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Embodiment of abstract categories in space... grounding or mere compatibility effects? The case of politics

Abstract

In two experiments, the role played by stimulus response compatibility in driving the spatial grounding of abstract concepts is examined. In experiment 1, participants were asked to classify politics-related words appearing to the left or the right side of a computer monitor as socialist or conservative. Responses were given by pressing vertically aligned keys and thus orthogonal to the spatial information that may have been implied by the words. Responses given by left or right index finger were counterbalanced. In experiment 2, a lexical decision task, participants categorized political words or non-words presented to the left or the right auditory channels, by pressing the top/bottom button of a response box. The response category labels (word or non-word) were also orthogonal to the spatial information that may have been implied by the stimulus words. In both experiments, responses were faster when socialism-related words were presented on the left and conservatism-related words were presented on the right, irrespective of the reference of the response keys or labels. Overall, our findings suggest that the spatial grounding of abstract concepts (or at least politics-related ones) is independent of experimentally driven stimulus-response compatibility effects.

Keywords: spatial grounding, abstract concepts, compatibility effects, politics

1. Introduction

Research to date has documented that abstract concepts like “affect”, “power” or “time” implicitly activate spatial associations (e.g., Boroditsky, 2000; Crawford, Margolies, Drake, & Murphy, 2006; Körner, Topolinski, & Strack, 2015; Lakens, Semin, & Garrido, 2011; Meier & Robinson, 2004; Palma, Garrido, & Semin, 2011; Schubert, 2005). More recently, others have shown that the political categories of left and right are represented horizontally in space (e.g., van Elk, van Schie, & Bekkering, 2010; Farias, Garrido, & Semin, 2013; Garrido, Farias, & Semin, 2015; Oppenheimer & Trail, 2010). The two experiments we report here investigate if these findings reveal a process that is independent of response compatibility effects that may have possibly confounded earlier findings.

According to conceptual metaphor theory (Lakoff & Johnson, 1999), a concrete source domain (e.g., space) helps ground an abstract target domain (e.g., politics) and facilitates comprehension and communication. The use of the spatially polar opposites of left–right when thinking and talking about a politics-related abstract concept may thus constitute an instance of a linguistic metaphor.

In the domain of politics, van Elk and colleagues (2010) have shown that participants indicating whether a stimulus appearing in the middle of the screen was a political acronym were faster when the key they were instructed to press was congruent with the political referent of the acronym. Overall, right-key press was faster when the political acronym represented a right-wing party and the reverse for left-key press. Moreover, faster responses were also observed when participants responded with a single key-press to stimuli appearing on the left or the right of the screen as a function of their political meaning. Acronyms representing right-wing parties presented on the right were classified faster.

The question of whether the associations between political referents and space are due to the representation of politics as two spatial polar opposites has been addressed as a facilitation effect (e.g., van Elk et al., 2010) derived from stimulus/response compatibility.

Stimulus-response compatibility (SRC) effects have been documented for stimulus and response sets that have dimensional overlap. Although originally defined as perceptual (physical) or conceptual similarity, irrespective of the spatial or non-spatial nature of the dimensions (e.g., Kornblum, 1991; Kornblum, Hasbroucq, & Osman, 1990) dimensional overlap can also include structural similarity (e.g., ordinal structure of the stimulus and response sets; Kornblum & Lee, 1995; see for a review, Proctor & Cho, 2006). A classic example of these facilitation effects is the one reported for number processing, which has been found to be accompanied by the activation of spatial left/right associations (spatial-numerical association of response codes – SNARC-effect; Dehaene, Bossini, & Giraux, 1993). Faster reaction times were observed for left (and down) button presses in the presence of low numbers and for right (and up) button presses for high numbers (see also Schwarz & Keus, 2004).

Recent studies in the domain of the representation of time related concepts have provided initial support for the assumption that time-related stimuli focus people's attention to the right and the left, while partially avoiding dimensional overlap (e.g., Lakens et al., 2011). Moreover, Farias and colleagues, (2015) have recently shown that words classified as socialism-related in terms of semantic meaning, were placed more to the left (vs. conservatism-related words) of a horizontal line and when presented equally loud to both ears were auditorily disambiguated to the ear congruent with the political position expressed by the word.

Notably, SRC can be operating in the case of politics related judgments. The spatial label represented in political stimuli (e.g., communism), can overlap with the left/right spatial nature of the response that is required (e.g., press right or left key, using left/right hand). Moreover, even when the response does not entail an obvious spatial referent (e.g., when there is no left/right button press), the spatial dichotomy is often present in the response label (e.g., indicate if it is a conservatism or socialism related word).

In the current paper, we aim to further demonstrate that people represent politics on the left-right spatial axis independently of potential SRC effects. Specifically, we will examine whether the outcomes of this spatial representation are driven by a specific match/mismatch between polarized political stimuli and the dichotomous response keys or hand that are being used to complete the task (Experiment 1). Additionally, we will also show that such spatial representation does not derive from any implicit aspect of the task that might call attention to the left-right axis, by eliminating politics-related response labels (Experiment 2).

In the first experiment, participants were asked to categorize conservatism or socialism related words by pressing response keys that were vertically aligned. Thereby we controlled for SRC, which could be introduced by horizontal (but not vertical) response key assignments. Further, we controlled for the dimensional overlap in stimulus-hand mappings and examined their influence in the results, by having participants responding to socialism (and conservatism) related stimuli either with a right or a left hand key press. In the second experiment, a lexical decision task, the stimuli were auditorily presented and participants responded by using vertically aligned keys. Importantly, as the response only required an indication of whether the stimuli presented was a word or a non-word, the potential overlap between the spatial

information that may have been implied by the words and the (absent) spatial labels (in this experiment “words-non-word) of the response were also avoided.

2. Experiment 1

Experiment 1 involved a speed accuracy classification task whereby participants classified a set of words as referring to either socialism or conservatism. Neutral politics-related words were also included. The words were randomly presented on the left or the right side of the monitor. Responses were given by pressing vertically aligned keys (the response keys were counterbalanced between participants). Thus, we were able to control for SRC effects, which could have emerged from the overlap between the spatial referents activated by political stimuli and the spatial alignment of the response keys. Further, we controlled for the structural overlap in stimulus-hand mappings by counterbalancing, between participants, the hand used to press the key to categorize the words as socialist or conservative.

We predicted that socialism-related words appearing on the left and conservatism-related words appearing on the right would be classified faster than vice versa regardless of the key or the hand used to provide the response. The classification of neutral words should be equally fast irrespective of the side they were presented.

2.1. Method

Participants

Sixty-nine ISCTE-IUL university students ($M_{\text{age}} = 20.88$; 54 females, 94% right handed) participated in this experiment. All procedures were executed in compliance with the relevant ethical guidelines and were approved by the ethics committee. All participants gave written informed consent for their participation.

Stimulus materials

We used 10 socialism-related words and 10 conservatism-related words as well as three neutral words, all of which had been previously piloted (Garrido, Farias, & Palma, 2010). The socialism-related stimuli comprised six socialism referent words (*Communism, Demonstration, Proletariat, Revolution, Strike, Union*) two socialist political party acronyms (*PCP – Portuguese Communist Party; BE – Left Block*) and two names of socialist politicians (*Jerónimo Sousa, leader of PCP and Francisco Louçã, leader of BE*). The conservatism related-stimuli included six conservatism-referent words (*Stock Market, Capitalism, Colonialism, Consumerism, Profit, Wealth*), two conservative political party acronyms (*CDS- Popular Party; PSD - Social Democratic Party*) and two names of conservative politicians (*Paulo Portas, leader of CDS – Popular Party and Passos Coelho, leader of PSD – Social Democratic Party*). The remaining words were neutral (*elections poll, government and parliament*) and not associated with any particular political orientation.

Procedure

Participants were seated in front of a computer monitor and informed they would be participating in a categorization study. They were further told that their task would be to indicate, as fast and as accurately as possible, if each stimulus presented was associated with socialism or conservatism by pressing the “T” and “V” keys on the keyboard (counterbalanced between participants). The hand pressing the key was also counterbalanced between participants. Thus, we had a 3 (Word Type: conservatism, socialism, neutral), by 2 (Side of Presentation: right, left), by 2 (Key: “T” vs. “V”), by 2 (Hand: left vs. right) design with the first two variables being within participants ones, and the latter two between participants. Thus, to classify a word as referring to socialism participants should press “T” with their left index

finger (condition 1; $N = 17$), with their right index finger (condition 2; $N = 13$), or to press “V” with their left (condition 3; $N = 13$) or right (condition 4; $N = 17$) index finger. The words were randomly presented on the left and right side of the monitor. Each word appeared three times in each location (left or right). In total there were 138 trials.

2.2. Results and Discussion

Inaccurate trials (20%), as well as trials with response latencies 2.5 SD above or below the latency mean (11%) were excluded from the subsequent analysis.¹

A 3 (Word Type: conservatism, socialism, neutral) X 2 (Side of Presentation: right, left) within participants X 4 (Condition: 1, 2, 3, 4) between participants analysis of variance revealed a main effect of Word Type $F(2,112) = 16.07$ $p < .001$, $MSE = 8795$, $\eta_p^2 = .223$, indicating that participants were faster in classifying conservatism ($M = 954$, $SD = 115$) and socialism-related words ($M = 948$, $SD = 119$), than neutral words ($M = 1011$, $SD = 165$); $t(56) = 4.02$, $p < .001$ and $t(56) = 4.42$, $p < .001$, respectively. These slower reaction times observed for neutral words may be due to the fact that classifying a neutral word as representing conservatism or socialism is likely to constitute a more difficult task.

As expected there was a significant interaction between the words’ associated political orientation and the side of the monitor in which they appeared ($F(2,112) = 13.20$, $MSE = 8583$, $p < .001$, $\eta_p^2 = .191$). Planned comparisons testing our specific hypothesis indicated that participants were faster in classifying conservative-related words appearing on the right ($M = 920$, $SD = 112$) than the same words appearing on the left ($M = 989$, $SE = 118$), $t(56) = 4.57$, $p < .001$. Participants were also faster in classifying socialism-related words appearing on the left ($M = 922$, $SD = 108$) than

¹ Nine participants with hit rates below 50% were excluded from the analysis.

the same words appearing on the right ($M = 973$, $SD = 130$), $t(56) = 4.05$, $p < .001$. As expected the classification of neutral words was equally fast on both the right ($M = 992$, $SD = 152$) and the left side ($M = 1030$, $SD = 177$), $t(56) = 1.59$, $p = .117$. No further main or interaction effects were significant, including condition (hand assignment; all $F_s < 1$).²

To further establish that people naturally represent politics on the left-right spatial axis, and that this representation does not derive from task demands and that is not learned over trials, we conducted additional analyses across trials to examine whether the effects can be observed in the very first trial.

A 3 (Word Type: conservatism, socialism, neutral) X 2 (Side of Presentation: right, left) X 3 (Trial of stimulus presentation: 1, 2, 3) within participants X 4 (Condition: 1, 2, 3, 4) between participants analysis of variance indicated a main effect of Trial $F(2,100) = 117.59$, $p < .001$, $\eta_p^2 = .702$ as well as an interaction between Word Type, Side of Presentation and Trial $F(4,200) = 2.664$ $p = .034$, $\eta_p^2 = 0.05$. The main effect of Trial indicates that participants became overall faster in classifying the stimuli from the first trial ($M = 1105$, $SD = 193$) to the second ($M = 933$, $SD = 140$) and the third ($M = 884$, $SD = 135$) trials ($t(50) = 10.08$, $p < .001$ and

² We computed an additional hand assignment variable as between participants factor with 2 levels (Congruent: participants categorized socialist words with the left index finger and conservative words with the right index finger - conditions 1 and 3; and Incongruent: participants categorized socialist words with the right index finger and conservative words with the left index finger - conditions 2 and 4). We then conducted an ANOVA with repeated measures introducing the hand assignment as between subjects factor. No main ($F < 1$) or interaction effects of this variable were observed (Word Type X Hand Assignment, $F < 1$; Side of Presentation X Hand Assignment, $F < 1$; Word Type X Side of Presentation X Hand Assignment, $F(2,116) = 1.185$, $p = .309$. Importantly, both the Word Type main effect $F(2,16) = 16.196$, $p < .001$, $\eta_p^2 = .218$ and the expected interaction between Word Type X Side of Presentation remained significant $F(2,16) = 13.403$, $p < .001$, $\eta_p^2 = .188$. These results provide additional support to our claim that the spatial effects observed are independent of the manual response features.

$t(50) = 4.72, p < .001$, respectively). To further examine the interaction between Word Type X Side of Presentation X Trial we computed an index of the difference between incongruent (mean reaction times for conservative words presented to the left auditory channel and socialist words presented to the right auditory channel) and congruent trials (mean reaction times for conservative words presented to the right auditory channel and socialist words presented to the left auditory channel) for each of the three trials. Planned comparison indicated that this difference was significantly higher in the first ($M = 82.76, SD = 144.07$) compared with the last trials ($M = 26.14, SD = 128.60$), $t(57) = 2.72, p = .009$. The difference was not significantly different between the first and second trials ($M = 44.18, SD = 93.44$), $t(57) = 1.67, p = .101$, or the second and the last trials, $t(56) = .31, p = .760$.

Importantly, when introducing the trials variable, the previously reported main and interaction effects remained significant (Main effect of Word Type $F(2,100) = 20.23, p < .001, \eta_p^2 = .288$, Word Type X Presentation Side $F(2,100) = 9.525, p < .001, \eta_p^2 = .160$).

Overall these results replicate the spatial grounding of politics (e.g., van Elk et al., 2010; Farias et al., 2013, Garrido et al., 2015; Oppenheimer & Trail, 2010). Importantly, they suggest that the observed effects, are not only independent of the compatibility between the spatial information that may have been implied by the words and the spatial alignment of the response-key but they also emerge in the absence of compatibility between stimulus spatial content and the hand used to provide the response. Furthermore, the effects emerged early in the experiment suggesting that they were not learned over trials, that is, that politics is spatially represented regardless of the task demands.

Therefore, the results provide preliminary support to the assumption that

political-related stimuli focus people's attention to the right and the left irrespective of stimulus-response-key, response-hand compatibility effects or other implicit features of the task demands.

However, before we proceed with a more general discussion of the significance of these results we further examined whether the spatial grounding of political concepts may derive from the overlap between the spatial nature of the stimuli (political left and right) and the nature of the response labels (socialist/ conservative). This was examined in a second experiment using a lexical decision task.

3. Experiment 2

Experiment 2 was designed to examine if the pattern of results obtained in the first experiment, where the response involved spatial response labels (socialist vs. conservative) holds in a paradigm that does not involve any type of overlap between the spatial referent of the stimuli and the nature of the response label (word or non-word).

In this experiment we used a lexical decision task (LDT) and asked participants to categorize a set of stimuli (words and non-words) that were auditorily presented to the left, right or both channels. The response was given by pressing the top or the bottom key of the response box, the response keys being thus orthogonal to the spatial information that may have been implied by the words. Importantly, the response label in the LDT (word or non-word) did not have a spatial (e.g., left / right) or political (e.g., socialist / conservatism) nature avoiding any possibility of stimulus-response label overlap. We predicted faster reaction times to socialism-related words presented to the left auditory channel and conservatism-related words presented to the right auditory channel. Response times to politically neutral words should be equally fast

irrespective of the auditory channel to which they were presented.

3.1. Method

Participants

Forty-six Utrecht University students ($M_{\text{age}} = 20.93$; 31 females) participated in this experiment for partial course credit. All procedures were executed in compliance with the relevant ethical guidelines and were approved by the ethics committee. All participants gave written informed consent for their participation.

Stimulus materials

We used six socialism referent words (*Communism, Demonstration, Proletariat, Revolution, Strike, Union*), six conservatism referent words (*Capitalism, Colonialism, Consumerism, Profit, Stockmarket, Wealth*), and six neutral words (*Dice, Glass, Paper, Pot, Record, Ring*) as well as eighteen non-words (e.g., word: *aandelenmarkt* (stockmarket), non-word: *mtnrkdlaenaea*; word: *kapitalisme* (capitalism), non-word: *eiipalstamk*; word: *dobbelen* (dice), non-word: *msteokot*) to divert participant's attention to the political reference of the stimuli. The words used were selected from the Portuguese pretest (Garrido, et al, 2010) but their appropriateness to be used as stimulus materials was confirmed with the Dutch sample. In a 7 point Likert scale the ratings for socialism-related words ($M = 2.97$, $SD = .74$) significantly differed from those obtained for conservatism-related words ($M = 5.53$, $SD = 1.10$), $t(45) = -10.86$, $p < .001$, on a socialism-conservatism dimension. Both the socialism and conservative related words were significantly distant from the scale midpoint $t(45) = -9.47$, $p < .001$ and $t(45) = 9.38$, $p < .001$ respectively. The non-words used were generated by scrambling the stimulus words with a software available on the internet. In some cases, because a newly created non-word was similar to an existing Dutch word, we simply replaced vowels or consonants to ensure

that they were really non-words. In any case, the length of the non-words was exactly the same as the length of the words.

The words were converted to audio files using a text to speech application. Each word was randomly presented three times to the left and three times to the right auditory channel as well as three times to both auditory channels simultaneously. Again, simultaneous presentation to both auditory channels was used to divert participants' attention from any right/left spatial cues. There were 324 trials in total.

Participants were seated in the cubicles wearing headphones. Their task was to classify, as fast and as accurately as possible, if the word that was presented over headphones was a word or a non-word by pressing the top or bottom key of the E-prime response box. The key position was counterbalanced between participants.

3.2. Results and Discussion

Inaccurate trials (8.21%), as well as trials with response latencies 2.5 SD above or below the latency mean (21.8%) were excluded from the subsequent analysis.³

A repeated measures analysis of variance on the response latencies with Word Type (socialist, neutral or conservative) and Auditory Channel (left, right, both) as independent variables revealed two main effects and the expected interaction.

The first main effect of Word Type, $F(2,82) = 97.2, p < .001, MSE = 2907, \eta_p^2 = .703$, indicated that participants were faster in categorizing neutral words ($M = 779, SD = 80$) than conservative ($M = 864, SD = 90$), $t(41) = 10.70, p < .001$, and socialism-related words ($M = 857, SD = 81$), $t(41) = 11.28, p < .001$. This was not a surprising result as neutral words were probably more familiar to participants than the two politics-related word categories.

The second main effect was for the Auditory Channel, $F(2,82) = 25.59, p <$

³ Note that from the total of trials excluded over 20% correspond to non-words, overall with very long response latencies. Four participants with error rates above 50% were excluded from the analysis.

.001, $MSE = 1457$, $\eta_p^2 = .384$, and indicated that participants were faster in classifying the words presented simultaneously to both ears ($M = 814$, $SD = 85$) than those presented to right ($M = 839$, $SD = 84$), $t(41) = 4.76$, $p < .001$, or to the left auditory channel ($M = 848$, $SD = 82$), $t(41) = 6.48$, $p < .001$. Classification times were also significantly faster when the words were presented to the right than to the left auditory channel, $t(41) = 2.19$, $p = .034$. The overall pattern was therefore skewed to the right reflecting a general bias due to hemispheric asymmetry with verbal information presented to the right ear being processed more efficiently (e.g., Belin et al., 1998; Kimura, 1961).

The interaction between Word Type and Auditory Channel was also significant $F(4,164) = 2.42$, $p = .051$, $MSE = 1466$, $\eta_p^2 = .056$. This interaction shows that conservatism words were classified faster when they were presented to both auditory channels ($M = 837$, $SD = 95$) than when they were presented to the right ($M = 866$, $SD = 93$), $t(41) = 2.79$, $p = .008$, or the left auditory channel ($M = 890$, $SD = 83$), $t(41) = 5.68$, $p < .001$. Importantly for our predictions, participants were significantly faster classifying conservative words when they were presented to the right than when they were presented to the left, $t(41) = 3.198$, $p = .003$. Similarly, socialism related words we classified faster when presented to both auditory channels ($M = 843$, $SD = 80$) than when they were presented to the right ($M = 865$, $SD = 83$; $t(41) = 3.07$, $p = .004$,) or to the left auditory channel ($M = 863$, $SD = 80$), $t(41) = 2.86$, $p = .007$.. Classification times of socialist words did not differ between left and right auditory channels, $t(41) = .22$, $p = .825$. Finally, neutral words were classified faster when presented to both auditory channels ($M = 763$, $SD = 80$) than when presented to the right ($M = 785$, $SD = 75$, $t(41) = 2.62$, $p = .012$ and the left auditory channel ($M = 789$, $SD = 84$), $t(41) = 2.88$, $p = .006$). No significant differences were observed in the

classification latencies of neutral words on the left and right auditory channels, $t(41) = .59, p = .562$.

Because neutral words and dual channel presentation simply constituted distracting conditions we tested whether the observed interaction would hold when only socialism and conservatism words and left-right channels were considered. A repeated measures analysis of variance on the response latencies with Word Type (socialist, conservative) and Auditory Channel (left, right) as independent variables was then performed to test our specific hypotheses.

The results revealed a main effect of Auditory Channel, $F(1,41) = 4.36, p = .043, MSE = 1238, \eta_p^2 = .096$, indicating that participants were faster in categorizing the words when they were presented to the right ($M = 865; SD = 88$) than to the left auditory channel ($M = 877; SD = 82$). Additionally, participants' were faster classifying socialist ($M = 864; SD = 82$) than conservative words ($M = 878; SD = 88$), $F(1,41) = 5.71, p = .022, MSE = 1441, \eta_p^2 = .122$.

Importantly, the interaction between Word Type and Auditory Channel was also significant, $F(1,41) = 5.80, p = .021, MSE = 1233, \eta_p^2 = .124$, confirming that the classification of conservatism-related words was faster when these words were presented to the right channel ($M = 866, SD = 93$) than to the left one ($M = 890, SD = 83$). For socialism-related words, mean response latencies were reversed but did not differ significantly between the left ($M = 863, SD = 80$) and the right channel ($M = 865, SD = 83$).

Like we did for Experiment 1, in order to establish that the representation of politics on the left-right spatial axis does not derive from task demands and that is not learned over trials, we conducted additional analyses across trials. A 2 (Word Type: conservatism, socialism) X 2 (Auditory Channel: right, left) X 3 (Trial of stimulus

presentation: 1, 2, 3) within participants analysis of variance indicated a main effect of Trial $F(2,82) = 29.88, p < .001, \eta_p^2 = .422$ but the interaction Trial X Auditory Channel X Word Type was not significant $F(2,82) = 2.22, p = .115, \eta_p^2 = 0.051$. The main effect of Trial indicates that participants became overall faster in classifying the stimuli from the first trial ($M = 918, SD = 110$) to the second ($M = 859, SD = 99$) and the third ($M = 833, SD = 113$) trials ($t(41) = 5.33, p < .001$ and $t(41) = 7.28, p < .001$, respectively). Importantly, when introducing the trials variable, the following main and interaction effects remained significant (Main effect of Word Type $F(1,41) = 6.30, p = .016, \eta_p^2 = .133$, and Word Type X Auditory Channel $F(1,41) = 5.22, p = .028, \eta_p^2 = .113$).

These findings suggest that the classification of words referring to different political positions is driven automatically and systematically as a function of their spatial presentation congruence. Conservative words were recognized as words more rapidly when presented to the right auditory channel. The predicted reverse pattern for socialism-related words was not significant (see general discussion). Nevertheless, the observed effects emerged in a lexical decision task, which avoids structural overlap in stimulus–response mappings from influencing the results (e.g., Proctor & Cho, 2006). Moreover, this cross modal demonstration complements and adds generalizability to the effect. Likewise, using another sample in a different country indicates that the effect is robust and generalizable.

4. General Discussion

The use of the spatial polar opposites of left–right when thinking and talking about politically related abstract concepts may constitute an instance of a linguistic metaphor (Lakoff & Johnson, 1999), whereby nonlinguistic mappings from the

concrete source domain (e.g., space) are applied to the relatively abstract target domain (e.g., politics).

Previous studies have already documented that the political categories of left and right are represented horizontally in space (van Elk et al., 2010; Farias et al., 2013; Oppenheimer & Trail, 2010). In a series of studies, van Elk and colleagues (2010) have come to the conclusion that the processing of political information is accompanied by the implicit activation of spatial left-right associations. The associations between political and spatial stimuli has however been addressed as a facilitation effect (e.g., Dehaene et al., 1993). Faster reaction times were observed when participants responded with the key/hand that was congruent to the perceived orientation of the political stimuli (e.g., making faster right-hand button presses in response to political stimuli representing a right-wing party, van Elk et al., 2010). In contrast, if the side of response key/hand did not match the spatial referent of the perceived stimuli, slower reaction times were observed (van Elk et al., 2010).

Our results suggest however that the observed association between political abstract concepts and space does not derive merely from the fact that political information primes particular spatial response codes. In fact, our results show that the association between political concepts and space is observed in the absence of a structural overlap in stimulus-response mappings.

In experiment one, we showed that participants were faster classifying political stimuli as conservative when they were presented on the right side, and vice versa for socialism-related stimuli in the absence of a left-right button press or regardless the hand used to respond. In experiment 2, and in the absence of political response labels, we have shown that political conservatism-related stimuli presented to the right auditory channel were classified faster as words than when presented to the left

auditory channel although the reverse pattern did now show a significant difference in the case of socialism related words. It is possible that the weak effect observed for socialism-related words was due to right-channel classification advantage. Words were always classified faster on the right channel but conservative ones more so than socialism-related ones. Taken together the results of both experiments support the idea that political-related stimuli are grounded in space independently of stimulus-response compatibility.

Our results are in line previous evidence of the spatial grounding of politics that is now further demonstrated with different types of political stimuli (words, party acronyms, politicians' names), in two different linguistic communities and across visual and auditory modalities. Furthermore, the similar pattern of results obtained in experiments 1 and 2 across two different sensory modalities (vision and audition), replicates the previously observed crossmodal overlap (Farias, et al., 2013).

The results from the experiments reported here show that SRC effects do not drive the representation of political concepts in a horizontal dimension. What then is the driving mechanism of this representation that yields these systematic effects?

As stated in the introduction, the effects rely on socially constructed linguistic metaphors. Like other social concepts, such as power (associated with the vertical dimension, see for example Schubert, 2005) or time (associated with the horizontal dimension, see for example Lakens, et al, 2011), politics is also spatially grounded. The particular feature of the metaphorical associations in the political domain, at least as compared with the other two examples, is that the link between abstract and concrete concepts that is metaphorically established is unambiguously a cultural construct (see Garrido et al., 2015). For example, while an actually tall person can be seen as more powerful, a socialist is physically not the left side of anything. The

association of political concepts and the horizontal spatial dimension is a culturally supplied linguistic one (see Semin, 2011). The question of the mechanism driving the systematic effects that we and others have reported is that this culturally anchored metaphor activates complementary attentional processes whereby socialism-related stimuli drive attention to the left (see Meier & Robinson, 2004, for a similar argument) and vice versa for conservatism related words. Alternative methods that would converge this attention driving argument of political metaphors (as well as other spatially grounded ones) would be to examine such attentional processes by tracking eye movement in a classification task. Another possibility would be to tap whether specific brain areas linked to spatial processing become activated in the presence of politically relevant stimuli.

Finally, because many studies examining the sensory basis of abstract concepts (e.g., valence, time, power, etc.) resort to experimental paradigms that may be interpreted as SRC effects, the paradigms used in the current experiments and the general findings we have obtained can be seen as a contribution for clarifying these effects. These findings can also be seen as potentially contributing a perspective to other domains in which abstract concepts have being arguably spatially grounded.

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