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Rapid communication

The politics of insight

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Previous studies showed that liberals and conservatives differ in cognitive style. Liberals are more flexible, and tolerant of complexity and novelty, whereas conservatives are more rigid, are more resistant to change, and prefer clear answers. We administered a set of compound remote associate problems, a task extensively used to differentiate problem-solving styles (via insight or analysis). Using this task, several researches have proven that self-reports, which differentiate between insight and analytic problem-solving, are reliable and are associated with two different neural circuits. In our research we found that participants self-identifying with distinct political orientations demonstrated differences in problem-solving strategy. Liberals solved significantly more problems via insight instead of in a step-by-step analytic fashion. Our findings extend previous observations that self-identified political orientations reflect differences in cognitive styles. More specifically, we show that type of political orientation is associated with problem-solving strategy. The data converge with previous neurobehavioural and cognitive studies indicating a link between cognitive style and the psychological mechanisms that mediate political beliefs.

Keywords: Problem-solving; Political orientation; Insight; Creativity.

Liberals and conservatives appear to approach and justify decisions differently (Jost, Glaser, Kruglanski, & Sulloway, 2003). But do they differ in how they solve non-political problems? For instance, do they differ in whether they use creative versus analytical problem-solving processes?

Across several studies, conservatives and liberals appear to differ in creative abilities (Dollinger, 2007), and in basic processes that could feed into them. Behavioural, neuroscientific, and genetic research converge in supporting such a difference.

Conservatives seem to be more structured, to be more rigid, and to prefer clear answers, whereas

liberals have higher tolerance of ambiguity and complexity, and greater openness (Jost et al., 2003). Such tendencies appear to be related to perceptual processing of simple versus complex or ambiguous stimuli. For low-level cognitive processes, like the resolution of perceptual ambiguity and perceptual bias, conservatives show greater perceptual rigidity and are more influenced by contextual information and by figures' global shape than liberals (Caparos, Fortierst-pierre, Gosselin, Blanchette, & Brisson, 2015). For high-level perceptual processes, like art preferences, conservatives tend to prefer simplicity—for example, they dislike complex, representational, and

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abstract paintings. Liberals, in contrast, are more interested in complex art (Gillies & Campbell, 1985; Glasgow & Cartier, 1985; Wilson, Ausman, & Mathews, 1973).

Zamboni et al. (2009) have shown that various aspects of political beliefs (i.e., liberalism, conservatism, radicalism) have selective associations with activity in discrete neural regions and systems. Amodio, Jost, Master, and Yee (2007) found that when people perform a go/no-go task—a taxing cognitive control task in which participants give a response on frequent (go) trials and must withhold their response on infrequent (no-go) trials—liberals show higher activity in the anterior cingulate cortex, indicating greater sensitivity to cognitive conflict. In contrast, conservative participants demonstrated less neurocognitive sensitivity to response conflicts and, at the behavioural level, made more errors of commission (Amodio et al., 2007). Kanai and collaborators (2011) explored this relationship further and found that greater liberalism was associated with increased grey matter volume in the anterior cingulate cortex, probably related to sensitivity to response or processing competition, whereas greater conservatism was associated with increased volume of the right amygdala, probably related to greater sensitivity to fear (Adolphs, Tranel, Damasio, & Damasio, 1995). Anterior cingulate cortex activation appears related to creativity, in particular to solving with sudden insight. Increased anterior cingulate cortex activity has been detected in association with insight-based solutions (Jung-Beeman et al., 2004; Subramaniam, Kounios, Parrish, & Jung-Beeman, 2009), during the solving process (Aziz-Zadeh, Kaplan, & Jacoboni, 2009; Luo, Niki, & Phillips, 2004) and during a preparation period before trials are subsequently solved by insight (Kounios et al., 2006; Subramaniam et al., 2009). The anterior cingulate cortex is considered important for initiating processes that monitor for conflicts in information processing (Botvinick, 2007), which could lead to the breaking of the mental mindset that confines a person to the wrong solution space.

Political differences are reflected in personality traits, where conservatism is inversely related to

novelty seeking and openness (Caprara, Schwartz, Capanna, Vecchione, & Barbaranelli, 2006; Dollinger, 2007). Liberalism, novelty seeking, and creativity all share the tendency (or the ability) to think in ways that differ from established lines of thought (in the case of novelty seeking and creativity by associating previously unrelated elements with each other). Indeed, novelty seeking is seen more often in liberals and may be related to genetic variations in neurotransmitter functions, which are also important for creativity. Specifically, individuals with a DRD4 variant of the dopamine receptor gene have a higher predisposition toward novelty seeking (Cloninger, Svrakic, & Przybeck, 1993; Wiesbeck, Mauerer, Thome, Jakob, & Boening, 1995), which is associated with liberal political ideology and openness (Settle, Dawes, Christakis, & Fowler, 2010). The association between DRD4 and novelty seeking is independent of ethnicity, culture, sex, or age (Benjamin et al., 1996; Golimbet, Alfimova, Gritsenko, & Ebstein, 2007; Tomitaka et al., 1999), but certain environmental variables may contribute to a cognitive–motivational disposition toward the social world that is either closed and invariant or open and exploratory (Kruglanski & Webster, 1996; Settle et al., 2010). For example, novelty seeking is conceptually related to a personality trait like “openness to experience”, which is negatively related to political and socio-cultural conservatism (Cornelis, Van Hiel, Roets, & Kossowska, 2009; Jost et al., 2003; McCrae, 1996; Mondak & Halperin 2008; Trapnell, 1994; Van Hiel, Kossowska, & Mervielde, 2000). Moreover, neurobiological evidence links the dopamine system with cognitive flexibility (Van Holstein et al., 2011) and predicts the degree to which people maintain ongoing processes or switch to new processes (Müller et al., 2007)—the kind of cognitive flexibility that is important for creativity and problem-solving.

Other evidence has reinforced the association between dopamine and creativity. Several eye movement studies demonstrated that eye blinks, a biomarker of the dopamine system (e.g., Akbari Chermahini & Hommel, 2010; Karson, 1983), vary when people are generating new ideas.

Increases in eye blink frequency and duration are observed when people solve problems via insight (Salvi, Bricolo, Franconeri, Kounios, & Beeman, 2015) and divergent thinking tasks (Akbari Chermahini & Hommel, 2010; Ueda, Tominaga, Kajimura, & Nomura, 2015).

Given the prior behavioural, neuroscientific, and genetic findings relating political persuasion to characteristic cognitive styles, we hypothesized that liberals and conservatives would preferentially employ different processes when processing problems that could be solved either analytically or with sudden insight. Insight relies on the sudden reorganization of a mental representation of a problem, allowing the problem to be seen in a new light (Sternberg & Davidson, 1995). These moments often surprise the solvers, who are typically unaware of how the reorganization occurred. Insight solutions contrast with methodological and analytical solving, which involve a gradual approach toward the solution and awareness of the steps involved (Metcalfe & Wiebe, 1987).

In this study we aimed at investigating if, and how, political orientation is related to the way people solve problems. By definition, having an insight implies a problem-solving process that happens because the initial elements of the problem are restructured or seen “under a new light”. This is different from implicit or automatic processes (for example “gut reactions”), which are instead associated with conservatism (Jost & Krochik, 2014).

Considering that insight problem-solving is an expression of cognitive flexibility, its association with novelty seeking, and its unique relation with the dopamine system, we predicted that liberals would tend to solve problems via insight more often than conservatives, while conservatives would have a tendency to solve problems analytically.

EXPERIMENTAL STUDY

Method

Participants

A total of 129 Northwestern University students (74 women, average age = 18.7 ± 0.9 years)

were randomly assigned to the study. All the subjects were right-handed and native speakers of American English. The sample included 72.7% White/Caucasians; 8.3% African Americans; 7.6% mixed ethnicity; 6.1% Asian Americans; 2.6% Latino Americans; and 0.8% Native Americans. The study was approved by the Northwestern Institutional Review Board, and all participants gave written informed consent. After screening for political beliefs (see below), we matched 22 liberal participants to 22 conservative participants, in age and ethnicity. Sample size could have power to detect small to medium size effects.

Political ideology

At the beginning of the academic quarter, the participant's political ideology was measured by two 7-point Likert scales (Robinson, Shaver, & Wrightsman, 1999). The two scales were: (a) I endorse many aspects of conservative political ideology (from 1 = not conservative to 7 = more conservative ideology); (b) I endorse many aspects of liberal political ideology (from 1 = not liberal to 7 = more liberal ideology). We divided our sample into three groups: Conservatives were defined as participants who scored above 4 on the question of conservative political ideology (16.7%, $N=22$). Liberals were defined as participants who scored above 4 on the question of liberal political ideology (59.8%, $N=79$). Participants who scored the same number (e.g., 4 neutral) on the questions of conservative and liberal ideology were excluded from the analysis (21.2%, $N=28$). Our final sample consisted of 22 conservatives who were matched with 22 liberal participants. For example, each participant who scored 7 on the conservatism scale and 1 on the liberalism scale was matched (on age and ethnicity) with another participant who scored 7 on the liberalism scale and 1 on the conservatism scale. Each participant who scored 7 on the conservatism scale and 2 on the liberalism scale was matched (on age and ethnicity) with another participant who scored 7 on the liberalism scale and 2 on the conservatism scale and so on. The final sample of 44 participants was balanced for political orientation and ethnicity.

Table 1. Data for demographic and political involvement measures for the conservative and liberal sample participants?

Measure	Conservatives (n = 22)		Liberals (n = 22)	
	N	Mean ± SD	N	Mean ± SD
Age (years)		19.0 ± 1.07		18.59 ± 0.95
Gender				
Male	11		7	
Female	11		15	
Ethnicity				
White/Caucasian	17		18	
African American			4	
Mixed ethnicity	3			
Asian American	1			
Latino American	1			
Conservatism		5.77 ± 0.68		2.31 ± 1.08
Liberalism		2.31 ± 1.21		5.77 ± 0.68

See Table 1 for a summary of demographic characteristics. The two groups showed a significant negative correlation, $r = -.89$, $p < .001$, between political ideology calculated between the two scales.

Problem-solving experimental paradigm

Stimuli. To test our hypothesis, we used a well known task in the problem-solving literature: the compound remote associate (CRA) problems (Bowden & Beeman, 1998; Bowden & Jung-Beeman, 2003). CRA problems are hybrid-type problems since they can be solved through either insight or analytic processes with participants reporting how they solved each problem. Self-reports differentiating between insight and analytic problem-solving are reliable, and their association with numerous behavioural and neuroimaging markers have been documented (Bowden & Jung-Beeman, 2003; Jung-Beeman et al., 2004; Kounios et al., 2006, 2008; Subramaniam et al., 2009).

Each problem consisted of the simultaneous presentation of three words, each of which could form a compound word or phrase with the solution word (e.g., pine/crab/sauce—the solution word is APPLE). Each of these problems could be solved by insight or analysis (for the full list of the problems and solution rates, see Bowden & Jung-Beeman, 2003). Stimuli were

presented as black words on a white background and were viewed with both eyes. The three compound remote associate words were presented in normal horizontal orientation above, at, and below the centre of the monitor (Figure 1). The experimental procedure was presented using E-Prime 2.10 (Schneider, Eschman, & Zuccolotto, 2002) on a 22" LCD screen at a viewing distance of 60 cm.

Experimental procedure. One CRA problem was presented in each trial. Participants were informed that they would have to read the three words and try to come up with the solution word. Three practice CRA problems and instructions regarding how to distinguish insight from analytic problem-solving were given prior to the experiment. Participants were instructed that there was no optimal problem-solving style nor right or wrong answers in reporting insight or analysis.

Further explanation of the task was given if necessary. Each trial began with a central fixation cross lasting one second, followed by a response prompt screen. Once participants were ready, they had to press a button for the fixation cross to appear for another second, and then the three problem words were presented simultaneously on the screen. Following the verbally reported solution, or the end of the time limit (15 s), the problem words were erased, and subjects had to decide how they solved the problem: via insight or via analysis. No feedback was given to the participants regarding whether the solution they provided was accurate or inaccurate (see Figure 1). In total the experiment took approximately 1 hour.

During the evaluation, participants were assigned to other unrelated tasks, therefore the number of trials varied slightly between 97 and 120. Specifically, among the first sample of 129 participants, 90 were asked to solve 100 CRAs, 23 were asked to solve 97 CRAs, and 16 were asked to solve 120 CRAs. Slightly similar proportions of number of problems were maintained in the 44-participant sample: Thirty-two of them were asked to solve 100 CRAs, six were asked to solve 97 CRAs, and six were asked to solve 120

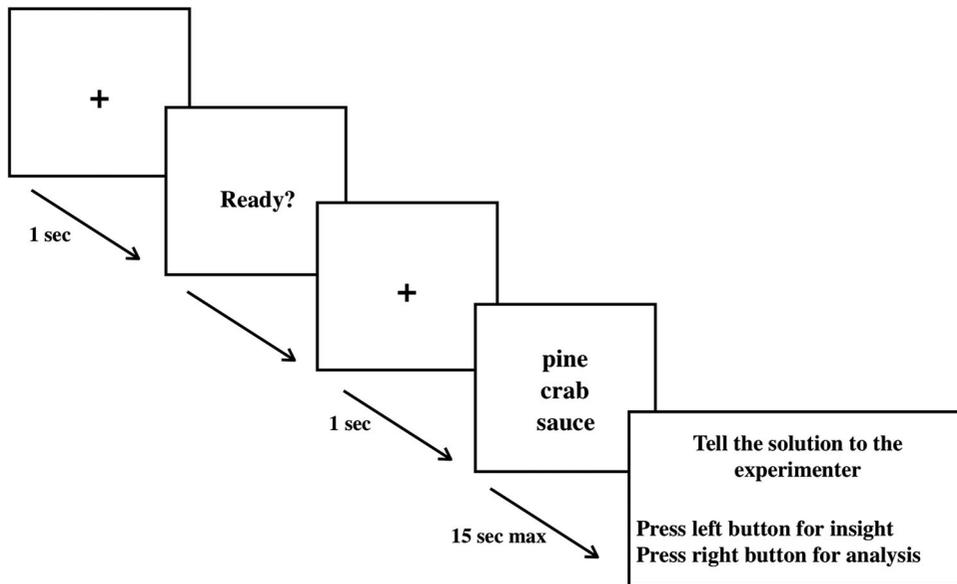


Figure 1. *Experimental paradigm.*

CRA. These differences in number of problems were independent of political ideology or problem-solving style ($p = .942$).

Statistical analysis

Behavioural data analysis was performed using SPSS 22.0 (www.spss.com), and significance level was set to .05. Data were tested for Gaussian distribution (Kolmogorov–Smirnov test) and homogeneity of variance (Levene’s test). Data were normally distributed, and assumptions for analysis of variance were not violated. Between/within-participant analyses of variance (ANOVAs) were used to compare the effect of political ideology (between participants: liberal and conservative) on problem-solving strategies (within participants: insight versus analysis).

Results

Participants solved an average of 40.6% ($SD = \pm 15.5\%$, 95% confidence interval, CI [37.5, 43.7]) of the problems. A total of 25% of the problems were solved by insight

($SD = \pm 11\%$, 95% CI [22.3, 28.1]), and 16% of the problems were solved using an analytic strategy ($SD = \pm 8.8\%$, 95% CI [14.0, 19.3]). The type of solution interacted with political orientation, $F(2, 42) = 5.42$, $MSE = 0.012$, $p < .05$, $\eta^2 = .205$. Planned paired comparisons revealed that liberal participants solved more problems by insight (29%, $SD = \pm 11.7\%$, 95% CI [26.3, 32.1]) than by analysis (15%, $SD = \pm 8.2\%$, 95% CI [12.1, 18.3]), $t(21) = 3.90$, $p < .001$, $d = 1.38$, whereas conservative participants showed no preference for problem-solving style (see Figure 2). Although liberal participants solved nominally more total problems (42.1%, $SD = \pm 10.6\%$, 95% CI [36.4, 46.7]) than did conservatives (39.1%, $SD = \pm 19.9\%$, 95% CI [35.1, 44.6]), this difference was not reliable, $F(2, 42) = 0.93$; $MSE = 0.011$, $p > .250$, $\eta^2 = .022$ (95% CI [3.6, 9.8]). Restricting our analysis to problems solved via insight, liberals solved more problems with insight (28.7%, $SD = \pm 11.7\%$) than did conservatives (21%, $SD = \pm 8.9\%$), $t(21) = -2.45$, $p < .05$; $d = 0.74$ (95% CI [-14.3, -11.8]). No significant differences were found between liberals and

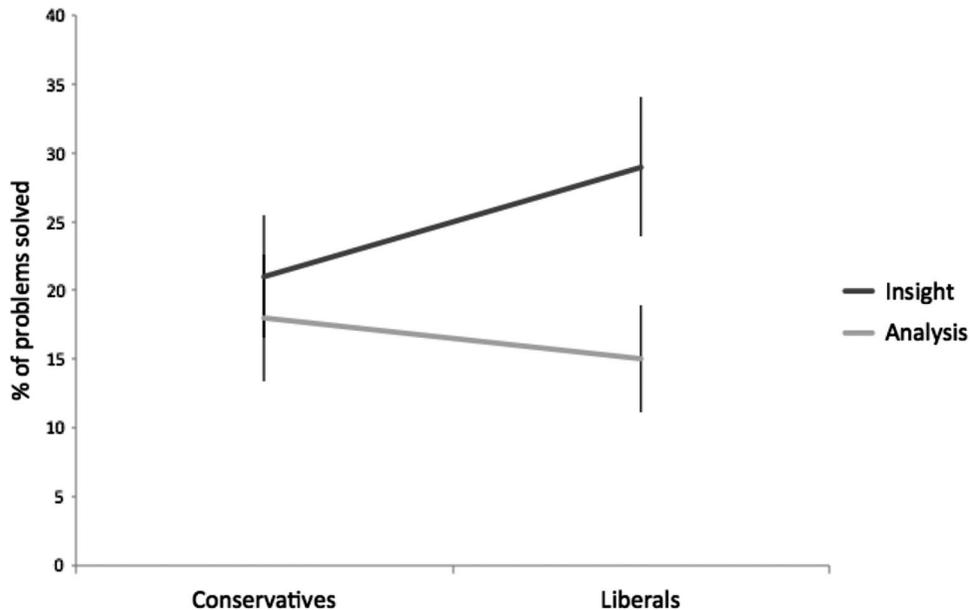


Figure 2. Percentage of problems solved via analysis versus via insight in the three political orientation groups (error bar = standard error).

conservatives if we restricted our analysis to problems solved via analysis.¹

GENERAL DISCUSSION

Our study provides novel evidence that political orientation is associated with problem-solving strategy. We found that liberals are more likely than conservatives to use an insight strategy to solve verbal problems. This view is consistent with similar results across behavioural, neuroscientific, and genetic studies, which converge in showing that conservatives have more structured and persistent cognitive styles, whereas liberals have a less structured and flexible cognitive style. Our results support the view that political orientation reflects differences in cognitive control and self-regulation strategy preferences (Amodio et al., 2007; Jost et al., 2003).

Both analytical solution style and conservative political orientation are associated with a tendency to make errors of commission (i.e., incorrect responses), and these problem-solving tendencies are distinct from the insight strategies used by people with a liberal political orientation (Amodio et al., 2007; Kounios et al., 2008; Salvi, Bricolo, Bowden, Kounios, & Beeman, 2016). The study reported in this paper indicates that differences in political orientation are also apparent in a structured and quantitative *convergent* thinking task.

The data converge with previous neurobehavioural and cognitive studies indicating a link between cognitive style and the psychological mechanisms that mediate political beliefs. In fact, previous studies have shown that political orientation is associated with psychological traits such as openness and rigidity for liberals and conservatives, respectively (e.g., Caprara et al., 2006). In

¹The same result was obtained considering the whole sample of 79 liberals and 22 conservatives. Overall, participants solved 41.3% ($SD = \pm 11.5\%$, 95% CI [39.1, 43.4]) of problems, solving more problems by insight (23.8%, $SD = \pm 11\%$; 95% CI [21.6, 25.9]) than by analysis (17.7%, $SD = \pm 9\%$; 95% CI [15.8, 19.4]). Planned paired comparisons revealed that liberal participants solved more problems by insight (24.5%, $SD = \pm 11.4\%$; 95% CI [22.4, 27.27]) than by analysis (17.6%, $SD = \pm 11$, 95% CI [15.57, 19.89]), $t(78) = 3.5$, $p < .001$, $d = 0.61$), whereas conservative participants showed no preference for problem-solving style: Insight solutions were 21% ($SD = \pm 19.5\%$; CI [17.17, 24.80]) compared to 17.9% ($SD = \pm 20.3$, 95% CI [14.2, 22.3]) for solutions via analysis.

addition, different studies have associated dopamine functioning with political beliefs and creativity. For example, people with a DRD4 genetic variant of the dopamine are more prone to a liberal political ideology (Settle et al., 2010) and eye blink (dopamine biomarker) increase during solutions via insight (Salvi et al., 2015).

Here, we found that political orientation can also be associated with cognitive problem-solving style. This is consistent with the results from Amodio et al. (2007), where liberal political ideology was associated with higher sensitivity to cognitive flexibility and increased activity in the anterior cingulate cortex, a critical region also for solving problems via insight (Subramaniam et al., 2009).

Some prior work has linked conservatism to increased use of “Type 1” or fast, heuristic processing (as opposed to “Type 2” or slow, systematic processing; Jost & Krochik, 2014). Sometimes Type 1 processing is framed as “going with your gut”, and thus at first blush one might think that relates to insight. However, insight solutions require that all elements of a problem converge on the solution (indeed, the novel characteristic is that many weak associations converge to bring the solution into sudden consciousness). In contrast, Type 1 heuristic processing may incline a problem solver to quickly pursue strong associations. When these are appropriate, they will lead to analytic solutions, but if the strong associations are misleading, strongly attending to them will make it more difficult for the weak associations to converge in a sudden insight. Thus, the current results fit quite nicely with the prior results (Jost & Krochik, 2014).

Our study motivates several questions that future research needs to explore. For example, what is the causal direction (if there is only one) between insight solutions and liberal attitudes/beliefs? What other factors (social, educational, or neurological) modulate this connection?

A possible critique of our study is that we relied on participants’ self-reports to discriminate how

they solved the problems (insight versus analysis), self-reports that could be biased by participants’ political orientation instead of reflecting the actual problem-solving strategy utilized. Three main lines of evidence refute this possibility. First, self-reports differentiating between insight and analytic solving have been thoroughly demonstrated, reliably and consistently, to be associated with numerous behavioural and neuroimaging markers (Bowden & Jung-Beeman, 2003; Jung-Beeman et al., 2004; Kounios et al., 2006, 2008; Salvi et al., 2015; Subramaniam et al., 2009). If, therefore, even solely for aesthetic preferences, conservatives and liberals liked to think of themselves as more analytical or insightful, their self-reports still correlate with distinct behaviour and neurological processes. Second, our participants’ political orientation was recorded at the beginning of the academic quarter, approximately one month before the experiment was run, in a general demographic questionnaire dissociated with any experiment intake paperwork. It is therefore highly improbable that they associated the political orientation question with the experiment in an attempt to positively represent themselves or their political orientation in any particular way.² Third, our participants were fully informed, before starting the experiment, on how to distinguish solutions via insight or analysis solution, when we specifically stated that neither cognitive strategy was better than the other. Therefore, if there was a preference for insight or analytical solving it should have been equally distributed between and within subject groups.

Our sample was restricted to college students, and we excluded all participants who did not express a clear political preference (e.g., participants who did not consistently identify as either conservative or liberal). Larger and more diverse samples should be used to confirm the association of political preferences and cognitive processing styles. Further investigations are also warranted to determine whether priming distinct problem-solving styles

²We abstained from further defining a “liberal” or “conservative” outside of participant self-reports. We also acknowledge that young participants, especially in a formative and new idea-rich environment such as a university, may change their beliefs and even self-reported political identity as, for example, new peers and professors come to influence them. Therefore, participants were determined to be a “liberal” and “conservative” only by self-report.

such as those investigated in our study influences the development and maturation of political orientation. Human social beliefs can shape a person's character and decision-making processes. A better understanding of differences in cognitive strategies between individuals holding different social/political orientations may benefit efforts to help them reconcile differences in dealing with social concerns.

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