***	***.63***	–	***-.43***	***.49***	***.45***
25. Self-Report Democrat	***.43***	***-.52***	***-.59***	***-.43***	–	***-.73***	***-.69***
26. Self Report Republican	***-.58***	***.61***	***.66***	***.49***	***-.73***	–	***.76***
27. Political Spectrum Rank	***-.52***	***.56***	***.65***	***.45***	***-.69***	***.76***	–

Note. N = 499, except for Self-Report Democrat (N = 491) and Self Report Republican (N = 486). Emphasized values are significant at $p < .01$. BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 30

Intercorrelations Between Political Ideology Measures and All Criterion Variables in the REP Dataset

	Criterion						
Criterion	21	22	23	24	25	26	27
1. BFAS Neuroticism	.12	-.09	***-.14***	-.07	***.15***	***-.17***	***-.16***
2. BFAS Withdrawal	***.17***	***-.15***	***-.19***	***-.14***	***.18***	***-.19***	***-.20***
3. BFAS Volatility	.05	-.02	-.07	.01	.10	-.11	-.09
4. BFAS Agreeableness	***.32***	***-.28***	***-.29***	***-.41***	***.24***	***-.22***	***-.16***
5. BFAS Compassion	***.35***	***-.30***	***-.34***	***-.39***	***.28***	***-.25***	***-.17***
6. BFAS Politeness	***.20***	***-.18***	***-.15***	***-.30***	.13	-.11	-.10
7. BFAS Conscientiousness	***-.21***	***.25***	***.26***	.13	***-.17***	***.21***	***.23***
8. BFAS Industriousness	***-.17***	***.19***	***.25***	.12	***-.17***	***.21***	***.22***
9. BFAS Orderliness	***-.19***	***.24***	***.19***	.10	-.12	***.15***	***.17***
10. BFAS Extraversion	.02	.00	.01	-.04	.03	.06	.06
11. BFAS Enthusiasm	.03	-.03	-.02	-.10	.03	.05	.01
12. BFAS Assertiveness	-.01	.02	.04	.02	.02	.05	.09
13. BFAS Openness/Intellect	***.41***	***-.29***	***-.37***	***-.31***	***.22***	***-.26***	***-.22***
14. BFAS Openness	***.42***	***-.32***	***-.43***	***-.34***	***.29***	***-.31***	***-.30***
15. BFAS Intellect	***.23***	-.12	***-.14***	***-.16***	.05	-.09	-.04
16. PID-5 NegativeAffect	.09	-.05	-.11	-.06	***.16***	-.11	-.14
17. PID-5 Detachment	-.04	.05	.01	.13	.02	-.05	-.05
18. PID-5 Antagonism	***-.23***	***.16***	***.15***	***.31***	-.03	.07	.04
19. PID-5 Disinhibition	.00	-.06	-.10	.04	.12	-.10	***-.14***
20. PID-5 Psychoticism	-.02	.00	-.03	.09	.08	-.08	-.10
21. MFQ Progressivism	–	***-.63***	***-.77***	***-.61***	***.50***	***-.62***	***-.56***
22. SWB	***-.63***	–	***.65***	***.58***	***-.60***	***.67***	***.59***

23. RWA	***-.77***	***.65***	–	***.65***	***-.66***	***.70***	***.67***
24. SDO	***-.61***	***.58***	***.65***	–	***-.49***	***.52***	***.46***
25. Self-Report Democrat	***.50***	***-.60***	***-.66***	***-.49***	–	***-.85***	***-.75***
26. Self Report Republican	***-.62***	***.67***	***.70***	***.52***	***-.85***	–	***.78***
27. Political Spectrum Rank	***-.56***	***.59***	***.67***	***.46***	***-.75***	***.78***	–

Note. N = 347, except for Self-Report Democrat (N =340) and Self Report Republican (N = 334). Emphasized values are significant at $p < .01$. BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 31

Intercorrelations Between Political Ideology Measures and All Criterion Variables in the MTurk Dataset

	Criterion						
Criterion	21	22	23	24	25	26	27
1. BFAS Neuroticism	-.10	.19	.06	***.22***	-.04	.05	.01
2. BFAS Withdrawal	-.08	.16	.03	.18	.01	.03	.01
3. BFAS Volatility	-.12	.20	.08	***.23***	-.08	.06	.00
4. BFAS Agreeableness	.03	***-.22***	-.07	***-.36***	-.03	-.05	.03
5. BFAS Compassion	.01	***-.22***	-.06	***-.40***	.03	-.09	-.01
6. BFAS Politeness	.04	-.17	-.07	***-.23***	-.10	.01	.08
7. BFAS Conscientiousness	-.03	-.09	.00	-.16	-.12	.05	.08
8. BFAS Industriousness	.07	-.20	-.07	***-.28***	-.13	-.01	.00
9. BFAS Orderliness	-.11	.04	.07	.02	-.06	.09	.13
10. BFAS Extraversion	-.16	-.09	.08	***-.23***	-.03	-.02	-.04
11. BFAS Enthusiasm	-.14	-.15	.05	***-.28***	-.02	-.01	-.04
12. BFAS Assertiveness	-.13	-.01	.08	-.12	-.03	-.02	-.02
13. BFAS Openness/Intellect	***.34***	***-.37***	***-.38***	***-.40***	.04	***-.26***	-.18
14. BFAS Openness	***.32***	***-.35***	***-.39***	***-.41***	.10	***-.29***	-.21
15. BFAS Intellect	***.28***	***-.29***	***-.28***	***-.30***	-.03	-.15	-.10
16. PID-5 NegativeAffect	-.14	.20	.08	.19	.03	.09	.01
17. PID-5 Detachment	.03	.15	-.03	***.33***	.02	.06	.00
18. PID-5 Antagonism	-.13	.18	.04	***.28***	.12	.02	-.10
19. PID-5 Disinhibition	***-.24***	***.25***	***.21***	***.39***	.04	.13	.01
20. PID-5 Psychoticism	-.10	.09	.07	.23	.00	.02	.00
21. MFQ Progressivism	–	***-.66***	***-.80***	***-.50***	***.34***	***-.53***	***-.46***
22. SWB	***-.66***	–	***.67***	***.59***	***-.34***	***.54***	***.49***

23. RWA	***-.80***	***.67***	–	***.61***	***-.44***	***.62***	***.60***
24. SDO	***-.50***	***.59***	***.61***	–	***-.34***	***.44***	***.41***
25. Self-Report Democrat	***.34***	***-.34***	***-.44***	***-.34***	–	***-.56***	***-.59***
26. Self Report Republican	***-.53***	***.54***	***.62***	***.44***	***-.56***	–	***.71***
27. Political Spectrum Rank	***-.46***	***.49***	***.60***	***.41***	***-.59***	***.71***	–

Note. N = 152, except for Self-Report Democrat (N =151). Emphasized values are significant at $p < .01$. BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 32

Correlations Between the BFAS and PID-5 Facets in the Combined Dataset

	BFAS Measure														
PID-5 Facet	N	With	Vol	A	Comp	Pol	C	Ind	Ord	E	Enth	Assert	O/I	Open	Int
Anhedonia	***.51***	***.55***	***.37***	***-.27***	***-.35***	-.09	***-.24***	***-.38***	-.02	***-.62***	***-.67***	***-.40***	***-.22***	***-.12***	***-.26***
Anxiousness	***.75***	***.80***	***.57***	.07	.06	.06	***-.20***	***-.44***	.11	***-.25***	***-.21***	***-.22***	***-.12***	.04	***-.25***
Attention Seeking	***.14***	.03	***.23***	***-.15***	.06	***-.37***	***-.15***	***-.12***	***-.13***	***.45***	***.36***	***.41***	-.03	-.02	-.02
Callousness	.05	-.04	***.13***	***-.79***	***-.73***	***-.65***	***-.14***	-.10	***-.15***	***-.24***	***-.40***	-.01	***-.22***	***-.24***	***-.12***
Deceitfulness	***.20***	***.13***	***.25***	***-.50***	***-.36***	***-.53***	***-.26***	***-.27***	***-.16***	-.02	-.11	.08	***-.19***	***-.14***	***-.18***
Depressivity	***.56***	***.63***	***.40***	***-.15***	***-.19***	-.06	***-.32***	***-.45***	-.08	***-.44***	***-.44***	***-.32***	***-.16***	-.01	***-.27***
Distractability	***.47***	***.49***	***.37***	-.09	-.05	***-.12***	***-.62***	***-.75***	***-.28***	***-.18***	-.10	***-.20***	***-.17***	.07	***-.37***
Eccentricity	***.23***	***.20***	***.22***	***-.29***	***-.23***	***-.29***	***-.24***	***-.29***	-.11	***-.15***	***-.24***	-.02	.10	***.16***	.00
Emotional Lability	***.70***	***.62***	***.67***	-.01	.09	***-.13***	***-.21***	***-.34***	.00	.01	.01	.01	-.05	.07	***-.17***
Grandiosity	.00	-.11	***.12***	***-.52***	***-.34***	***-.60***	.00	.05	-.04	***.18***	.00	***.30***	-.06	-.11	.02
Hostility	***.54***	***.35***	***.64***	***-.48***	***-.37***	***-.49***	-.11	***-.21***	.03	-.10	***-.25***	.07	***-.19***	***-.15***	***-.17***
Impulsivity	***.18***	.06	***.28***	***-.29***	***-.14***	***-.41***	***-.41***	***-.35***	***-.34***	***.20***	***.13***	***.21***	-.11	-.04	***-.15***
Intimacy Avoidance	***.16***	***.20***	.10	***-.34***	***-.40***	***-.18***	***-.15***	***-.19***	-.06	***-.40***	***-.48***	***-.20***	***-.16***	-.11	***-.16***
Irresponsibility	***.24***	***.18***	***.26***	***-.39***	***-.30***	***-.39***	***-.48***	***-.42***	***-.38***	-.10	***-.14***	-.02	***-.14***	-.01	***-.23***
Manipulativeness	.02	-.08	***.12***	***-.37***	***-.18***	***-.51***	***-.12***	-.06	***-.14***	***.29***	.11	***.40***	.05	.00	.08
Perceptual Dysregulation	***.31***	***.30***	***.27***	***-.25***	***-.16***	***-.29***	***-.32***	***-.36***	***-.18***	-.09	***-.16***	.02	-.06	.07	***-.18***
Perseveration	***.51***	***.51***	***.43***	***-.16***	***-.13***	***-.15***	***-.27***	***-.46***	.01	***-.22***	***-.20***	***-.18***	***-.21***	-.06	***-.30***
Restricted Affectivity	.00	.04	-.03	***-.53***	***-.61***	***-.29***	***-.15***	***-.17***	-.09	***-.49***	***-.60***	***-.25***	***-.21***	***-.22***	***-.12***
Rigid Perfectionism	***.34***	***.31***	***.31***	***-.20***	***-.20***	***-.15***	***.28***	.01	***.46***	-.11	***-.20***	.00	***-.14***	***-.15***	-.08
Risk Taking	***-.17***	***-.25***	-.06	***-.16***	.02	***-.34***	***-.24***	-.07	***-.35***	***.39***	***.27***	***.41***	***.14***	.10	***.13***
Separation Insecurity	***.44***	***.43***	***.37***	-.03	.06	***-.13***	***-.18***	***-.26***	-.04	.02	.07	-.03	***-.21***	-.10	***-.26***
Submissiveness	***.32***	***.42***	***.17***	***.19***	***.16***	***.18***	***-.19***	***-.34***	.03	***-.19***	.03	***-.35***	***-.24***	-.08	***-.33***

Suspiciousness	***.36***	***.32***	***.35***	***-.34***	***-.33***	***-.26***	-.11	***-.20***	.02	***-.24***	***-.34***	-.08	-.11	-.02	***-.16***
Unusual Beliefs	***.12***	.07	***.14***	***-.25***	***-.16***	***-.30***	***-.18***	***-.17***	***-.13***	.01	-.09	.11	.01	.07	-.06
Withdrawal	***.28***	***.32***	***.20***	***-.44***	***-.58***	***-.15***	***-.06***	***-.18***	.08	***-.70***	***-.78***	***-.43***	***-.18***	***-.12***	***-.18***

Note. N = 499. Emphasized values are significant at $p < .01$. BFAS = Big Five Aspect Scales;N = Neuroticism; With = Withdrawal; Vol = Volatility; A = Agreeableness; Comp = Compassion; Pol = Politeness; C = Conscientiousness; Ind = Industriousness; Ord = Orderliness; E = Extraversion; Enth = Enthusiasm; Assert = Assertiveness; O/I = Openness/Intellect; Open = Openness; Int = Intellect; PID-5 = Personality Inventory for DSM-5.

Table 33

Intercorrelations Between the PID-5 Domains and Facets in the Combined Dataset

	PID-5 Domain				
PID-5 Facet	Negative Affect	Detachment	Antagonism	Disinhibition	Psychoticism
Anhedonia	***.46***	***.84***	***.12***	***.34***	***.39***
Anxiousness	***.86***	***.45***	.10	***.35***	***.39***
Attention Seeking	***.32***	***-.14***	***.61***	***.43***	***.34***
Callousness	.11	***.54***	***.64***	***.47***	***.51***
Deceitfulness	***.35***	***.32***	***.87***	***.59***	***.54***
Depressivity	***.60***	***.71***	***.17***	***.49***	***.51***
Distractability	***.55***	***.39***	***.31***	***.84***	***.54***
Eccentricity	***.36***	***.47***	***.44***	***.53***	***.89***
Emotional Lability	***.87***	***.27***	***.30***	***.48***	***.43***
Grandiosity	***.15***	***.16***	***.84***	***.37***	***.46***
Hostility	***.52***	***.45***	***.56***	***.49***	***.50***
Impulsivity	***.27***	***.14***	***.50***	***.84***	***.48***
Intimacy Avoidance	***.15***	***.80***	***.25***	***.35***	***.41***
Irresponsibility	***.34***	***.38***	***.52***	***.80***	***.56***
Manipulativeness	***.21***	.08	***.89***	***.41***	***.46***
Perceptual Dysregulation	***.51***	***.44***	***.50***	***.65***	***.88***
Perseveration	***.67***	***.50***	***.40***	***.61***	***.62***
Restricted Affectivity	.04	***.66***	***.35***	***.30***	***.45***
Rigid Perfectionism	***.45***	***.39***	***.34***	***.17***	***.38***
Risk Taking	-.01	***-.17***	***.40***	***.40***	***.30***
Separation Insecurity	***.77***	.07	***.29***	***.36***	***.29***
Submissiveness	***.40***	.11	.08	***.22***	.08

Suspiciousness	***.43***	***.55***	***.39***	***.42***	***.54***
Unusual Beliefs	***.32***	***.32***	***.55***	***.51***	***.86***
Withdrawal	***.23***	***.90***	***.16***	***.24***	***.41***

Note. N = 499. Emphasized values are significant at p < .01. PID-5 = Personality Inventory for DSM-5.

Table 34

Correlations Between Political Ideology Measures and PID-5 Facets in the Combined Dataset

PID-5 Aspect	PID-5 Domain MFQ Progressivism	SWB	RWA	SDO	Self Report Democrat	Self Report Republican	Political Spectrum Rank
Anhedonia	.05	.08	-.04	***.14***	.03	-.07	-.03
Anxiousness	.07	-.04	***-.13***	-.03	***.17***	-.07	***-.13***
Attention Seeking	***-.16***	.04	.06	***.16***	.08	.05	-.06
Callousness	***-.17***	***.26***	***.20***	***.41***	-.11	.11	.07
Deceitfulness	***-.12***	***.13***	.05	***.27***	.06	-.01	-.07
Depressivity	.05	.03	-.07	.09	.08	-.07	-.11
Distractability	.00	-.01	-.08	.07	***.14***	-.05	***-.13***
Eccentricity	.02	.00	-.05	.09	.01	-.04	-.07
Emotional Lability	.04	-.06	-.11	-.01	***.12***	-.06	-.10
Grandiosity	***-.24***	***.20***	***.18***	***.32***	-.01	***.12***	.04
Hostility	***-.12***	***.19***	.09	***.28***	-.02	.02	-.01
Impulsivity	***-.13***	.05	.05	***.16***	.06	.03	-.04
Intimacy Avoidance	-.07	.07	.07	***.21***	-.02	.03	-.01
Irresponsibility	-.10	.06	.04	***.19***	.06	-.01	-.08
Manipulativeness	***-.13***	.10	.04	***.18***	.04	.01	-.02
Perceptual Dysregulation	-.05	.05	.02	***.16***	.09	-.04	-.05
Perseveration	-.11	.09	.07	***.17***	.09	.00	-.05
Restricted Affectivity	-.10	***.18***	.11	***.26***	-.06	.06	.08
Rigid Perfectionism	***-.18***	***.25***	***.17***	***.22***	-.05	***.15***	.11
Risk Taking	-.04	-.05	-.01	.05	.03	.02	-.05
Separation Insecurity	***-.13***	***.12***	.06	.10	.09	.04	-.04

Submissiveness	-.10	.05	-.02	.05	.08	.09	-.02
Suspiciousness	***-.14***	***.18***	***.13***	***.25***	-.09	.05	.03
Unusual Beliefs	***-.13***	.08	.07	***.16***	.03	-.01	-.03
Withdrawal	-.01	***.17***	.05	***.21***	-.08	.03	.03

Note. N = 499 except for Self Report Democrat (N = 491) and Self Report Republican (N = 486). Emphasized values are significant at $p < .01$. PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 35

Age and Gender Correlations with Predictors and Mediators

Variable	Age	Gender
LQ	-.04	***-.15***
LQ-Abs	-.05	***-.14***
Familial NRH	-.03	.05
BAS	***-.24***	-.10
BAS-FS	***-.33***	-.05
BAS-RR	***-.13***	***-.22***
BAS-D	***-.12***	.03
BIS	***-.21***	***-.37***
BIS-A	***-.22***	***-.36***
FFFS	***-.14***	***-.30***
NA	***-.34***	***-.16***
PA	***-.20***	.02
ATQ-Avoid	***-.20***	***-.29***
ATQ-App	***-.28***	***-.13***
MM-App	-.02	***-.15***
MM-Avoid	.04	.06
DiffScore-RT	-.02	.06
DiffScore-Error	***.15***	.06

Note. N = 499, except for DiffScore-RT (N = 430) and DiffScore-Error (N = 432). Emphasized values are significant at $p < .01$. Gender was scored as 1=Female and 2=Male, so more negative correlations indicate a variable that females tended to score highly on, while more positive correlations indicate a variable males tended to score highly on. LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handednes; BAS = Behavioral Activation System; BAS-FS = BAS Fun Seeking; BAS-RR = BAS Reward Responsiveness; BAS-D = BAS Drive; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ-Avoid = Approach-Avoidance Temperament Questionnnaire - Avoidance; ATQ-App = Approach-Avoidance Temperament Questionnnaire - Approach; PA = Positive and Negative Affect Scale-Positive Affect; NA = Positive and Negative Affect Scale-Negative Affect; MM-App = Moral Motives Approach; MM-Avoid=Moral Motives Avoidance; DiffScore-RT = Difference between push and pull reaction times on mushroom task; DiffScore-Error = Difference in push and pull error rates on mushroom task.

Table 36

Age and Gender Correlations with Criteria

Variable	Age	Gender
BFAS Neuroticism	***-.19***	***-.29***
BFAS Withdrawal	***-.22***	***-.32***
BFAS Volatility	***-.13***	***-.21***
BFAS Agreeableness	-.08	***-.28***
BFAS Compassion	***-.18***	***-.25***
BFAS Politeness	.06	***-.25***
BFAS Conscientiousness	.09	-.04
BFAS Industriousness	***.19***	.07
BFAS Orderliness	-.05	***-.15***
BFAS Extraversion	***-.19***	-.01
BFAS Enthusiasm	***-.19***	-.08
BFAS Assertiveness	***-.14***	.07
BFAS Openness/Intellect	.04	.04
BFAS Openness	-.01	-.05
BFAS Intellect	.08	***.13***
PID-5 Negative Affect	***-.24***	***-.20***
PID-5 Detachment	***.13***	.07
PID-5 Antagonism	***-.12***	***.25***
PID-5 Disinhibition	***-.15***	.10
PID-5 Psychoticism	***-.13***	***.18***
MFQ Progressivism	.00	-.08
SWB	.11	.06
RWA	.10	.09

SDO	-.01	***.12***
Self Report Democrat	***-.17***	-.09
Self Report Republican	.00	.00
Political Spectrum Rank	.09	.03

Note. N = 499, except for Self Report Democrat (N = 491) and Self Report Republican (N = 486). Emphasized values are significant at $p < .01$. Gender was scored as 1=Female and 2=Male, so more negative correlations indicate a variable that females tended to score highly on, while more positive correlations indicate a variable males tended to score highly on. BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 37

Effects of Handedness Classification on Predictor-Mediator Associations in Combined Dataset

	Predictor							
Mediator	LQ	LQAbs	FamilialNRH	Self Report RL	Med. Split +80	Med. Split +71	RL Split +/- 71	RL Split +/-50
BAS	–	–	–	–	–	–	–	–
BAS-FS	–	–	–	–	–	–	–	–
BAS-RR	–	Consistent**	–	–	Consistent*	Consistent**	–	–
BAS-D	–	–	–	–	–	–	–	–
BIS	Right**	Consistent**	–	–	Consistent**	Consistent**	–	–
BIS-A	Right**	Consistent**	–	–	Consistent*	Consistent**	–	–
FFFS	Right**	Consistent**	–	–	Consistent**	Consistent**	–	–
NA	Right**	Consistent*	–	Right**	–	–	Right*	Right**
PA	–	–	–	–	–	–	–	–
ATQ-Avoid	Right**	Consistent**	–	–	Consistent*	Consistent**	–	–
ATQ-App	–	Consistent*	–	–	–	–	–	–
MM-App	–	–	–	–	–	–	–	–
MM-Avoid	Left*	Inconsistent*	Left/Inconsistent**	–	Inconsistent*	–	–	–
DiffScore-RT	Right*	–	–	–	–	–	–	–
DiffScore-Error	–	–	–	–	–	–	–	–

* = $p < .05$

** = $p < .01$

Note. N = 499, except for DiffScore-RT (N = 430) and DiffScore-Error (N = 432). For all significant relationships, the category of handedness (left, right, inconsistent, or consistent) associated with higher scores on that mediator variable is listed. LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handedness; Self Report RL = self report question asking participants if they are right or left handed; Med. Split 80 = split using traditional EHI median score of +80; Med. Split +71 = median split using this dataset's median EHI score of +.71; RL Split +/- 71 = comparing those above the median EHI score of +71 to those below -71 without including those in the middle; RL Split +/- 50 = comparing those above +50 to those below -50 without including those in the middle; BAS = Behavioral Activation System; BAS-FS = BAS Fun Seeking; BAS-RR = BAS Reward Responsiveness; BAS-D = BAS Drive; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ-Avoid = Approach-Avoidance Temperament Questionnnaire - Avoidance; ATQ-App = Approach-Avoidance Temperament Questionnnaire - Approach; PA = Positive and Negative Affect Scale-Positive Affect; NA = Positive and Negative Affect Scale-Negative Affect; MM-App = Moral Motives Approach; MM-Avoid=Moral Motives Avoidance; DiffScore-RT = Difference between push and pull reaction times on mushroom task; DiffScore-Error = Difference in push and pull error rates on mushroom task.

Table 38

Effects of Handedness Classification on Predictor-Criterion Associations in Combined Dataset

Mediator	Predictor							
	LQ	LQAbs	FamilialNRH	Self Report RL	Med. Split +80	Med. Split +71	RL Split +/- 71	RL Split +/-50
BFAS Neuroticism	Right**	Consistent**	–	–	Consistent*	Consistent**	–	Right*
BFAS Withdrawal	Right**	Consistent**	–	–	Consistent*	Consistent**	–	–
BFAS Volatility	Right**	Consistent*	–	–	Consistent*	Consistent*	–	Right*
BFAS Agreeableness	–	Consistent**	–	–	Consistent**	Consistent**	–	–
BFAS Compassion	Right**	Consistent**	–	–	Consistent**	Consistent**	–	–
BFAS Politeness	–	–	–	–	–	–	–	–
BFAS Conscientiousness	–	–	–	–	–	–	–	–
BFAS Industriousness	Left*	–	–	–	–	–	–	–
BFAS Orderliness	–	–	–	–	–	–	–	–
BFAS Extraversion	–	–	–	–	–	–	–	–
BFAS Enthusiasm	–	–	–	–	–	–	–	–
BFAS Assertiveness	–	–	–	–	–	–	–	–
BFAS Openness/Intellect	Left*	Inconsistent*	–	–	Inconsistent**	Inconsistent*	–	Left*
BFAS Openness	–	–	–	–	–	–	–	–
BFAS Intellect	Left*	Inconsistent*	–	–	Inconsistent**	–	–	–
PID-5 Negative Affect	Right**	Consistent**	–	Right**	–	Consistent*	–	Consistent*
PID-5 Detachment	–	–	–	–	–	–	–	–
PID-5 Antagonism	–	–	–	Right*	–	–	–	–
PID-5 Disinhibition	–	–	–	–	–	–	–	–
PID-5 Psychoticism	–	Inconsistent*	Left/Inconsistent**	–	–	Inconsistent*	–	–
MFQ Progressivism	–	–	Right*	–	–	–	–	–

SWB	–	–	–	–	–	–	–	–
RWA	–	–	–	–	–	–	–	–
SDO	–	–	–	–	–	–	–	–
Self Report Democrat	–	Consistent*	–	–	–	–	–	–
Self Report Republican	–	–	–	–	–	–	–	–
Political Spectrum Rank	–	–	–	–	–	–	–	–

* = $p < .05$

** = $p < .01$

Note. N = 499, except for Self Report Democrat (N = 491) and Self Report Republican (N = 486). For all significant relationships, the category of handedness listed (left, right, inconsistent, or consistent) is associated with higher scores on that mediator variable. LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handedness; Self Report RL = self report question asking participants if they are right or left handed; Med. Split 80 = split using traditional EHI median score of +80; Med. Split +71 = median split using this dataset's median EHI score of +.71; RL Split +/- 71 = comparing those above the median EHI score of +71 to those below -71 without including those in the middle; RL Split +/- 50 = comparing those above +50 to those below -50 without including those in the middle; BFAS = Big Five Aspect Scales; PID-5 = Personality Inventory for DSM-5; MFQ Progressivism = Moral Foundations Questionnaire Progressivism score; SWB = Society Works Best Index; RWA = Right-Wing Authoritarianism; SDO = Social Dominance Orientation.

Table 39

Effects of Handedness Classification on Predictor-PID-5 Aspect Associations in Combined Dataset

	Predictor							
PID-5 Aspect	LQ	LQAbs	FamilialNRH	Self Report RL	Med. Split +80	Med. Split +71	RL Split +/- 71	RL Split +/-50
Anhedonia	–	–	–	–	–	–	–	–
Anxiousness	Right*	Consistent*	–	–	–	–	–	–
Attention Seeking	Right*	–	–	–	–	–	–	–
Callousness	–	Inconsistent**	–	–	–	Inconsistent*	–	–
Deceitfulness	–	–	–	–	–	–	–	–
Depressivity	–	–	–	Right**	–	–	–	–
Distractability	–	–	–	Right*	–	–	–	–
Eccentricity	–	Inconsistent*	Left/Inconsistent**	–	Inconsistent*	Inconsistent*	–	–
Emotional Lability	Right**	Consistent*	–	Right**	Consistent*	–	Right*	Right**
Grandiosity	–	–	–	–	–	–	–	–
Hostility	Right*	–	–	Right*	–	–	–	Right*
Impulsivity	–	–	–	–	–	–	–	–
Intimacy Avoidance	–	–	–	–	–	–	–	–
Irresponsibility	–	–	–	–	–	–	–	–
Manipulativeness	–	–	–	–	–	Inconsistent*	–	–
Perceptual Dysregulation	–	–	–		–	–	–	–
Perseveration	–	–	–	–	–	–	–	–
Restricted Affectivity	–	–	–	–	–	–	–	–
Rigid Perfectionism	Right*	Consistent*	–	–	–	–	–	–
Risk Taking	–	–	–	–	–	–	–	–
Separation Insecurity	Right**	Consistent**	–	Right**	–	Consistent*	–	–

Submissiveness	Right**	Consistent**	–	–	Consistent**	Consistent**	–	–
Suspiciousness	–	–	–	–	–	–	–	–
Unusual Beliefs	–	Inconsistent*	Left/Inconsistent**	–	–	Inconsistent*	–	–
Withdrawal	–	–	–	–	–	–	–	–

* = $p < .05$

** = $p < .01$

Note. $N = 499$. For all significant relationships, the category of handedness listed (left, right, inconsistent, or consistent) is associated with higher scores on that mediator variable. LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; Familial NRH = Familial non-right handedness; Self Report RL = self report question asking participants if they are right or left handed; Med. Split 80 = split using traditional EHI median score of +80; Med. Split +71 = median split using this dataset's median EHI score of +.71; RL Split +/- 71 = comparing those above the median EHI score of +71 to those below -71 without including those in the middle; RL Split +/- 50 = comparing those above +50 to those below -50 without including those in the middle.

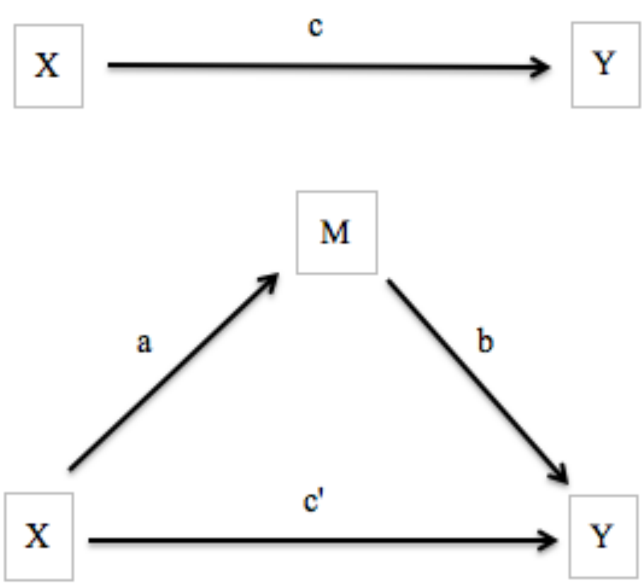
Table 40

Results of Exploratory Mediation Analyses in the Combined Dataset

Tested Mediation Model			Path *a*				Path *b*				Path *c* (Total Effect)				Path *c′* (Direct Effect)			Path *ab* (Indirect Effect)		
Predictor	Mediator	Criterion	*b*	*SE*	*p*	R^2	*b*	*SE*	*p*	R^2	*b*	*SE*	*p*	R^2	*b*	*SE*	*p*	ab_{cs}	*SE*	99% CI
LQ-Abs	BIS	BFAS Neur	.028	.006	<.001	.044	.123	.006	<.001	.443	.003	.001	.004	.017	.000	.000	.719	.141	.031	.062, .217
LQ-Abs	BIS	BFAS With	.028	.006	<.001	.044	.147	.006	<.001	.526	.004	.001	.002	.020	.000	.001	.727	.153	.033	.071, .237
LQ-Abs	BIS	PID-5 NA	.028	.006	<.001	.044	.084	.006	<.001	.331	.003	.001	.002	.020	.000	.001	.582	.120	.027	.051, .189
LQ-Abs	BIS-A	BFAS Neur	.016	.004	<.001	.038	.168	.011	<.001	.325	.003	.001	.004	.017	.000	.001	.626	.110	.027	.041, .180
LQ-Abs	BIS-A	BFAS With	.016	.004	<.001	.038	.206	.011	<.001	.406	.004	.001	.002	.020	.001	.001	.590	.123	.030	.045, .202
LQ-Abs	BIS-A	PID-5 NA	.016	.004	<.001	.038	.119	.009	<.001	.262	.003	.001	.002	.020	.001	.001	.271	.098	.024	.037, .161
LQ-Abs	FFFS	BFAS Neur	.012	.003	<.001	.034	.242	.013	<.001	.411	.003	.001	.004	.017	.000	.001	.768	.118	.023	.047, .191
LQ-Abs	FFFS	BFAS With	.012	.003	<.001	.034	.281	.014	<.001	.460	.004	.001	.002	.020	.001	.001	.598	.124	.030	.046, .202
LQ-Abs	FFFS	PID-5 NA	.012	.003	<.001	.034	.158	.012	<.001	.283	.003	.001	.002	.020	.001	.001	.251	.096	.024	.035, .158
LQ-Abs	ATQ-Avoid	BFAS Neur	.044	.012	<.001	.025	.066	.003	<.001	.565	.003	.001	.004	.017	.000	.001	.755	.119	.034	.029, .206
LQ-Abs	ATQ-Avoid	BFAS With	.044	.012	<.001	.025	.076	.003	<.001	.634	.004	.001	.002	.020	.000	.001	.552	.126	.035	.037, .214
LQ-Abs	ATQ-Avoid	PID-5 NA	.044	.012	<.001	.025	.053	.002	<.001	.577	.003	.001	.002	.020	.000	.001	.479	.120	.033	.032, .206
LQ	BIS	BFAS Neur	.013	.004	<.001	.026	.121	.006	<.001	.446	.002	.001	.001	.024	.001	.001	.149	.106	.028	.033, .180
LQ	BIS	BFAS With	.013	.004	<.001	.026	.146	.006	<.001	.528	.002	.001	.001	.023	.001	.001	.247	.116	.030	.034, .190
LQ	BIS	PID-5 NA	.013	.004	<.001	.026	.083	.005	<.001	.336	.002	.001	<.001	.028	.001	.001	.039	.091	.024	.028, .151
LQ	BIS-A	BFAS Neur	.006	.002	.005	.016	.166	.011	<.001	.331	.002	.001	.001	.024	.001	.001	.022	.070	.025	.006, .132
LQ	BIS-A	BFAS With	.006	.002	.005	.016	.205	.011	<.001	.411	.002	.001	.001	.023	.001	.001	.034	.078	.028	.009, .150
LQ	BIS-A	PID-5 NA	.006	.002	.005	.016	.117	.009	<.001	.271	.002	.001	<.001	.028	.001	.000	.007	.062	.022	.004, .120
LQ	FFFS	BFAS Neur	.007	.002	<.001	.030	.240	.013	<.001	.413	.002	.001	.001	.024	.001	.001	.187	.109	.027	.034, .180
LQ	FFFS	BFAS With	.007	.002	<.001	.030	.279	.014	<.001	.461	.002	.001	.001	.023	.001	.001	.271	.115	.028	.045, .192
LQ	FFFS	PID-5 NA	.007	.002	<.001	.030	.156	.012	<.001	.287	.002	.001	<.001	.028	.001	.000	.042	.089	.023	.035, .151
LQ	ATQ-Avoid	BFAS Neur	.023	.007	.002	.020	.065	.003	<.001	.568	.002	.001	.001	.024	.001	.000	.100	.106	.034	.016, .192
LQ	ATQ-Avoid	BFAS With	.023	.007	.002	.020	.076	.003	<.001	.635	.002	.001	.001	.023	.001	.000	.145	.112	.035	.020, .199
LQ	ATQ-Avoid	PID-5 NA	.023	.007	.002	.020	.052	.002	<.001	.580	.002	.001	<.001	.028	.001	.000	.039	.106	.034	.019, .190

Note. N = 499. All mediation models listed here showed evidence of mediation as the CIs of the completely standardized indirect effects did not include zero and the p-values for the a, b, and c paths were all significant at p <.01. The only questionable result was the LQ/BIS-A/PID-5 Negative Affect model, which meets these criteria but has a CI very close to zero and a significant c' path at p <.01, which Barron and Kenny (1986) considered as evidence against mediation. ab_{cs} = Completely standardized indirect effect, LQ = Laterality quotient; LQ-Abs = Laterality quotient absolute value; BIS = Behavioral Inhibition System; BIS-A = BIS Anxiety; FFFS = Fight Flight Freezing System; ATQ-Avoid = Approach-Avoidance Temperament Questionnnaire - Avoidance; BFAS Neur = Big Five Aspect Scales Neuroticism; BFAS With =Big Five Aspect Scales Withdrawal; PID-5 NA = Personality Inventory for DSM-5 Negative Affect.

Figure 1 . Diagram depicting relationships in a typical mediation analysis.



Note. This diiagram depicts relationships between the predictor (X), the mediator (M), and the criterion (Y) in a typical mediation analysis. Path c is the total effect, path c’ is the direct effect, and path ab is the indirect effect.

Appendix A

The EHI

Instructions

Please indicate your preference in the use of hands in the following activities by putting a '1' in the appropriate column. Where the preference is so strong that you would never try to use the other hand unless absolutely forced to, put a '2'. If in any case you are really indifferent, put a '1' in both columns. Some of the activities require both hands. In these cases the part of the task or object for which hand preference is wanted is indicated in parentheses. Please try to answer all the questions, and only leave a blank if you have had no experience at all of the object or task.

	Left	Right
Writing		
Drawing		
Throwing		
Scissors		
Toothbrush		
Knife (without fork)		
Spoon		
Broom (upper hand)		
Striking match (match)		
Opening box (lid		

Appendix B

The BIS/BAS

Below are a series of statements concerning certain behaviors or feelings about certain situations.
Please indicate the degree to which you agree or disagree with each statement using the scale below:

1	2	3	4
agree strongly	agree somewhat	disagree somewhat	disagree strongly

1. I feel worried when I think I have done poorly at something.
2. I will often do things for no other reason than that they might be fun.
3. I worry about making mistakes.
4. I go out of my way to get things I want.
5. When I get something I want, I feel excited and energized.
6. I crave excitement and new sensations.
7. Criticism or scolding hurts me quite a bit.
8. I often act on the spur of the moment.
9. If I see a chance to get something I want, I move on it right away.
10. When good things happen to me, it affects me strongly.
11. If I think something unpleasant is going to happen, I usually get pretty "worked up."
12. When I see an opportunity for something I like, I get excited right away.
13. I feel pretty worried or upset when I think or know somebody is angry at me.
14. It would excite me to win a contest.
15. When I go after something I use a "no holds barred" approach.
16. I'm always willing to try something new if I think it will be fun.
17. I have very few fears compared to my friends.
18. When I want something, I usually go all-out to get it.
19. When I'm doing well at something, I love to keep at it.
20. Even if something bad is about to happen to me, I rarely experience fear or nervousness.

Appendix C

The ATQ

Please indicate how much you agree or disagree with each of the following statements by writing a number in the space provided. All of your responses are anonymous and confidential. Please select numbers according to the following scale:

1	2	3	4	5	6	7
Strongly Disagree			Neither Agree Nor Disagree			Strongly Agree

____1. By nature, I am a very nervous person.
____2. Thinking about the things I want really energizes me.
____3. It doesn't take much to make me worry.
____4. When I see an opportunity for something I like, I immediately get excited.
____5. It doesn't take a lot to get me excited and motivated.
____6. I feel anxiety and fear very deeply.
____7. I react very strongly to bad experiences.
____8. I'm always on the lookout for positive opportunities and experiences.
____9. When it looks like something bad could happen, I have a strong urge to escape.
____10. When good things happen to me, it affects me very strongly.
____11. When I want something, I feel a strong desire to go after it.
____12. It is easy for me to imagine bad things that might happen to me.

Appendix D

The PANAS

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you generally feel this way, that is, how you feel on the average. Use the following scale to record your answers.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

______	interested	______	irritable
______	distressed	______	alert
______	excited	______	ashamed
______	upset	______	inspired
______	strong	______	nervous
______	guilty	______	determined
______	scared	______	attentive
______	hostile	______	jittery
______	enthusiastic	______	active
______	proud	______	afraid

Appendix E

The MM Scale

We are interested in the extent to which you agree or disagree with the statements below. Using the following scale, please indicate the extent of your agreement by placing the number that best represents your response on the line following each statement. There are no correct or incorrect reactions, so please be as honest as possible in responding. Thanks.

Strongly Disagree					**Strongly Agree**	
1	**2**	**3**	**4**	**5**	**6**	**7**

1. It's particularly important to me to demonstrate self-control in the face of temptation. _______

2. We should all be responsible for improving the welfare of others beyond our immediate circle of friends and family. ________

3. Giving people the freedom to choose the way they live threatens the societal bonds that hold us together. ________

4. I'm willing to put the necessary time and effort into providing for my own well-being and success. ________

5. It's an obligation, not a matter of personal preference, to provide for people worse off even if we're not close to them. ________

6. I value hard work and personal commitment when it comes to making decisions in my life. _______

7. People should not be completely free to express themselves through their own choice of lifestyle, even if they don't harm others. _______

8. When things get tough, I apply myself and work even harder to overcome difficulties. ________

9. Self-discipline in the lifestyle I choose is an important way for me to feel like a decent person. __________

10. It's important for those who are better off in society to work hard to provide more resources for those who are worse off. ________

11. By bucking tradition and choosing new lifestyles, people are actually threatening the wider society. ___________

12. I demonstrate I'm a better person every time I exercise self- restraint rather than give in to my desires. _________

13. I think it's important to take responsibility for my failures and setbacks rather than blame other people. __________

14. It's not always easy to avoid temptations, but for my own good I feel I really have to try my best. ________

15. If we look after ourselves, we still need to look after others in society. ________

16. Whether or not I have others to lean on, I think it's important for me to try to provide for myself. _________

17. When we try to get people to abide by our own code of behavior, we are not invading other people's privacy and right to choose for themselves. _______

18. In the healthiest societies those at the top feel responsible for providing better lives for those at the bottom. ________

19. Life is full of unhealthy attractions, so it's important for me develop a strong sense of self-discipline and control. ________

20. In a decent society, people should not be free to make their own choices about how to live their lives, but should attend to community standards. _________

Appendix F

The BFAS

Here are a number of characteristics that may or may not describe you. For example, do you agree that you seldom feel blue, compared to most other people? Please fill in the number that best indicates the extent to which you agree or disagree with each statement listed below. Be as honest as possible, but rely on your initial feeling and do not think too much about each item.

Use the following scale:

1 - - - - - - - - 2 - - - - - - - - - 3 - - - - - - - - - 4 - - - - - - - - 5

Strongly Disagree	**Neither Agree Nor Disagree**	**Strongly Agree**

1. ___ Seldom feel blue.
2. ___ Am not interested in other people's problems.
3. ___ Carry out my plans.
4. ___ Make friends easily.
5. ___ Am quick to understand things.
6. ___ Get angry easily.
7. ___ Respect authority.
8. ___ Leave my belongings around.
9. ___ Take charge
10. ___ Enjoy the beauty of nature.
11. ___ Am filled with doubts about things.
12. ___ Feel others' emotions.

12a. ___ Place a "3" on the line.

13. ___ Waste my time.
14. ___ Am hard to get to know.
15. ___ Have difficulty understanding abstract ideas.
16. ___ Rarely get irritated.
17. ___ Believe that I am better than others.
18. ___ Like order.
19. ___ Have a strong personality.
20. ___ Believe in the importance of art.
21. ___ Feel comfortable with myself.
22. ___ Inquire about others' well-being.
23. ___ Find it difficult to get down to work.
24. ___ Keep others at a distance.
25. ___ Can handle a lot of information.
26. ___ Get upset easily.
27. ___ Hate to seem pushy.
28. ___ Keep things tidy.
29. ___Lack the talent for influencing people.
30. ___ Love to reflect on things.
31. ___ Feel threatened easily.
32. ___ Can't be bothered with other's needs.

33. ___ Mess things up.

34. ___ Reveal little about myself.

35. ___ Like to solve complex problems.

36. ___ Keep my emotions under control.

37. ___ Take advantage of others.

38. ___ Follow a schedule.

39. ___ Know how to captivate people.

40. ___ Get deeply immersed in music.

41. ___ Rarely feel depressed.

41a. ___Place a “5” on the line.

42. ___ Sympathize with others' feelings.

43. ___ Finish what I start.

44. ___ Warm up quickly to others.

45. ___ Avoid philosophical discussions.

46. ___ Change my mood a lot.

47. ___ Avoid imposing my will on others.

48. ___ Am not bothered by messy people.

49. ___ Wait for others to lead the way.

50. ___ Do not like poetry.

51. ___ Worry about things.

52. ___ Am indifferent to the feelings of others.

53. ___ Don't put my mind on the task at hand.

54. ___ Rarely get caught up in the excitement.

55. ___ Avoid difficult reading material.

56. ___ Rarely lose my composure.

57. ___ Rarely put people under pressure.

58. ___ Want everything to be “just right.”

59. ___ See myself as a good leader.

60. ___ Seldom notice the emotional aspects of paintings and pictures.

61. ___ Am easily discouraged.

62. ___ Take no time for others.

63. ___ Get things done quickly.

64. ___ Am not a very enthusiastic person.

65. ___ Have a rich vocabulary.

65a. ___Place a “1” on the line.

66. ___ Am a person whose moods go up and down easily.

67. ___ Insult people.

68. ___ Am not bothered by disorder.

69. ___ Can talk others into doing things.

70. ___ Need a creative outlet.

71. ___ Am not embarrassed easily.

72. ___ Take an interest in other people's lives.

73. ___ Always know what I am doing.

74. ___ Show my feelings when I'm happy.

75. ___ Think quickly.

76. ___ Am not easily annoyed.

77. ___ Seek conflict.

78. ___ Dislike routine.

79. ___ Hold back my opinions.

80. ___ Seldom get lost in thought.

81. ___ Become overwhelmed by events.

82. ___ Don't have a soft side.

83. ___ Postpone decisions.

84. ___ Have a lot of fun.

85. ___ Learn things slowly.

86. ___ Get easily agitated.

87. ___ Love a good fight.

88. ___ See that rules are observed.

89. ___ Am the first to act.

90. ___ Seldom daydream.

91. ___ Am afraid of many things.

92. ___ Like to do things for others.

93. ___ Am easily distracted.

94. ___ Laugh a lot.

95. ___ Formulate ideas clearly.

96. ___ Can be stirred up easily.

97. ___ Am out for my own personal gain.

98. ___ Want every detail taken care of.

99. ___ Do not have an assertive personality.

100. ___ See beauty in things that others might not notice

Appendix G

The PID-5

Instructions to the individual receiving care: This is a list of things different people might say about themselves. We are interested in how you would describe yourself. There are no "right" or "wrong" answers. So you can describe yourself as honestly as possible, we will keep your responses confidential. We'd like you to take your time and read each statement carefully, selecting the response that best describes you.						Clinician Use
		Very False or Often False	Sometimes or Somewhat False	Sometimes or Somewhat True	Very True or Often True	Item score
1	I don't get as much pleasure out of things as others seem to.	0	1	2	3	
2	Plenty of people are out to get me.	0	1	2	3	
3	People would describe me as reckless.	0	1	2	3	
4	I feel like I act totally on impulse.	0	1	2	3	
5	I often have ideas that are too unusual to explain to anyone.	0	1	2	3	
6	I lose track of conversations because other things catch my attention.	0	1	2	3	
7	I avoid risky situations.	0	1	2	3	
8	When it comes to my emotions, people tell me I'm a "cold fish".	0	1	2	3	
9	I change what I do depending on what others want.	0	1	2	3	
10	I prefer not to get too close to people.	0	1	2	3	
11	I often get into physical fights.	0	1	2	3	
12	I dread being without someone to love me.	0	1	2	3	
13	Being rude and unfriendly is just a part of who I am.	0	1	2	3	
14	I do things to make sure people notice me.	0	1	2	3	
15	I usually do what others think I should do.	0	1	2	3	
16	I usually do things on impulse without thinking about what might happen as a result.	0	1	2	3	
17	Even though I know better, I can't stop making rash decisions.	0	1	2	3	
18	My emotions sometimes change for no good reason.	0	1	2	3	
19	I really don't care if I make other people suffer.	0	1	2	3	
20	I keep to myself.	0	1	2	3	
21	I often say things that others find odd or strange.	0	1	2	3	
22	I always do things on the spur of the moment.	0	1	2	3	
23	Nothing seems to interest me very much.	0	1	2	3	
24	Other people seem to think my behavior is weird.	0	1	2	3	
25	People have told me that I think about things in a really strange way.	0	1	2	3	
26	I almost never enjoy life.	0	1	2	3	
27	I often feel like nothing I do really matters.	0	1	2	3	
28	I snap at people when they do little things that irritate me.	0	1	2	3	
29	I can't concentrate on anything.	0	1	2	3	
30	I'm an energetic person.	0	1	2	3	
31	Others see me as irresponsible.	0	1	2	3	
32	I can be mean when I need to be.	0	1	2	3	
33	My thoughts often go off in odd or unusual directions.	0	1	2	3	
34	I've been told that I spend too much time making sure things are exactly in place.	0	1	2	3	
35	I avoid risky sports and activities.	0	1	2	3	
36	I can have trouble telling the difference between dreams and waking life.	0	1	2	3	

		Very False or Often False	Sometimes or Somewhat False	Sometimes or Somewhat True	Very True or Often True	Item score
37	Sometimes I get this weird feeling that parts of my body feel like they're dead or not really me.	0	1	2	3	
38	I am easily angered.	0	1	2	3	
39	I have no limits when it comes to doing dangerous things.	0	1	2	3	
40	To be honest, I'm just more important than other people.	0	1	2	3	
41	I make up stories about things that happened that are totally untrue.	0	1	2	3	
42	People often talk about me doing things I don't remember at all.	0	1	2	3	
43	I do things so that people just have to admire me.	0	1	2	3	
44	It's weird, but sometimes ordinary objects seem to be a different shape than usual.	0	1	2	3	
45	I don't have very long-lasting emotional reactions to things.	0	1	2	3	
46	It is hard for me to stop an activity, even when it's time to do so.	0	1	2	3	
47	I'm not good at planning ahead.	0	1	2	3	
48	I do a lot of things that others consider risky.	0	1	2	3	
49	People tell me that I focus too much on minor details.	0	1	2	3	
50	I worry a lot about being alone.	0	1	2	3	
51	I've missed out on things because I was busy trying to get something I was doing exactly right.	0	1	2	3	
52	My thoughts often don't make sense to others.	0	1	2	3	
53	I often make up things about myself to help me get what I want.	0	1	2	3	
54	It doesn't really bother me to see other people get hurt.	0	1	2	3	
55	People often look at me as if I'd said something really weird.	0	1	2	3	
56	People don't realize that I'm flattering them to get something.	0	1	2	3	
57	I'd rather be in a bad relationship than be alone.	0	1	2	3	
58	I usually think before I act.	0	1	2	3	
59	I often see vivid dream-like images when I'm falling asleep or waking up.	0	1	2	3	
60	I keep approaching things the same way, even when it isn't working.	0	1	2	3	
61	I'm very dissatisfied with myself.	0	1	2	3	
62	I have much stronger emotional reactions than almost everyone else.	0	1	2	3	
63	I do what other people tell me to do.	0	1	2	3	
64	I can't stand being left alone, even for a few hours.	0	1	2	3	
65	I have outstanding qualities that few others possess.	0	1	2	3	
66	The future looks really hopeless to me.	0	1	2	3	
67	I like to take risks.	0	1	2	3	
68	I can't achieve goals because other things capture my attention.	0	1	2	3	
69	When I want to do something, I don't let the possibility that it might be risky stop me.	0	1	2	3	
70	Others seem to think I'm quite odd or unusual.	0	1	2	3	
71	My thoughts are strange and unpredictable.	0	1	2	3	
72	I don't care about other people's feelings.	0	1	2	3	

		Very False or Often False	Sometimes or Somewhat False	Sometimes or Somewhat True	Very True or Often True	Item score
73	You need to step on some toes to get what you want in life.	0	1	2	3	
74	I love getting the attention of other people.	0	1	2	3	
75	I go out of my way to avoid any kind of group activity.	0	1	2	3	
76	I can be sneaky if it means getting what I want.	0	1	2	3	
77	Sometimes when I look at a familiar object, it's somehow like I'm seeing it for the first time.	0	1	2	3	
78	It is hard for me to shift from one activity to another.	0	1	2	3	
79	I worry a lot about terrible things that might happen.	0	1	2	3	
80	I have trouble changing how I'm doing something even if what I'm doing isn't going well.	0	1	2	3	
81	The world would be better off if I were dead.	0	1	2	3	
82	I keep my distance from people.	0	1	2	3	
83	I often can't control what I think about.	0	1	2	3	
84	I don't get emotional.	0	1	2	3	
85	I resent being told what to do, even by people in charge.	0	1	2	3	
86	I'm so ashamed by how I've let people down in lots of little ways.	0	1	2	3	
87	I avoid anything that might be even a little bit dangerous.	0	1	2	3	
88	I have trouble pursuing specific goals even for short periods of time.	0	1	2	3	
89	I prefer to keep romance out of my life.	0	1	2	3	
90	I would never harm another person.	0	1	2	3	
91	I don't show emotions strongly.	0	1	2	3	
92	I have a very short temper.	0	1	2	3	
93	I often worry that something bad will happen due to mistakes I made in the past.	0	1	2	3	
94	I have some unusual abilities, like sometimes knowing exactly what someone is thinking.	0	1	2	3	
95	I get very nervous when I think about the future.	0	1	2	3	
96	I rarely worry about things.	0	1	2	3	
97	I enjoy being in love.	0	1	2	3	
98	I prefer to play it safe rather than take unnecessary chances.	0	1	2	3	
99	I sometimes have heard things that others couldn't hear.	0	1	2	3	
100	I get fixated on certain things and can't stop.	0	1	2	3	
101	People tell me it's difficult to know what I'm feeling.	0	1	2	3	
102	I am a highly emotional person.	0	1	2	3	
103	Others would take advantage of me if they could.	0	1	2	3	
104	I often feel like a failure.	0	1	2	3	
105	If something I do isn't absolutely perfect, it's simply not acceptable.	0	1	2	3	
106	I often have unusual experiences, such as sensing the presence of someone who isn't actually there.	0	1	2	3	
107	I'm good at making people do what I want them to do.	0	1	2	3	
108	I break off relationships if they start to get close.	0	1	2	3	
109	I'm always worrying about something.	0	1	2	3	
110	I worry about almost everything.	0	1	2	3	

		Very False or Often False	Sometimes or Somewhat False	Sometimes or Somewhat True	Very True or Often True	Item score
111	I like standing out in a crowd.	0	1	2	3	
112	I don't mind a little risk now and then.	0	1	2	3	
113	My behavior is often bold and grabs peoples' attention.	0	1	2	3	
114	I'm better than almost everyone else.	0	1	2	3	
115	People complain about my need to have everything all arranged.	0	1	2	3	
116	I always make sure I get back at people who wrong me.	0	1	2	3	
117	I'm always on my guard for someone trying to trick or harm me.	0	1	2	3	
118	I have trouble keeping my mind focused on what needs to be done.	0	1	2	3	
119	I talk about suicide a lot.	0	1	2	3	
120	I'm just not very interested in having sexual relationships.	0	1	2	3	
121	I get stuck on things a lot.	0	1	2	3	
122	I get emotional easily, often for very little reason.	0	1	2	3	
123	Even though it drives other people crazy, I insist on absolute perfection in everything I do.	0	1	2	3	
124	I almost never feel happy about my day-to-day activities.	0	1	2	3	
125	Sweet-talking others helps me get what I want.	0	1	2	3	
126	Sometimes you need to exaggerate to get ahead.	0	1	2	3	
127	I fear being alone in life more than anything else.	0	1	2	3	
128	I get stuck on one way of doing things, even when it's clear it won't work.	0	1	2	3	
129	I'm often pretty careless with my own and others' things.	0	1	2	3	
130	I am a very anxious person.	0	1	2	3	
131	People are basically trustworthy.	0	1	2	3	
132	I am easily distracted.	0	1	2	3	
133	It seems like I'm always getting a "raw deal" from others.	0	1	2	3	
134	I don't hesitate to cheat if it gets me ahead.	0	1	2	3	
135	I check things several times to make sure they are perfect.	0	1	2	3	
136	I don't like spending time with others.	0	1	2	3	
137	I feel compelled to go on with things even when it makes little sense to do so.	0	1	2	3	
138	I never know where my emotions will go from moment to moment.	0	1	2	3	
139	I have seen things that weren't really there.	0	1	2	3	
140	It is important to me that things are done in a certain way.	0	1	2	3	
141	I always expect the worst to happen.	0	1	2	3	
142	I try to tell the truth even when it's hard.	0	1	2	3	
143	I believe that some people can move things with their minds.	0	1	2	3	
144	I can't focus on things for very long.	0	1	2	3	
145	I steer clear of romantic relationships.	0	1	2	3	
146	I'm not interested in making friends.	0	1	2	3	
147	I say as little as possible when dealing with people.	0	1	2	3	
148	I'm useless as a person.	0	1	2	3	

		Very False or Often False	Sometimes or Somewhat False	Sometimes or Somewhat True	Very True or Often True	Item score
149	I'll do just about anything to keep someone from abandoning me.	0	1	2	3	
150	Sometimes I can influence other people just by sending my thoughts to them.	0	1	2	3	
151	Life looks pretty bleak to me.	0	1	2	3	
152	I think about things in odd ways that don't make sense to most people.	0	1	2	3	
153	I don't care if my actions hurt others.	0	1	2	3	
154	Sometimes I feel "controlled" by thoughts that belong to someone else.	0	1	2	3	
155	I really live life to the fullest.	0	1	2	3	
156	I make promises that I don't really intend to keep.	0	1	2	3	
157	Nothing seems to make me feel good.	0	1	2	3	
158	I get irritated easily by all sorts of things.	0	1	2	3	
159	I do what I want regardless of how unsafe it might be.	0	1	2	3	
160	I often forget to pay my bills.	0	1	2	3	
161	I don't like to get too close to people.	0	1	2	3	
162	I'm good at conning people.	0	1	2	3	
163	Everything seems pointless to me.	0	1	2	3	
164	I never take risks.	0	1	2	3	
165	I get emotional over every little thing.	0	1	2	3	
166	It's no big deal if I hurt other peoples' feelings.	0	1	2	3	
167	I never show emotions to others.	0	1	2	3	
168	I often feel just miserable.	0	1	2	3	
169	I have no worth as a person.	0	1	2	3	
170	I am usually pretty hostile.	0	1	2	3	
171	I've skipped town to avoid responsibilities.	0	1	2	3	
172	I've been told more than once that I have a number of odd quirks or habits.	0	1	2	3	
173	I like being a person who gets noticed.	0	1	2	3	
174	I'm always fearful or on edge about bad things that might happen.	0	1	2	3	
175	I never want to be alone.	0	1	2	3	
176	I keep trying to make things perfect, even when I've gotten them as good as they're likely to get.	0	1	2	3	
177	I rarely feel that people I know are trying to take advantage of me.	0	1	2	3	
178	I know I'll commit suicide sooner or later.	0	1	2	3	
179	I've achieved far more than almost anyone I know.	0	1	2	3	
180	I can certainly turn on the charm if I need to get my way.	0	1	2	3	
181	My emotions are unpredictable.	0	1	2	3	
182	I don't deal with people unless I have to.	0	1	2	3	
183	I don't care about other peoples' problems.	0	1	2	3	
184	I don't react much to things that seem to make others emotional.	0	1	2	3	
185	I have several habits that others find eccentric or strange.	0	1	2	3	
186	I avoid social events.	0	1	2	3	

		Very False or Often False	Sometimes or Somewhat False	Sometimes or Somewhat True	Very True or Often True	Item score
187	I deserve special treatment.	0	1	2	3	
188	It makes me really angry when people insult me in even a minor way.	0	1	2	3	
189	I rarely get enthusiastic about anything.	0	1	2	3	
190	I suspect that even my so-called "friends" betray me a lot.	0	1	2	3	
191	I crave attention.	0	1	2	3	
192	Sometimes I think someone else is removing thoughts from my head.	0	1	2	3	
193	I have periods in which I feel disconnected from the world or from myself.	0	1	2	3	
194	I often see unusual connections between things that most people miss.	0	1	2	3	
195	I don't think about getting hurt when I'm doing things that might be dangerous.	0	1	2	3	
196	I simply won't put up with things being out of their proper places.	0	1	2	3	
197	I often have to deal with people who are less important than me.	0	1	2	3	
198	I sometimes hit people to remind them who's in charge	0	1	2	3	
199	I get pulled off-task by even minor distractions.	0	1	2	3	
200	I enjoy making people in control look stupid.	0	1	2	3	
201	I just skip appointments or meetings if I'm not in the mood.	0	1	2	3	
202	I try to do what others want me to do.	0	1	2	3	
203	I prefer being alone to having a close romantic partner.	0	1	2	3	
204	I am very impulsive.	0	1	2	3	
205	I often have thoughts that make sense to me but that other people say are strange.	0	1	2	3	
206	I use people to get what I want.	0	1	2	3	
207	I don't see the point in feeling guilty about things I've done that have hurt other people.	0	1	2	3	
208	Most of the time I don't see the point in being friendly.	0	1	2	3	
209	I've had some really weird experiences that are very difficult to explain.	0	1	2	3	
210	I follow through on commitments.	0	1	2	3	
211	I like to draw attention to myself.	0	1	2	3	
212	I feel guilty much of the time.	0	1	2	3	
213	I often "zone out" and then suddenly come to and realize that a lot of time has passed.	0	1	2	3	
214	Lying comes easily to me.	0	1	2	3	
215	I hate to take chances.	0	1	2	3	
216	I'm nasty and short to anybody who deserves it.	0	1	2	3	
217	Things around me often feel unreal, or more real than usual.	0	1	2	3	
218	I'll stretch the truth if it's to my advantage.	0	1	2	3	
219	It is easy for me to take advantage of others.	0	1	2	3	
220	I have a strict way of doing things.	0	1	2	3	

Appendix H

The MFQ

MFQ-30

Part 1. When you decide whether something is right or wrong, to what extent are the following considerations relevant to your thinking? Please rate each statement using this scale:

[0] = not at all relevant (This consideration has nothing to do with my judgments of right and wrong)
[1] = not very relevant
[2] = slightly relevant
[3] = somewhat relevant
[4] = very relevant
[5] = extremely relevant (This is one of the most important factors when I judge right and wrong)

_______Whether or not someone suffered emotionally

_______Whether or not some people were treated differently than others

_______Whether or not someone's action showed love for his or her country

_______Whether or not someone showed a lack of respect for authority

_______Whether or not someone violated standards of purity and decency

_______Whether or not someone was good at math

_______Whether or not someone cared for someone weak or vulnerable

_______Whether or not someone acted unfairly

_______Whether or not someone did something to betray his or her group

_______Whether or not someone conformed to the traditions of society

_______Whether or not someone did something disgusting

_______Whether or not someone was cruel

_______Whether or not someone was denied his or her rights

_______Whether or not someone showed a lack of loyalty

_______Whether or not an action caused chaos or disorder

______Whether or not someone acted in a way that God would approve of

Part 2. Please read the following sentences and indicate your agreement or disagreement:

[0]	[1]	[2]	[3]	[4]	[5]
Strongly disagree	Moderately disagree	Slightly disagree	Slightly agree	Moderately agree	Strongly agree

______Compassion for those who are suffering is the most crucial virtue.

______When the government makes laws, the number one principle should be ensuring that everyone is treated fairly.

______I am proud of my country's history.

______Respect for authority is something all children need to learn.

______People should not do things that are disgusting, even if no one is harmed.

______It is better to do good than to do bad.

______One of the worst things a person could do is hurt a defenseless animal.

______Justice is the most important requirement for a society.

______People should be loyal to their family members, even when they have done something wrong.

______Men and women each have different roles to play in society.

______I would call some acts wrong on the grounds that they are unnatural.

______It can never be right to kill a human being.

______ I think it's morally wrong that rich children inherit a lot of money while poor children inherit nothing.

______ It is more important to be a team player than to express oneself.

______ If I were a soldier and disagreed with my commanding officer's orders, I would obey anyway because that is my duty.

______ Chastity is an important and valuable virtue.

Appendix I

The RWA Scale

This survey is part of an investigation of general public opinion concerning a variety of social issues. You will probably find that you agree with some of the statements, and disagree with others, to varying extents. Please indicate your reaction to each statement on the line to the left of each item according to the following scale:

Put a -4 in the blank if you very strongly disagree with the statement.
-3 if you strongly disagree with the statement.
-2 if you moderately disagree with the statement.
-1 if you slightly disagree with the statement.

Put a +1 in the blank if you slightly agree with the statement.
+2 if you moderately agree with the statement.
+3 if you strongly agree with the statement.
+4 if you very strongly agree with the statement.

If you feel exactly and precisely neutral about an item, put a "0" in the blank.

You may find that you sometimes have different reactions to different parts of a statement. For example, you might very strongly disagree ("-4") with one idea in a statement, but slightly agree ("+1") with another idea in the same item. When this happens, please combine your reactions, and write down how you feel on balance (a "-3" in this case).

1. The established authorities generally turn out to be right about things, while the radicals and protestors are usually just "loud mouths" showing off their ignorance. ____

2. Women should have to promise to obey their husbands when they get married. ___

3. Our country desperately needs a mighty leader who will do what has to be done to destroy the radical new ways and sinfulness that are ruining us. ____

4. Gays and lesbians are just as healthy and moral as anybody else. ____

5. It is always better to trust the judgment of the proper authorities in government and religion than to listen to the noisy rabble-rousers in our society who are trying to create doubt in people's minds. ____

6. Atheists and others who have rebelled against the established religions are no doubt every bit as good and virtuous as those who attend church regularly. ____

7. The only way our country can get through the crisis ahead is to get back to our traditional values, put some tough leaders in power, and silence the troublemakers spreading bad ideas. ____

8. There is absolutely nothing wrong with nudist camps. ____

9. Our country needs free thinkers who have the courage to defy traditional ways, even if this upsets many people. ____

10. Our country will be destroyed someday if we do not smash the perversions eating away at our moral fiber and traditional beliefs. ____

11. Everyone should have their own lifestyle, religious beliefs, and sexual preferences, even if it makes them different from everyone else. ____

12. The "old-fashioned ways" and the "old-fashioned values" still show the best way to live. ____

13. You have to admire those who challenged the law and the majority's view by protesting for women's abortion rights, for animal rights, or to abolish school prayer. _____

14. What our country really needs is a strong, determined leader who will crush evil, and take us back to our true path. ____

15. Some of the best people in our country are those who are challenging our government, criticizing religion, and ignoring the "normal way things are supposed to be done." ____

16. God's laws about abortion, pornography and marriage must be strictly followed before it is too late, and those who break them must be strongly punished. ____

17. There are many radical, immoral people in our country today, who are trying to ruin it for their own godless purposes, whom the authorities should put out of action. ____

18. A "woman's place" should be wherever she wants to be. The days when women are submissive to their husbands and social conventions belong strictly in the past. ____

19. Our country will be great if we honor the ways of our forefathers, do what the authorities tell us to do, and get rid of the "rotten apples" who are ruining everything. ____

20. There is no "ONE right way" to live life; everybody has to create their own way. ____

21. Homosexuals and feminists should be praised for being brave enough to defy "traditional" family values. ____

22. This country would work a lot better if certain groups of troublemakers would just shut up and accept their group's traditional place in society. ____

Appendix J

The SDO Scale

INSTRUCTIONS
Below are a series of statements with which you may either agree or disagree. For each statement, please indicate the degree of your agreement\disagreement by putting the appropriate number from '1' to '7' on the dotted line. Put a "1" in the blank if you strongly disagree with a statement, and a "7" if you strongly agree with a statement, as shown in the following scale:

Strongly Disagree Strongly Agree
1 2 3 4 5 6 7

Once again, remember that your first responses are usually the most accurate.

1. Some groups of people are just more worthy than others ....

2. In getting what your group wants, it is sometimes necessary to use force against other groups ....

3. It's OK if some groups have more of a chance in life than others ....

4. To get ahead in life, it is sometimes necessary to step on other groups ....

5. If certain groups of people stayed in their place, we would have fewer problems ....

6. It's probably a good thing that certain groups are at the top and other groups are at the bottom ....

7. Inferior groups should stay in their place ....

8. Sometimes other groups must be kept in their place....................................

9. It would be good if all groups could be equal ....

10. Group equality should be our ideal ....

11. All groups should be given an equal chance in life....................................

12. We should do what we can to equalize conditions for different groups ....

13. We should increase social equality ....

14. We would have fewer problems if we treated different groups more equally ....

15. We should strive to make incomes more equal ....

16. No one group should dominate in society ....

Appendix K

The SWB Index

Please choose one of the two possible responses for each of the following questions by putting an “X” after the option you most agree with.

1. Society works best when…

a. People live according to traditional values

b. People adjust their values to fit changing circumstances

2. Society works best when…

a. Behavioral expectations are based on an external code

b. Behavioral expectations are allowed to evolve over the decades

3. Society works best when…

a. Our leaders stick to their beliefs regardless

b. Our leaders change positions whenever situations change

4. Society works best when…

a. People realize the world is dangerous

b. People assume all those in far away places are kindly

5. Society works best when…

a. We take care of our own people first

b. We realize that people everywhere deserve our help

6. Society works best when…

a. Those who break the rules are punished

b. Those who break the rules are forgiven

7. Society works best when…

a. Every member contributes

b. More fortunate members sacrifice to help others

8. Society works best when…

a. People are rewarded according to merit

b. People are rewarded according to need

9. Society works best when…

a. People take primary responsibility for their welfare

b. People join together to help others

10. Society works best when…

a. People are proud they belong to the best society there is

b. People realize that no society is better than any other

11. Society works best when…

a. Our leaders are obeyed

b. Our leaders are questioned

12. Society works best when…

a. Our leaders call the shots

b. Our leaders are forced to listen to others

13. Society works best when…

a. People recognize the unavoidable flaws of human nature

b. People recognize that humans can be changed in positive ways

14. Society works best when…

a. Our leaders compromise with their opponents in order to get things done

b. Our leaders adhere to their principles no matter what

Appendix L

Sample Mushroom Images

Appendix M

Instructions for the Mushroom AAT Practice and Test Blocks

<u>First set of practice instructions:</u>
In the following task, you will be presented images either GOOD OR BAD mushroom format.
Your task is to: move the MOUSE
TOWARDS you if you see an image of a GOOD mushroom.
(aka move the mouse cursor DOWN)
AWAY from you if you see an image of a BAD mushroom.
(aka move the mouse cursor UP)
When you move the mouse AWAY from you, the image will SHRINK.
When you move the mouse TOWARDS you, the image will ENLARGE.
You need to move the mouse UNTIL the mouse cursor hits the top or bottom of the screen (aka cannot go any further).
Afterwards you will be asked to click on an 'X' in the middle of the screen to bring the mouse cursor back into the center.
Once you clicked on it a new image will be presented.
Click the button to see which mushroom are GOOD and which are BAD.
<u>Second set of practice instructions:</u>
This is practice.
You will be presented with mushroom images that are either GOOD or BAD format.
****
Move the mouse TOWARDS you if you see a GOOD mushroom.
Move the mouse AWAY from you if you see a BAD mushroom.
****
Remember to move the mouse (cursor) until the mouse cursor hits the top or bottom of the screen.
Afterwards you will be asked to click on an 'X' in the middle of the screen to bring the mouse cursor back into the center.
Once you clicked on it a new image will be presented.
Be as fast and accurate as you possibly can.
Click the button to start 40 practice trials.

<u>Test block instructions:</u>
This is the real task.
You will be presented with different types of mushroom images that are either GOOD or BAD format. Just like you did during practice,
****
Move the mouse TOWARDS you if you see a GOOD mushroom.
Move the mouse AWAY from you if you see a BAD mushroom.
****
Be as fast and accurate as you possibly can. There will be 80 images total. Click the button to start.