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The hand in motion of liberals and conservatives reveals the differential processing of positive and negative information

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ABSTRACT

Recent research revealed that political conservatives and liberals differ in the processing of valenced information. In particular, conservatives (vs. liberals) tend to weigh negative information more than positive information in their perception of the physical and social world. In the present work, we further investigated the ideology-based asymmetries in the processing of negative and positive information examining both the attention-grabbing power of negative information and the trajectories of the movements performed by respondents when required to categorize positive and negative stimuli. To this end we employed a modified version of the Mouse-Tracking procedure (Freeman & Ambady, 2010), recording hand movements during the execution of categorization tasks. Results showed that conservatives were indeed slower to start and execute response actions to negative stimuli, and, more specifically, the trajectories of their movements signaled avoidance tendencies aimed at increasing the distance from negative stimuli. In addition, this pattern of findings emerged both when participants were asked to categorize the stimuli according to their valence and when the same stimuli had to be categorized on the basis of irrelevant perceptual features. Overall, results demonstrate that conservatives and liberals process valenced information differently, perform different spontaneous movements when exposed to them, and that such asymmetries are largely independent from current processing goals.

1. Introduction

In the last decades, scientific research has revealed a variety of relevant differences between political conservatives and liberals. Importantly, these differences are not only confined to ideological issues, but they appear to be related to several different domains. For instance, conservatives and liberals tend to display distinguishing facial features (e.g., Rule & Ambady, 2010; Samochowiec, Wänke, & Fiedler, 2010; Wilson & Rule, 2014), different personality profiles (Caprara & Zimbardo, 2004; Carney, Jost, Gosling, & Potter, 2008), and divergent cognitive styles with conservatives expressing greater need for closure, structure, and order as compared to liberals (e.g., Caparos, Fortier-St-Pierre, Gosselin, Blanchette, & Brisson, 2015; Carney et al., 2008; Chirumbolo, 2002; Jost, Glaser, Kruglanski, & Sulloway, 2003). For their part, liberals display greater tolerance of ambiguity and integrative complexity (Jost et al., 2003), and greater neurocognitive sensitivity to cognitive conflicts (e.g., Amodio, Jost, Master, & Yee, 2007).

A fruitful line of research has recently investigated the reactions of conservatives and liberals towards negative information, consistently showing that conservatism is related to an increased attention towards negative aspects of the physical and social world. For instance, conservatives, as compared to liberals, tend to display both higher changes in skin conductance and stronger startle-blink when presented with threatening images (Oxley et al., 2008; see also Smith, Oxley, Hibbing, Alford, & Hibbing, 2011). Similarly, conservatives are more likely to interpret ambiguous facial expressions as associated to threatening emotions (Vigil, 2010), and in impression formation processes they tend to weigh negative information more than positive information (Carraro, Negri, Castelli, & Pastore, 2014; Castelli & Carraro, 2011). In addition, conservatives exhibit both a more cautious exploratory behavior in novel situations as compared to liberals, and a greater learning asymmetry, namely a tendency to learn negative information better than positive information (Shook & Fazio, 2009; see also Shook & Clay, 2011).

Recently, Carraro, Castelli, and Macchiella (2011), investigated attentional processes and showed that conservative respondents display an automatic selective attention for negative (vs. positive) stimuli.

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More specifically, in an Emotional Stroop Task the irrelevant negative (vs. positive) dimension of the stimuli was more likely to impair the performance of conservative respondents, whereas in a Dot–Probe Task negative (vs. positive) stimuli grabbed the attention of conservatives more than that of liberals.

Interestingly, in line with these results, a structural MRI study (Kanai, Feilden, Firth, & Rees, 2011; see also Ahn et al., 2014; Schreiber et al., 2013) revealed that the volume of the right amygdala is bigger in conservatives as compared to liberals. Remarkably, the right amygdala is a brain structure involved in the emotion of fear and in the processing of threatening information (Adolphs, Tranel, & Damasio, 1998) and this further supports the idea that ideology-based differences in the processing of valenced information are very much pervasive and can be observed even at the level of neuroanatomical structures (Hibbing, Smith, & Alford, 2014). The differential processing of positive and negative information displayed by conservatives and liberals has also important implications in terms of attitude formation processes. Indeed, it has been shown that illusory correlation phenomena (Hamilton & Gifford, 1976; Stroessner & Placks, 2001) are accentuated in the case of conservative respondents when infrequent behaviors are negative. Conservatives thus appear to more likely develop negative attitudes towards numerical minority groups simply because of the extreme distinctiveness of the rare negative behaviors that more strongly grab their attention (Castelli & Carraro, 2011).

Although previous research has largely examined the cognitive, physiological, and neuropsychological correlates of the processing of positive and negative information by liberals and conservatives, the differences at the behavioral level have been far less investigated. Positive and negative information may differentially elicit approach and avoidance behavior (Chen & Bargh, 1999; Krieglmeyer, De Houwer, & Deutsch, 2013; Paladino & Castelli, 2008) and it can thus be predicted that the stronger reactions of conservatives, as compared to liberals, when faced with negative stimuli would also reflect into accentuated spontaneous avoidance behaviors. If political beliefs are characterized by specific motivational underpinning (Jost et al., 2003), conservatives and liberals should not only process emotional stimuli in a different way, but they should also display different functional responses in terms of approach and avoidance tendencies. In this regard, from a slightly different perspective, Janoff-Bulman and colleagues (Janoff-Bulman, 2009; Janoff-Bulman, Sheikh, & Baldacci, 2008) investigated the motivational bases of political ideology and morality, suggesting that conservatives are more likely to display avoidance rather than approach regulatory strategies, that is an orientation focused on the prevention of negative outcomes. This line of research further corroborates the idea that conservatives might be especially concerned about the avoidance of threatening stimuli. Thus, following these assumptions we may expect that conservatives (vs. liberals) will display avoidance tendencies in reaction to negative (vs. positive) images, in line also with studies investigating approach–avoidance behavior, in which negative information is often associated with both an early attentional bias and stronger avoidance tendencies (e.g., Rinck & Becker, 2006). It is important to note, however, that an opposite prediction could be put forward based on the observation that negative/aversive stimuli are more likely to attract the attention of individual with conservative political inclinations (Carraro et al., 2011; Dodd et al., 2012). For instance, Dodd et al. (2012) in a freeview eyetracking study found that conservatives spent a relatively greater amount of time gazing at negative images, and, in addition, they were faster to fixate negative as compared to positive images in an array. Results clearly indicated that when simultaneously provided with several images, people with right-oriented political preferences displayed an attentional bias towards rather than away from negative stimuli. The authors (Dodd et al., 2012) suggest that individuals with a more conservative political orientation are also more likely to confront themselves with aversive stimuli. Accordingly, if conservatives appear to be particularly attuned and attentive towards stimuli that signal a potential threat, spontaneous behaviors might also show increased approach tendencies towards that type of stimuli as compared to positive stimuli.

In order to investigate behavioral tendencies we adopted a computer mouse-tracking procedure (MT; Freeman & Ambady, 2010; Freeman, Dale, & Farmer, 2011) that allows to record and analyze hand movements during the execution of categorization tasks. This hand-tracking provides an online measure of the spontaneous behaviors performed by the participant and opens a window onto the underlying psychological processes (Freeman et al., 2011). For instance, hand movements have been useful to study and uncover the processes involved in the categorization of ambiguous social targets (Freeman, Ambady, Rule, & Johnson, 2008; see also Freeman, 2014) and in the integration of multiple channels (e.g., face and voice) in social categorization (Freeman & Ambady, 2011). The MouseTracker software package developed by Freeman (see Freeman & Ambady, 2010) provides detailed information about the continuous stream of the motor output mapping the position of the mouse on the x and y coordinate space. In a typical trial, participants are required to place the mouse on the START button located at the bottom of the screen (see Fig. 1) and to categorize a target appearing at the center of the screen by clicking on an appropriate response button located either at the top-left or top-right of the computer screen. The MouseTracker can thus allow assessing whether participants, while moving towards the response button, tend also to move either towards or away from the target stimulus displayed at the center of the screen. In other words, a behavioral online measure of approach and avoidance tendencies can be derived.

In the present study we also addressed an additional important processing component, namely the conditional automaticity of the process (Bargh, 1989; see also Bargh, 1994; Macrae, Bodenhausen, Milne, Thorn, & Castelli, 1997). Indeed, we explored whether directing participants' attention towards an irrelevant and valence-unrelated aspect of the stimuli (e.g., asking to categorize stimuli on the basis of a perceptual feature) can actually make the differences between liberals and conservatives in the processing of valenced information disappear. In contrast, if such ideology-based differences are indeed so strong and ubiquitous (Hibbing et al., 2014), the effects should be largely unaffected by the current conscious processing-goals of the perceivers while they perform the categorization task. Overall, it can thus be explored the extent to which people embracing different political views not only appraise and process valence stimuli in a different way, but also the impact that such stimuli have on actual behaviors.

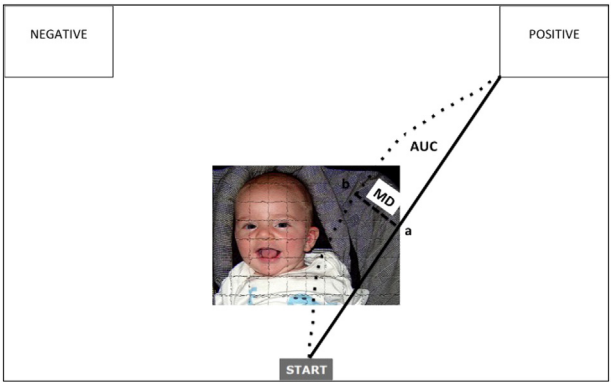

Fig. 1. The Figure shows an idealized response trajectory in a valenced-based categorization trial. The example displays a mosaic image. The MD index refers to the distance from "a" to "b". The AUC index refers to the whole area between the actual trajectory (black dotted line from START to the response button) and the idealized one (black straight line from START to the response button).

2. Method

2.1. Participants

Forty non-student participants (i.e., workers or unemployed people; 22 female; age $M = 32.18$, $SD = 12.89$) were recruited from a female researcher in a city of North Italy contacting informal groups and using social networks. Informed consent was obtained from all participants and they were not paid for the participation. The sample was determined in accordance with previous studies in our lab investigating the relation between ideology and the processing of positive vs. negative information (e.g., Carraro et al., 2011).

2.2. Materials

Ten positive (number 1440, 1630, 1710, 1750, 2035, 2045, 2311, 5825, 7325, 7580; e.g., a rabbit, a baby) and 10 negative images (number 1201, 1271, 7360, 9042, 9043, 9291, 9301, 9320, 9561 9571; e.g., a dead cat; a dump) from the IAPS (International Affective Picture System; Lang, Bradley, & Cuthbert, 2008) were used. In addition, a mosaic filter was applied using Adobe Photoshop 6.0 to all the images in order to obtain a slightly different version for each of them (for an example see Fig. 1). All negative images had the potential to elicit disgust and previous literature has indeed shown that conservatives and liberals have very different reactions towards this specific type of negative stimuli (Inbar, Pizarro, & Bloom, 2009; Inbar, Pizarro, Iyer, & Haidt, 2012; Smith et al., 2011; Terrizzi, Shook, & Ventis, 2010).

2.3. Measures

2.3.1. Political ideology

In order to assess political ideology, participants were administered a pencil-and-paper questionnaire and asked to rate their level of agreement (from 1 = "not at all" to 7 = "very much") towards 9 social issues (i.e., reduction of immigration, abortion, medically assisted procreation, homosexual marriage, adoption by homosexual couples, legalization of soft drugs, euthanasia, use of stem cells, homosexual couples; see also Carraro et al., 2011). Responses were rescaled so that higher scores corresponded to more conservative views ($\alpha = 0.94$, $M = 3.66$, $SD = 1.64$: range from 1.32, to 6.22).

2.3.2. Mouse Tracker tasks

Two categorization tasks were designed in order to measure participants' automatic reactions towards positive and negative images. Participants were required to categorize the images presented on a computer screen as fast and accurately as possible using the mouse. In one categorization task, the pictures had to be categorized according to their valence (i.e., positive vs. negative). In the other categorization task, pictures had to be categorized according to a valence-irrelevant perceptual feature, namely the fact that the picture was intact or mosaic. The order of these two tasks was counterbalanced between participants. As in the original Mouse-Tracking (MT) procedure (Freeman & Ambady, 2010), both response latencies and trajectories were recorded.

In each categorization task, 10 positive and 10 negative pictures (400×300 pixels) were presented. Half of them were intact and half were mosaic. Each picture was presented twice, so that each categorization task comprised 40 trials. Any given trial started when participants clicked with the mouse on the START button located at the bottom of the screen (see Fig. 1). After 1000 ms a picture appeared in the center of the screen and participants were instructed to immediately move the mouse and press the appropriate response button located either at the top-left or top-right of the computer screen. The location of the positive vs. negative (intact vs. mosaic) response button at the top-left or top-right of the computer screen was counterbalanced across participants. Each target image remained visible until participants had provided their response. In the case of errors a red cross was displayed for 2000 ms. After having pressed a response button, participants were instructed to move back to the START button and press it, so that the following trial could start.

Before each categorization task, participants performed four practice trials to ensure that they had correctly understood the task.

2.4. Procedure

Participants were seated in front of a computer screen and they were asked to perform two categorization tasks, as described above. After the computer tasks, they were asked to fill in a pencil-and-paper questionnaire aimed at assessing political ideology. Finally, participants were thanked and fully debriefed.

3. Results

For both categorization tasks we analyzed trajectories and response times for correct responses. The order of the tasks (i.e., based on the valence or perceptual) did not lead to any significant effect and therefore it was no longer considered in the analyses.

3.1. Response times

Two different indexes were considered: response initiation times (RI) and response execution times (RE). The RI time is the interval from the onset of the image to the onset of the movement of the mouse. Instead, the RE time is the interval between the onset of the movement and the click on the response button. For each participant, we separately computed the average RI and RE time for positive and negative images within each of the two categorization tasks.

Data about the RI time were analyzed through an ANCOVA with the valence of the stimulus (positive vs. negative) and the categorization task (valence vs. perceptual) as within-participants factors, and political ideology as a covariate. A main effect of the valence of the images emerged, $F(1,37) = 10.05$, $p = 0.003$, $\eta^2_p = 0.214$, indicating that participants were faster in initiating the response movement in the case of positive ($M = 333$, $SD = 15$) than in the case of negative images ($M = 350$, $SD = 17$). More interestingly, the analysis revealed an interaction between the valence of the images and political ideology, $F(1,37) = 18.63$, $p < 0.001$, $\eta^2_p = 0.335$. This interaction was not qualified by the type of task, $F(1,37) = 2.26$, $p = 0.14$. In order to explore the significant two-way interaction, the political ideology index was entered as a dependent variable in a linear regression analysis whereas the two RI times related to positive and negative images were simultaneously entered as independent variables. The model was significant, $R^2 = 0.42$, $F(1,38) = 13.19$, $p < 0.001$ (post-hoc power analysis: f2 = 0.72, Power 1-$\beta = 0.999$[1]). More specifically, the RI time related to negative images was strongly related with political ideology, $\beta = 1.02$, $t(38) = 4.07$, $p < 0.001$, suggesting that conservatives (vs. liberals) were more likely to freeze when a negative image appeared. On the contrary, the RI time related to positive images did not emerge to be a significant predictor of political ideology, $\beta = -0.48$, $t(38) = -1.94$, $p = 0.06$, although the trend suggests that faster responses were provided by conservatives as compared to liberals.

As for the RE time, an ANCOVA showed a significant main effect related to the type of images, $F(1,37) = 45.51$, $p < 0.001$, $\eta^2_p = 0.552$, indicating that, overall, participants performed faster movements in response to positive images ($M = 782$, $SD = 53$) as compared to negative images ($M = 1021$, $SD = 57$). Moreover, a main effect of the type of task emerged, $F(1,37) = 8.66$, $p = 0.006$, $\eta^2_p = 0.190$: participants were

[1] A post hoc power analysis was conducted using the software package, GPower (Faul, Erdfelder, Buchner, & Lang, 2009; Faul, Erdfelder, Lang, & Buchner, 2007). The sample size of 40 was used for the statistical power analyses and two predictors were indicated. The alpha level used for this analysis was $p < 0.05$, two tailed.

slower when the images had to be categorized according to their valence ($M = 909, SD = 61$) rather than according to a trivial perceptual feature ($M = 894$, $SD = 50$). Most importantly, the analysis revealed a significant interaction between the valence of the images and political ideology, $F(1,37) = 135.86$, $p < 0.001$, $\eta^2_p = 0.786$. As before, the political ideology index was entered as a dependent variable in a linear regression analysis, whereas the two RE times related to positive and negative images were simultaneously entered as independent variables, $R^2 = 0.79$, $F(1,37) = 68.11$, $p < 0.001$ (post-hoc power analysis: f2 = 3.76, Power 1-β = 1). The RE time related to negative images emerged to be a positive predictor of political ideology, $\beta = 1.28$, $t(38) = 11.55$, $p < 0.001$. This means that conservatives (vs. liberals) were more likely to perform slower movements when they had to categorize negative images. At the same time, the RE time related to positive images emerged to be a significant predictor of political ideology but in the opposite direction, $\beta = -0.80$, $t(38) = -7.22$, $p < 0.001$, indicating that conservatives (vs. liberals) were faster in responding to positive images or, from another point of view, that liberals were slower when positive images were presented as targets. The three-way interaction between valence, categorization task, and ideology was not significant, $F(1,37) = 0.005$, $p = 0.94$, suggesting that the differential processing of positive and negative information by liberals and conservatives is not task-dependent.

3.2. Trajectories analysis

As for the trajectories analysis, we obtained three indexes: Maximum Deviation (MD), Area under the Curve (AUC) and x-flips. The MD is the maximum perpendicular deviation between the actual trajectory and the idealized response trajectory (see Fig. 1). The idealized trajectory is the straight line from the START button towards the selected response. Instead, the AUC is the geometric area between the actual and the idealized trajectory (see Fig. 1). Finally, the x-flips are the number of fluctuations along the x-axis that are expected to signal some level of uncertainty in the definition of the appropriate response.

The three indexes (x-flips, MD, AUC) were submitted to three separate ANCOVAs with the valence of the images (positive vs. negative) and the categorization task (valence vs. perceptual) as within-participants factors and political ideology as covariate.

As for the x-flips, only the expected interaction between the valence of the images and the covariate approached the conventional level of significance, $F(1,37) = 3.87$, $p = 0.057$, $\eta^2_p = 0.095$. Also in this case, in order to further investigate this interaction, a regression analysis was performed entering political ideology as the dependent variable and the two x-flips indexes related to positive and negative images as independent variables, $R^2 = 0.10$, $F(2,38) = 1.91$, $p = 0.162$ (post-hoc power analysis: f2 = 0.11, Power 1-β = 0.54). During the categorization of negative images conservatives (vs. liberals) made slightly more x-flips, $\beta = 0.62$, $t(38) = 1.84$, $p = 0.07$; on the contrary, conservatives (vs. liberals) made less x-flips during the categorization of positive images, $\beta = -0.66$, $t(38) = -1.94$, $p = 0.06$.

As for the MD, only the theoretically-irrelevant interaction between the type of task and political ideology emerged, $F(1,37) = 4.46$, $p = 0.04$, $\eta^2_p = 0.108$. In order to explore the direction of this interaction, political ideology was entered as a dependent variable in a linear regression analysis whereas the two MD indexes related to the two different tasks (valence vs. perceptual) were simultaneously entered as independent variables, $R2 = 0.11$, $F(2,38) = 2.33$, $p = 0.11$. Overall, in the valence-relevant task conservatives described smaller MDs as compared to liberals, $\beta = -0.36$, $t(38) = -2.07$, $p = 0.04$, whereas in the valence-irrelevant task no significant relation with political ideology emerged, $\beta = 0.25$, $t(38) = 1.46$, $p = 0.15$.

As for the AUC, the main effect related to the valence of the images was significant, $F(1,37) = 9.21$, $p = 0.004$, $\eta^2_p = 0.199$, indicating that participants were more likely to perform a smaller AUC in response to negative images ($M = 0.07$, $SD = 0.05$) as compared to positive images ($M = 0.21$, $SD = 0.04$). More interestingly, the analysis revealed a significant interaction between the valence of the images and political ideology, $F(1,37) = 29.58$, $p < 0.001$, $\eta^2_p = 0.444$. This interaction was not qualified by the type of task participants were required to perform, $F(1, 37) = 0.41$, $p = 0.52$. In order to better understand the significant two-way interaction, political ideology was entered as a dependent variable in a linear regression analysis whereas the two AUC indexes related to positive and negative images were simultaneously entered as independent variables, $R^2 = 0.44$, $F(2,38) = 14.45$, $p < 0.001$ (post-hoc power analysis: f2 = 0.78, Power 1-β = 0.999). The AUC related to negative images emerged to be a significant negative predictor of the political ideology, $\beta = -1.02$, $t(38) = -5.35$, $p < 0.001$. Conservatives (vs. liberals) were more likely to perform a smaller AUC when presented with negative images. The AUC related to positive images emerged as a positive predictor of political ideology, $\beta = 0.71$, $t(38) = 3.73$, $p < 0.001$, indicating the presence of smaller AUC in the case of liberal as compared to conservative respondents. In other words, liberals described bigger AUC with negative images and smaller AUC with positive images as compared to conservatives.

These two findings might appear to be inconsistent with the predictions and with the findings related to the response times. Indeed, conservatives when presented with negative images were significantly slower to categorize them, but the analysis of the AUC apparently indicated that conservatives followed a more straightforward line with minimal deviations from the idealized trajectory. One possible explanation is that conservatives provide very controlled responses when exposed to negative images so that the execution time is increased and the accuracy of the movement (i.e., reduced deviation from the idealized trajectory) is increased. An alternative explanation is that the AUC index actually masks different response tendencies. Indeed, the AUC index is computed (from the MouseTracker Analyzer) as the average of all the AUCs described by a participant, both above the idealized line (i.e., positive AUC) and below the idealized line (i.e., negative AUC). This implies that the presence of several trajectories below the idealized line could significantly reduce the magnitude of the observed AUC index. It does become important to assess the specific deviations from the idealized trajectory that characterize participants' responses (i.e., either above or below the idealized line). To this end, for each participant we first counted the number of cases in which a positive AUC (i.e., above the idealized line) or a negative AUC (below the idealized line) was described. These indexes (i.e., number of trajectories) were then submitted to a 2 (valence of the images: positive vs. negative) × 2 (type of AUC: below or above the idealized line) × 2 (categorization task: valence vs. perceptual) ANCOVA with political ideology included as a covariate. A significant main effect of the type of AUC emerged, $F(1,32) = 35.78$, $p < 0.001$, $\eta^2_p = 0.528$. Overall, participants described more trajectories above the idealized line ($M = 11.18$, $SD = 0.40$) than below the idealized line ($M = 8.47$, $SD = 40$). Moreover, this main effect was qualified by two different two-way interactions, one with the valence of the image, $F(1,32) = 10.34$, $p = 0.003$, $\eta^2_p = 0.244$, and the other one with political ideology, $F(1,32) = 25.25$, $p < 0.001$, $\eta^2_p = 0.441$. Most importantly, these interactions were qualified by a significant three-way interaction between the type of AUC, the valence of the images and political ideology, $F(1,32) = 22.30$, $p < 0.001$, $\eta^2_p = 0.411$. This interaction was not further qualified by the categorization task that participants were asked to perform, $F(1,32) = 0.82$, $p = 0.37$, $\eta^2_p = 0.025$. In order to better explore the significant three-way interaction, two differential scores were calculated, one for positive images and one for negative images, by subtracting the number of trajectories below the idealized line from the number of trajectory above the idealized line. These two indexes were entered as predictors in a linear regression analysis where political ideology was included as the dependent variable, $R^2 = 0.54$, $F(1,33) = 18.02$, $p < 0.001$ (post-hoc power analysis: f2 = 1.17, Power 1-β = 0.999). Only for negative images a significant relation emerged, $\beta = -0.76$, $t(33) = -5.49$, $p < 0.001$ ($\beta = -0.06$,

$t(35) = -0.41$, $p = 0.68$ for positive images), thus indicating that conservatives during the categorization of negative images described more trajectories under the idealized line (vs. above the idealized line) as compared to liberals.[2]

It thus appears that conservatives and liberals do move their hand differently when categorizing negative images. The pattern of findings that emerges from the analysis of the trajectories above and below the idealized line suggests that conservatives are more likely to perform avoidance behaviors moving their hand away from the center of the screen where the negative image is displayed. If this reasoning is correct, it should also be reflected onto the size of the AUC described in response to positive and negative images when the trajectories are below or above the idealized line. In other words, we predicted that the AUC would be lower when conservatives (vs. liberals) categorize a negative image performing a trajectory above the idealized line, whereas the AUC would be accentuated when conservatives (vs. liberals) categorize a negative image performing a trajectory below the idealized line.

A 2 (valence of the images) × 2 (type of the AUC: below or above the idealized line) × 2 (categorization task) ANCOVA was performed on the AUC size indexes including political ideology as a covariate. A main effect of the valence of the images emerged, $F(1,32) = 8.68$, $p = 0.006$, $\eta^2_p = 0.213$: overall participants described bigger AUC during the categorization of negative images ($M = 0.36$, $SD = 0.04$) as compared to positive images ($M = 0.27$, $SD = 0.36$). Moreover, a two-way interaction emerged between the valence of the images and political ideology, $F(1,32) = 18.19$, $p < 0.001$, $\eta^2_p = 0.362$. Conservatives (as compared to liberals) described bigger AUC for negative images, $\beta = 0.74$, $t(38) = 5.78$, $p < 0.001$ and at the same time they described slightly smaller AUC as compared to liberals for positive images, $\beta = -0.22$, $t(38) = -1.73$, $p = 0.092$ [$R^2 = 0.45$, $F(1,38) = 16.80$, $p < 0.001$; post-hoc power analysis: f2 = 0.82, Power 1-β = 0.999]. Most importantly, this two-way interaction was qualified by a three-way interaction with the type of AUC (below vs. above the idealized line), $F(1,32) = 5.49$, $p = 0.025$, $\eta^2_p = 0.146$. In order to better explore this significant three-way interaction, a linear regression analysis was performed in which political ideology was included as the dependent variable and the four independent indexes about the size of the trajectories (above vs. below the idealized line for both positive and negative images) were entered as predictors, $R^2 = 0.54$, $F(1,33) = 18.02$, $p < 0.001$ (post-hoc power analysis: f2 = 1.17, Power 1- β = 0.999). Conservatives, as compared to liberals, described significantly bigger AUC under the idealized line for negative images, $\beta = 0.78$, $t(38) = 5.04$, $p < 0.001$ [$R^2 = 0.70$, $F(1,38) = 23.29$, $p < 0.001$; post-hoc power analysis: f2 = 2.33, Power 1-β = 1]. No other significant effect emerged ($ps > 0.29$), suggesting that only the size of the trajectories below the idealized curve was indeed related to political ideology. The three-way interaction was not further qualified by the type of task, $F(1,32) = 2.64$, $p = 0.114$, $\eta^2_p = 0.076$.

[2] In order to better understand the three-way interaction involving the type of AUC, valence, and political ideology we also followed a different approach. In particular, a mixed-design ANOVA including political ideology as median split (instead of continuous variable; median = 3.168) was performed. The three-way interaction emerged to be significant, $F(1,32) = 10.81$, $p = 0.002$, $\eta^2_p = 0.25$. Next, two separate ANCOVAs were performed, one for liberal and one for conservative respondents. Interestingly, in the case of liberals the two-way interaction between type of AUC and valence of the images was not significant, $F(1,19) = 0.17$, $p = 0.68$, $\eta^2_p = 0.009$, whereas in the case of conservatives such two-way interaction was significant, $F(1,13) = 9.29$, $p = 0.009$, $\eta^2_p = 0.42$. More specifically, conservatives performed more trajectories above the idealized line for positive images as compared to negative images ($M_{positive} = 10.82$, SE = 0.70; $M_{negative} = 6.89$, SE = 1.15; post hoc *Sidak* $p < 0.001$), whereas they described more trajectories below the idealized line for negative as compared to positive images ($M_{negative} = 12.64$, SE = 1.26; $M_{positive} = 8.93$, SE = 0.64; post hoc *Sidak* $p < 0.001$). Similar analyses including political ideology as median split were also performed for all the other dependent variables and findings basically confirmed those already reported in the manuscript. For parsimony's sake, these analyses have not been reported in text but they are available from the first author.

4. Discussion

Recent research demonstrated a relation between political ideology and the processing of valenced information (e.g., Carraro et al., 2011; Dodd et al., 2012; Hibbing et al., 2014; Oxley et al., 2008), and more specifically of disgusting stimuli (e.g., Inbar et al., 2009; Smith et al., 2011). In the current work, we aimed at further exploring these ideology-based differences by assessing on-line behavioral information during the categorization of valenced images. The adoption of the Mouse-Tracker software package developed by Freeman (see Freeman & Ambady, 2010) provided several indexes that are informative about the way conservatives and liberals reacted to positive and negative images.

First, findings related to the response initiation time (RI) and to response execution time (RE) indicated that conservatives (vs. liberals) were more likely to freeze when exposed to negative (vs. positive) images and they were indeed slower, as compared to liberals, to start and execute any movement. Interestingly, the longer latencies to start and complete a movement did not lead to any increased level of certainty in the responses and, in contrast, conservatives (vs. liberals) tended to display more x-flips when presented with negative images. This is in line with previous results demonstrating the attention-grabbing power of negative information for individuals who embrace a conservative view of the world (see Carraro et al., 2011).

Most importantly, the analysis of the trajectories showed that conservatives and liberals performed very different behaviors when required to categorize positive and negative images. Indeed, when conservatives were faced with a negative target image they displayed a stronger tendency, as compared to liberals, to move away from the target and increase the distance between the image and the position of the mouse during the execution of the response behavior. This tendency clearly emerged from both the analysis of the number of trajectories above and below the idealized line and from the analysis of the size of the AUC, namely the geometric area between the idealized trajectory and the actual trajectories above and below the idealized line. Indeed, conservatives were more likely to respond to negative images by moving below the idealized line and thus placing more space between the target and the location of the mouse. These findings indicate that spontaneous behaviors during the processing of valenced images differ as a function of the political views of the respondent and, more specifically, that conservatives actually display consistent avoidance behavior when faced with negative images. Hand movements thus revealed ideology-based asymmetries in the tendency to approach and avoid images with a clear emotional connotation.

In addition, the described pattern of findings emerged both when participants' attention was explicitly directed towards the valence of the stimuli (i.e., positive vs. negative categorization task) and when processing goals involved an irrelevant perceptual feature (i.e., intact vs. mosaic categorization task). For instance, conservatives exposed to negative images showed a delayed start of their response movement independently from the specific processing goal (i.e., based on the valence or perceptual). This demonstrates the largely unconditional automatic nature of the processes (Bargh, 1989; see also Bargh, 1994; Bargh, Chaiken, Raymond, & Hymes, 1996) and that making valence irrelevant for the execution of the task does not override ideology-based asymmetries both in terms of attentional capture (see also Carraro et al., 2011, Study 1) and behavioral tendencies. The relative impermeability to the current conscious processing-goals of the perceivers while performing the categorization task supports the idea that ideology-based differences may operate in a largely automatic fashion (Hibbing et al., 2014) and possibly pervade any aspect of the way people perceive and, more importantly, react to positive and negative stimuli.

The present findings also represent a further demonstration of how the computer mouse-tracker methodology can provide key information about social psychological processes. Previous research has mainly used the analysis of mouse-trajectories as a way to grasp the tentative

commitment to multiple response alternatives over time (Freeman & Ambady, 2009, 2010; Hehman, Stolier, & Freeman, 2014). According to this framework, one might have predicted conservatives to display trajectories that are less likely to deviate from the idealized line. Indeed, if conservatives have a Manichean representation of the world and therefore they more easily differentiate between good and bad, their hand trajectory should have been less likely attracted by the alternative (and wrong) response option. The obtained results are only partially in line with this framework. On the one hand, as said, conservatives when responding to negative stimuli were clearly more likely to deviate from the idealized line by moving below the idealized line rather than simply following a more straightforward trajectory. On the other hand, no effect emerged in the case of positive images suggesting that the negative-category response alternative did not differentially attract conservatives and liberals. Overall, findings appear to better fit an explanation in terms of selective avoidance tendencies displayed by conservatives when exposed to negative images. At a more general level, they show the flexibility of the mouse-tracker methodology and the possibility of considering a further source of influence on the mouse-trajectory, namely the approach-avoidance behavioral tendencies triggered by the target stimulus in itself (at least when the target image remains visible until response). The present findings also strongly speak in favor of motivational theories that consider the valence of the stimuli as the key factor that triggers functional behavioral responses of approach and avoidance (Krieglmeyer, Deutsch, De Houwer, & De Raedt, 2010), and cannot be explained in terms of an evaluative-coding account (e.g., Eder & Rothermund, 2008; see also Hommel, Müsseler, Aschersleben, & Prinz, 2001). Indeed, differently from other procedures often used to assess approach and avoidance tendencies (e.g., pulling and pushing a joystick), it is unlikely that during the execution of the task with the Mouse Tracker participants labeled responses in evaluative terms. This prevents that any compatibility will arise between the valence of the target stimulus and the meaning that is attributed to the required response behavior, thus making the Mouse Tracker a further helpful tool for the assessment of motivation-based behaviors triggered by affective stimuli.

Finally, it has to be noted that the findings reported in the present paper have mainly been interpreted focusing on negative information and how this type of information might be maximally relevant for conservatives. However, because of the correlational nature of the data, findings could also be framed in terms of a stronger tendency displayed by liberals to prioritize positive stimuli and approach them more easily. In order to better identify the specific processing strategies that characterize conservatives and liberals, future research will benefit from recruiting samples with extremely polarized attitudes thus including respondents situated on opposite extremes of the ideological spectrum.

4.1. Limitations and directions for future research

A first limitation of the present work is that stimuli were always presented at the center of the screen. The presentation of lateralized stimuli (i.e., just below one of the two response buttons) might enable to obtain further insights about how the valence of the presented stimuli influences hand movements. In particular, we would predict that when negative stimuli are presented and the participant has to move towards them in order to provide an answer, trajectories will more likely be above the ideal line (i.e., towards the centre of the screen), especially in the case of conservatives, thus indicating a tendency to distance themselves from such stimuli.

Another limitation is that the present study addressed the reactions of conservatives and liberals towards a very specific type of negative images, namely disgusting images. There is a flourishing literature showing that political conservatism is associated to a greater disgust sensitivity (Inbar et al., 2009). For instance, greater disgust sensitivity predicted more conservative voting in the 2008 U.S. presidential election (Inbar, Pizarro, Iyer, et al., 2012). Moreover, it has been demonstrated that greater disgust sensitivity is related to more conservative attitudes towards several social issues, such as immigration, abortion, euthanasia, stem cell research, and homosexual marriages (Terrizzi et al., 2010). However, we cannot conclude that the findings obtained in the present study actually extend to other types of negative stimuli. For instance, it might be that in the case of threatening stimuli (e.g., a man holding a gun), conservatives are more likely to confront and be engaged with such stimuli (see Dodd et al., 2012). This is an empirical question that deserves further attention together with a more in-depth analysis of the directionality of the link between political ideology and the processing of valenced information that cannot be uncovered through correlational studies. A longitudinal approach would be clearly better suited to achieve this goal.

In addition, although the focus has been here on the distinction between the processing of positive and negative information, it has to be acknowledged that the images employed in the present study were not selected controlling for their arousal. It has been recently suggested that arousal rather than valence might be the key feature driving ideology-based asymmetries (Tritt, Inzlicht, & Peterson, 2013, 2014). Although we cannot currently rule out this alternative explanation, the different behavioral tendencies displayed by conservatives and liberals, as revealed by mouse-trajectories, nonetheless remain an important demonstration of the influence of political views on the way we move in an environment populated by emotionally-laden stimuli.

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