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Emotional Valence is Body-Specific: Evidence from spontaneous gestures during US presidential debates.

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Abstract

What is the relationship between motor action and emotion? Here we investigated whether people associate good things more strongly with the dominant side of their bodies, and bad things with the non-dominant side. To find out, we analyzed spontaneous gestures during speech expressing ideas with positive or negative emotional valence (e.g., freedom, pain, compassion). Samples of speech and gesture were drawn from the 2004 and 2008 US presidential debates, which involved two left-handers (Obama, McCain) and two right-handers (Kerry, Bush). Results showed a strong association between the valence of spoken clauses and the hands used to make spontaneous co-speech gestures. In right-handed candidates, right-hand gestures were more strongly associated with positive-valence clauses, and left-hand gestures with negative-valence clauses. Left-handed candidates showed the opposite pattern. Right- and left-handers implicitly associated positive valence more strongly with their dominant hand: the hand they can use more fluently. These results support the body-specificity hypothesis, (Casasanto, 2009), and suggest a perceptuomotor basis for even our most abstract ideas.

Keywords: Body-specificity hypothesis; Gesture; Handedness; Metaphor; Presidential election; Valence

Introduction

Language and culture are two powerful forces that shape our minds. Where languages and cultures differ from one another, linguistic and cultural experience gives rise to language-specific and culture-specific patterns of thinking and acting, plausibly via ordinary learning mechanisms (e.g., Casasanto, 2008a; Nisbett, Peng, Choi, & Norenzayan, 2001; cf., Fodor, 1985; Pinker, 1994).

Here we investigate another pervasive force that shapes our thoughts, feelings, and actions: bodily experience. According to the *body-specificity hypothesis* (Casasanto, 2009), people with different kinds of bodies, who interact with their physical environments in systematically different ways, should form correspondingly different ‘body-specific’ mental representations.

It is challenging to disentangle the potential contributions of linguistic, cultural, and bodily experience to the structure of our minds. Because patterns in language and culture closely mirror patterns of bodily interactions with the environment (Clark, 1973), language, culture, and body generally make the same neural and behavioral predictions. To overcome this obstacle, the present study tested for a body-specific association between physical space and

emotional valence that is not encoded in any known language or cultural artifacts, but which was predicted based on particulars of our bodies.

In language and culture, Good=Right.

Across languages and cultures, *left* is conventionally associated with *bad* and *right* with *good*. English idioms like *the right answer* and *my right hand man* link good things with rightward space, and complementary idioms like *out in left field* and *two left feet* associate bad things with leftward space. The Latin words for right and left, *dexter* and *sinister*, form the roots of English words meaning skillful and evil, respectively. The words for right in French (*droite*) and in German (*Recht*) are closely related to the words meaning a ‘right’ or privilege accorded by the law, whereas the words for left in French (*gauche*) and German (*Links*) are related to words meaning distasteful or clumsy.

Left-right idioms are also evident in nonlinguistic conventions in many cultures. Roman orators were admonished never to gesture with their left hand, alone (Quintillian, *Institutio Oratoria*, Book 11). Actors in the English renaissance were warned that vigorous left-hand gesturing was not only vulgar but also dangerous, and could result in the ‘vital spirits’ exploding out of the left ventricle (Bulwer, *Chironomia*, 1644). In modern Ghanaian society, pointing and gesturing with the left hand is prohibited (Kita & Essegby, 2001). According to Islamic doctrine, the left hand should only be used for dirty jobs like cleaning one’s self, whereas the right hand is used for eating. Likewise, the left foot is used for stepping into the bathroom, and the right foot for entering the mosque.

Why does *good* correspond to *right* and *bad* to *left*, throughout the world and throughout the ages? One possible explanation is that this pattern arises from universal properties of the human brain and mind, perhaps related to innate hemispheric specialization for approach and avoidance motivational systems (Maxwell & Davidson, 2007). Once established due to innate neurobiological factors, conventions in language and culture may reinforce this implicit preference for the right.

An alternative possibility, however, is that left-right conventions in language and culture arise as a consequence of body-specific associations between space and valence. Bodies are lopsided. Most people have a dominant hand, usually the right hand (Corballis & Beale, 1976), and therefore interact with their environment more fluently on

one side of body-centered space than the other. Greater perceptuomotor fluency has been shown to correlate with more positive evaluations: People like things that are easy to perceive and interact with (Oppenheimer, 2008; Reber, Winkielman, & Schwarz, 1998). For example, expert typists prefer pairs of letters that can be typed easily over pairs that are more difficult to type (even when typing is not relevant to the task), suggesting that motor experience can influence affective judgments (Beilock & Holt, 2007).

In a sense, we are all ‘experts’ at using our dominant hands. Perhaps over a lifetime of lopsided perceptuomotor experience, people come to implicitly associate good things with the side of space they can interact with more fluently, and bad things with the side of space they interact with less fluently? On this possibility, the apparent universality of the ‘good is right’ mapping suggested by linguistic and cultural conventions could be a result of right-handers’ predominance in the population, worldwide. Linguistic and cultural conventions may develop according to the implicit body-specific preferences of the majority.

Is the ‘right’ side sometimes the left?

If the experience of asymmetrical perceptuomotor fluency causes people to develop ‘mental metaphors’ (Casasanto, 2008b) linking space to valence, then right- and left-handers should develop contrasting space-valence associations. For right-handers, *right* should be linked with *good* and *left* with *bad*, but the opposite should be true for left-handers.

To investigate this possibility, a series of experiments compared right- and left-handers’ preferences for things on the right or left side of a page. In one study, participants saw two boxes, one on the right and the other on the left of a cartoon character (viewed from above). They were asked to indicate which of the boxes best represented *good things* and which best represented *bad things*. English- and Dutch-speaking participants showed reliable intuitions about which was the ‘good’ box, but these intuitions differed strikingly between right- and left-handers. The majority of right-handers chose the box on the right, whereas the majority of left-handers chose the box on the left (Casasanto, 2009). This pattern was found even when participants were forced to respond verbally, without writing or pointing with their hands.

In further experiments, participants were asked to evaluate pairs of alien creatures based on drawings, or pairs of job applicants and commercial products based on brief verbal descriptions. The pictures and descriptions appeared in columns on the left and right of the page, and the locations of the members of each pair were counterbalanced. Right-handed participants tended to attribute more positive characteristics to the alien creatures who they encountered in the right column, judging them to be smarter, happier, more attractive, and more honest on average than the creatures they saw in the left column. Left-handers showed the opposite preference. Likewise, right-handers tended to prefer the person or product they saw described on the right side of the page, whereas left-handers preferred the ones

described on the left (Casasanto, 2009). Even when the spatial manipulation was implicit, right- and left-handers’ showed a body-specific pattern of judgments.

Minding the US presidential candidates’ hands.

The goal of the present study was to test for a body-specific association between handedness and emotional valence in spontaneous behavior, in the real world. We analyzed a large and widely available corpus of speech and gesture: the final US presidential debates from 2004 and 2008. Serendipitously, both of the candidates from 2004 were right-handed (John Kerry, Democrat; George W. Bush, Republican), and both candidates from 2008 were left-handed (Barack Obama, Democrat; John McCain, Republican).

The complete transcripts from both debates were parsed into clauses. All spoken clauses were rated as expressing ideas with positive, negative, or indeterminate emotional valence, by raters blind to the gestures that accompanied them. Gesture strokes during clauses with positive and negative valence were then coded as having been performed with the left hand, right hand, or both hands. We then tested for associations between the hand used to perform each unimanual gesture (dominant, non-dominant) and the emotional valence of the co-occurring spoken clause (positive, negative).

We considered three possible outcomes. First, there could be no significant association between hand and valence. Given that this sample of over 700 gestures provided considerable power, this result would suggest that people do not spontaneously associate positive ideas with their dominant hand, and further that the previously discovered links between handedness and valence may only be observable under laboratory testing conditions.

Second, there could be an association of right-hand gestures with positive valence clauses. This could indicate that all speakers, right- and left-handers alike, had internalized the ‘good is right’ mapping in our language and culture (or alternatively, that the candidates had some explicit gesture coaching in line with our linguistic and cultural metaphors).

Finally, the most complex prediction was that the hand used to gesture would be significantly associated with the valence of the co-occurring speech, but this association would differ between right- and left-handers. An association between dominant hand gestures (whether the right or left hand) and positive valence would show that the body-specific mapping found in the previous experiments (Casasanto, 2009) is not limited to the simplified world of the laboratory, but also extends to a world as complex as that of presidential politics.

Methods

Materials

Written transcripts for the final debates preceding the 2004 and 2008 US presidential elections were obtained from the Commission on Presidential Debates <www.debates.org>.

Videos of the 2004 and 2008 debates were obtained from <www.archive.org> and <www.msnbc.msn.com>, respectively. The handedness of candidates was determined from the online resources listed in the Appendix, and confirmed by inspection of pictures and videos of the candidates writing or throwing, from various sources.

Procedure

Analysis of spoken text The goal of the text analysis was to determine the emotional valence of each spoken clause. Complete transcripts for both debates were parsed into clauses by a trained linguist, who served as Coder 1 for subsequent analyses. All analyses of the spoken text were conducted based on the written transcripts. The coders were blind to the gestures that accompanied them.

Coder 1 read each debate in full, classifying the valence each clause as either *positive*, *negative*, *neutral*, or *indeterminate* (i.e., ambiguous or mixed valence). There were 2998 clauses, in total. Of these, 1566 clauses (52%) were classified as either negative or positive.

The valence of these clauses was then evaluated by an independent coder (Coder 2). Coder 2 read the clauses individually, without reading the full debates, to ensure that valence judgments for individual clauses were not influenced by the valence conveyed in larger units of the discourse. Inter-rater agreement was 82%. Only those clauses for which both coders agreed were submitted to the gesture analysis (1279 clauses; 682 with negative valence, 597 with positive valence).

Analysis of gestures The goals of the gesture analysis were (1) to determine which hand was used for each gesture that accompanied spoken clauses with positive and negative valence, and (2) to test for associations of emotional valence with use of the dominant and non-dominant hand. Coder 1 edited the audio-video recordings of the debates, creating brief clips corresponding to each of the 1279 clauses that had been identified as positive or negative: One clause per clip. Clips lasted from the onset of the first word to the end of the last word of each clause. Coder 1 performed a non-blind analysis of the gestures in each clause, viewing the clips in chronological order and listening to the corresponding speech, to ensure that the clips contained the correct verbal material. During 176 of the clauses (14%), no gestures were observed. During the other 1103 of the clauses (86%), at least one gesture was observed. The video clips of these clauses were analyzed further.

Coder 1 determined the number of distinct gestures (i.e., gesture phrases) in each clip, according to segmentation criteria described by McNeill (1992, pp. 82-84), and coded the hand(s) used for each gesture stroke: left, right, or both hands. Of the 1103 clips, 395 (36%) contained more than one gesture, yielding a total of 1731 gestures. Of these, 915 gestures (53%) were bimanual, and therefore could not be interpreted with respect to the experimental predictions. For the remaining 816 gestures (47%), the strokes were

performed with either the left or the right hand, only. These gestures were analyzed further.

Of these 816 gestures, one was excluded (.001%) because the speaker's gesture space was substantially occluded due to the camera angle. An additional 43 gestures (5%) were excluded because they were highly stereotyped finger-counting gestures, which people have a strong tendency to perform with their dominant hand. Finally, 16 pointing or indicating gestures were excluded (2%) because they made deictic reference to one of the other people in the room, so the speakers' choice of hand may have been influenced by the locations of their interlocutors. The remaining 756 gestures (93%) comprised a mixture of iconic, metaphoric, deictic (abstract and self-referential), and most commonly beat-like gestures. Associations between the valence of the spoken clause and use of the dominant hand were tested in these gestures, based on Coder 1's judgments.

To test the reliability of these judgments, Coder 2 performed a blind (or rather *deaf*) analysis of the gestures identified by Coder 1, coding the hand(s) used for each stroke without listening to the accompanying speech. Of the 1731 gestures observed, 500 (29%) were randomly selected for analysis by Coder 2, half from 2004 and half from the 2008 debate. Selected video clips were numbered, and non-consecutive clips were given to Coder 2. The coder did not know whether gestures were produced during clauses with positive or negative valence, and could not determine their content from context. Inter-rater agreement was 97%.

Results

Summary of gestures observed

For each candidate, the number of gestures produced with the right and left hands during clauses with positive and negative emotional valence was tabulated (table 1). Candidates produced more gestures with their dominant hands (631 dominant hand gestures, 125 non-dominant hand gestures). Both of the left-handers produced more left-hand gestures (McCain: 240 left vs. 13 right, $p\text{-rep}=.99^1$; Obama: 66 left vs. 52 right, $p\text{-rep}=.80$), whereas both right-handers produced more right-hand gestures (Bush: 39 left vs. 153 right, $p\text{-rep}=.99$; Kerry: 21 left vs. 172 right, $p=.99$). This finding is consistent with the general tendency to gesture more with one's dominant hand, and corroborates biographical reports of the candidates' handedness.

A detailed analysis of the form and function of individual gestures lies beyond the scope of this report, and is not directly relevant to our experimental hypothesis, which only concerns the valence of the spoken clauses and the hands used for co-speech gesturing.

Tests of association between hand and valence

The association of dominant hand use with valence was tested using conditional binary logistic regression, stratified by candidate. Stratification protected against potential confounds such as Simpson's paradox (Simpson, 1951) that could result from combining data across individuals.

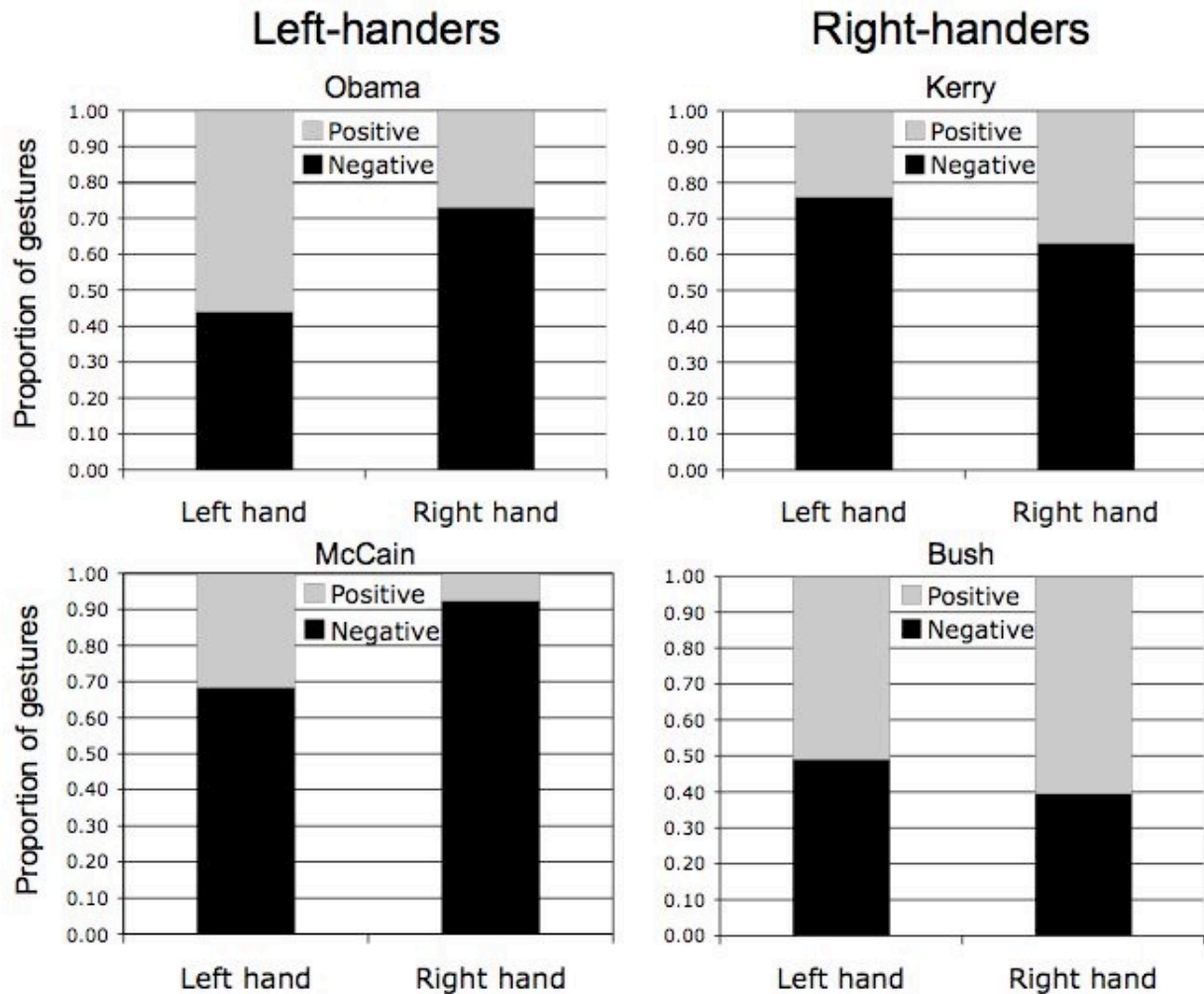


Figure 1. Proportion of right- and left-hand gestures during clauses with positive and negative emotional valence. In left-handers, left-hand gestures were more strongly associated with positive-valence clauses, whereas in right-handers right-hand gestures were more strongly associated with positive-valence clauses, consistent with the body-specificity hypothesis.

Table 1. Number of right- and left-hand gestures during clauses positive and negative emotional valence.

Candidate	Valence of clause	Left hand gestures	Right hand gestures	Total
Obama (Left-hander, Democrat)	Negative	29	38	67
	Positive	37	14	51
	Obama Total	66	52	118
McCain (Left-hander, Republican)	Negative	164	12	176
	Positive	76	1	77
	McCain Total	240	13	253
Kerry (Right-hander, Democrat)	Negative	16	108	124
	Positive	5	64	69
	Kerry Total	21	172	193
Bush (Right-hander, Republican)	Negative	19	59	78
	Positive	20	94	114
	Bush Total	39	153	192
Grand Total		366	390	756

Overall, for all speakers (right- and left-handers), there was a strong association between the valence of the spoken clauses (positive, negative) and the hand used for spontaneous co-speech gestures (dominant, non-dominant; Wald Chi Square=13.15, $df=1$, $p\text{-rep}=.99$; figure 1). The odds ratio for the regression of hand use on valence was estimated at 2.28 (95% C.I.=1.46-3.57), indicating that dominant hand gestures were more than two times more likely to occur during clauses with positive valence, and non-dominant hand gestures to occur during clauses with negative valence. The association between hand and valence was further confirmed by a Cochran-Mantel-Haenszel test, stratified by candidate (C-M-H statistic=13.48, $df=1$, $p\text{-rep}=.99$). This pattern supports the body-specificity hypothesis.

Of the 756 gestures included in the main analyses above, 499 were the first (or only) gestures produced during the corresponding spoken clause. Individuating the subsequent gestures was done systematically (according to McNeill, 1992), but this process is necessarily subjective, and gesture segmentation choices could, in principle, affect the outcome of these analyses. Thus, an analysis of the first gestures, alone, provided the strongest and most objective test of our hypothesis. This analysis showed a similar association between hand and valence as was found in the full data set (Wald Chi square=4.66, $df=1$, $p\text{-rep}=.94$; odds ratio estimate=1.80, 95% C.I.=1.06-3.09; C-M-H statistic=4.72, $df=1$, $p\text{-rep}=.94$).

To ensure that the observed pattern was not driven exclusively by right- or left-handers, the association of hand and valence was tested in each group, separately. Although the predicted association appears somewhat stronger in the left-handers, both groups showed a similar pattern as was found in the full analysis, each group associating gestures with their dominant hand more strongly with positive clauses (Left-handers: Wald Chi square=12.71, $df=1$, $p\text{-rep}=.99$; odds ratio estimate=3.67, 95% C.I.=1.80-7.51; Right-handers: Wald Chi square=2.68, $df=1$, $p\text{-rep}=.88$; odds ratio estimate=1.62, 95% C.I.=0.91-2.90).

Associations between hand and valence were then tested in the individual candidates. In both of the left-handed candidates, left-hand gestures were more strongly associated with positive-valence clauses, and right-hand gestures with negative-valence clauses (Obama: Fisher's exact $p\text{-rep}=.99$; McCain: Fisher's exact $p\text{-rep}=.92$). By contrast in both right-handed candidates, right-hand gestures were more strongly associated with positive-valence clauses, and left-hand gestures with negative-valence clauses (Kerry: Fisher's exact $p\text{-rep}=.88$; Bush: Fisher's exact $p\text{-rep}=.90$). The pattern of gestures observed in each candidate, individually, supported the body-specificity hypothesis.

A Breslow-Day test for the homogeneity of odds ratios was conducted to compare the observed pattern across individuals (Breslow-Day Chi Square=3.30, $df=3$, $p\text{-rep}=.75$). Results showed that the strength of the association between hand and valence did not differ significantly across candidates.

An additional analysis was conducted to assess the validity of interpreting John McCain's gestures in light of the war injuries he sustained, particularly to his right (non-dominant) arm. Like the other candidates, McCain produced fewer non-dominant hand gestures, but the asymmetry was most pronounced in his case. Still, the Fisher's exact test (above) showed a significant association between hand and valence in McCain's data, considered separately. A further analysis showed the predicted effect when McCain's more severely wounded arm was tested, alone. Although he only made 13 uni-manual gestures with his non-dominant hand, 12 of these gestures were during negative-valence clauses (sign test on 12 vs. 1, $p\text{-rep}=.99$).

General Discussion

Spontaneous gestures during the final 2004 and 2008 US presidential debates revealed a previously unattested pattern: Dominant-hand gestures were more strongly associated with speech about with good things, and non-dominant-hand gestures with speech about bad things. Right- and left-handers use their hands in contrasting ways when expressing ideas with positive and negative emotional valence.

The implicit association of handedness and valence shown previously in laboratory tests was demonstrated here in spontaneous behavior, confirming that the mental representation of emotional valence is *body-specific* (Casasanto, 2009). Right- and left-handers automatically activate contrasting associations between action and emotion when speaking and gesturing. These results were predicted based on patterns of bodily experience, and show that people associate good things with the hand they use to interact with their environment more fluently.

Do gestures follow party lines?

Political affiliations are spatialized along a left-right axis in linguistic metaphors: Democrats are on the left and Republicans on the right of the political spectrum. Yet, the implicit mapping from the left and right hands to valence in politicians' gestures does not appear to follow party lines. Because our sample included a right-hander and a left-hander from each party, the body-specificity hypothesis could be tested within Democrats and Republicans, separately. Both parties showed a similar pattern as was found in the full analysis (Democrats: Wald Chi square=10.10, $df=1$, $p\text{-rep}=.99$; odds ratio estimate=2.82, 95% C.I.=1.49-5.33; Republicans: Wald Chi square=2.68, $df=1$, $p\text{-rep}=.91$; odds ratio estimate=1.85, 95% C.I.=0.98-3.45). Moreover, the overall association of hand and valence remained significant when the effect of political party was controlled by conditional logistic regression (Wald Chi square=4.43, $df=1$, $p\text{-rep}=.97$; odds ratio estimate=1.56, 95% C.I.=1.03-2.35). The implicit association of dominant hand gestures with positive valence is something that Democrats and Republicans appear to agree on.

Distinguishing influences of language, culture, and body.

These results cannot be accounted for in terms of idioms in language or culture. In English-speaking cultures and many others, linguistic and non-linguistic conventions associate the *right* with ideas and actions that are good or allowable, and the *left* with those that are bad or prohibited. Conversely, there appear to be no linguistic or cultural conventions that link *left* with good and *right* with bad ('left-wing' and 'right-wing' politics notwithstanding, since whether liberal or conservative political views are considered good varies between individuals). Furthermore, people participate in the same conventions regardless of their handedness. Left-handers are not allowed to greet people with left-handed handshakes, or to refer to the correct answer as 'the *left* answer'.

Both enculturation and bodily experience could potentially explain the 'good is right' mapping shown in right-handers, but only body-specificity can account for the 'good is left' mapping found in left-handers, and for the difference between gesture-valence associations in right- vs. left-handers. By framing experimental predictions in terms of the body-specificity hypothesis, we were able to distinguish the possible contributions of linguistic and cultural experience from the contributions of bodily experience to the mental representation of emotional valence.

These results reveal a previously undiscovered link between bodily action and emotion. Like research on linguistic relativity and cultural relativity, research on *bodily relativity* (Casasanto, 2009) can elucidate ways in which particular patterns of experience can give rise to corresponding habits of thinking, perceiving, and acting.

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Notes

¹P-rep indicates the probability of producing a difference with the sign in the same direction as the observed difference, given an equipotent replication (Killeen, 2005).

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Appendix

Full URLs for the transcripts of the debates are as follows. 2004 election:

www.debates.org/pages/trans2004d.html

www.archive.org/details/presidential_debate_10_13_04

2008 election:

www.debates.org/pages/trans2008d.html

www.msnbc.msn.com/id/21134540/vp/27207488#27207488

Sources consulted to establish the handedness of the candidates included the following online articles and wikis: en.wikipedia.org/wiki/Handedness_of_Presidents_of_the_United_States

www.washingtonpost.com/wpdyn/content/article/2008/07/03/AR2008070303202.html

www.democraticunderground.com/discuss/duboard.php?az=view_all&address=273x37442#37482