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ORIGINAL RESEARCH REPORT

No Evidence That Lateral Preferences Predict Individual Differences in the Tendency to Update Mental Representations: A Replication-Extension Study

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A growing body of evidence suggests that inconsistent hand preference is indicative of an increased disposition to update one's beliefs upon exposure to novel information. This is attributed to a facilitated exchange of information between the two brain hemispheres among inconsistent handers, compared to consistent handers. Currently available studies provide only indirect evidence for such an effect, were mostly based on small sample sizes, and did not provide measures of effect size. Small sample size is a major factor contributing to low replicability of research findings and false-positive results. We thus attempted to replicate Experiment 1 of Westfall, Corser and Jasper (2014), which appears to be representative of research on degree of handedness and belief updating in terms of the employed methods. We utilized data from a sample more than 10 times the size ($N = 1243$) of the original study and contrasted the commonly applied median-split technique to classify inconsistent and consistent handers with an empirically grounded classification scheme. Following a replication-extension approach, besides handedness, footedness was also explored. Only one out of 12 chi-squared tests reached significance and supported the original hypothesis that inconsistent handers stay with, or switch more often from, the status quo than consistent handers, depending on the valence of novel information. A small-telescopes analysis suggested that the original study had too low analytic power to detect its reported effect reliably. These results cast doubt on the assumption that inconsistent and consistent-handers differ in the tendency to update mental representations. We discuss the use of the median-split technique in handedness research, available neuroscientific evidence on interhemispheric interaction and inconsistent handedness, and venues of future research.

Keywords: Handedness; Degree-of-handedness; Footedness; Status Quo Bias; Lateral Preference Classification

Introduction

Over the past two decades, a line of inquiry has emerged, which examines individual differences as a function of degree of handedness, based on the idea that the general population can be divided into consistent-handers and inconsistent-handers (e.g., Christman & Prichard, 2016). Individuals who prefer to use their dominant hand for almost any common manual task are classified as consistent-handers, whereas those who prefer to use their non-dominant hand for at least one such task are considered inconsistent-handers (Prichard, Propper, & Christman, 2013). The two degree-of-handedness groups are conventionally determined by splitting an observed sample distribution at the median of the absolute scores on the Edinburgh Handedness Inventory (EHI; Oldfield, 1971) or a slightly modified version thereof (Christman & Prichard, 2016). Thus, individuals who score below the median make up the group of inconsistent-handers, whereas those whose scores are equal to, or above, the median are categorized as consistent-handers.

One of the most studied topics in this field of research pertains to differences in the tendency to update mental representations between inconsistent-handers and consistent-handers. Numerous studies have examined the relationship between degree of handedness and the tendency to update bodily (Christman, Bentle, & Niebauer, 2007; Niebauer, Aselage, & Schutte, 2002), perceptual (Christman, Sontam, & Jasper, 2009), and conceptual representations (Christman, Henning, Geers, Propper, & Niebauer, 2008; Christman, Jasper, Sontam, & Cooil, 2007; Jasper & Christman, 2005; Jasper, Fournier, & Christman 2014; Jasper, Kunzler, Prichard, & Christman, 2014; Jasper, Prothero, & Christman, 2009; Jasper, Kunzler, Prichard, & Christman, 2014; Niebauer, Christman, Reid, & Garvey, 2004). The findings of these studies seem to suggest

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that inconsistent-handers are more prone to update mental representations in light of novel information than consistent-handers. This may explain why inconsistent-handers appear to be more susceptible to persuasive and ambiguous communication (Christman et al., 2008), as well as why they might be less likely to hold onto pre-existing beliefs (Niebauer et al., 2004).

An often-cited neuropsychological account for the process of belief updating is based on the idea that the left cerebral hemisphere maintains one's beliefs or schemata, whereas the right hemisphere acts as an anomaly detector set out to register discrepancy with these currently held schemata (Gazzaniga, 2000; Ramachandran, 1995). The theory states that sufficient anomalous information activates this module, which in turn updates the current beliefs of the left hemisphere in accordance with the new information (Ramachandran, 1995). This account is consistent with lesion studies (Rausch, 1977), data from electroencephalography (Cacioppo, Petty, & Quintanar, 1982), as well as with experiments aiming to induce hemispheric activation (Drake, 1991; Drake & Bingham, 1985). Furthermore, it is assumed that the two cerebral hemispheres need to interact for an updating process to take place (Ramachandran, 1995).

Inconsistent and consistent-handers are hypothesized to have systematically differing degrees of functional access to right-hemisphere-based processes, with the degree of access depending on the strength of the interhemispheric connection (Christman, Henning et al., 2008; Christman, Sontam, & Jasper, 2009; Jasper & Christman, 2005; Niebauer et al., 2002). In other words, inconsistent-handers exhibit lower thresholds for the process of belief updating to take place, due to their hemispheres being linked to a stronger degree, resulting in a facilitated exchange of information between the two hemispheres. With increasing consistency of hand preference, interhemispheric communication becomes weaker, and, as a consequence, the extent to which the processes of the right hemisphere are accessible approaches a minimum.

One morphological link, which has repeatedly been hypothesized to underlie these differences (Prichard et al., 2013), is a negative correlation between the degree of handedness and the size of the corpus callosum, suggesting that corpus callosum size decreases with increasing handedness consistency (Luders et al., 2010). With respect to functional cerebral lateralization, one study (Bourne, 2008) found a positive correlation between functional brain asymmetry and consistency of hand preference, while another reported less resting alpha activity in the right hemispheres of non-right handers (Propper, Pierce, Geisler, Christman, & Bellorado, 2012). Other studies provide evidence that direction of handedness (i.e., left vs. right) is indicative of the lateralization of cognitive processes across the cerebral hemispheres (e.g., Martin, Jacobs, & Frey, 2011; Szaflarski, 2012; Willems, Peelen, & Hagoort, 2010).

Currently available studies (cited above) provide only indirect evidence for a link between interhemispheric communication and the tendency to update mental representations. The bulk of these studies utilized an experimental design to study the effect of degree of handedness on belief updating (e.g., Christman et al., 2008; Jasper & Christman, 2005) and employed the median-split technique to discern consistent from inconsistent-handers (Prichard et al., 2013). Across the 22 experiments of eleven studies (Bhattacharya & Jasper 2018; Christman, Bentle, & Niebauer, 2007; Christman et al., 2008; Christman et al., 2009; Jasper & Christman, 2005; Jasper et al., 2009; Jasper, Fournier, & Christman, 2014; Jasper, Kunzler et al., 2014; Jasper, Woolf, & Christman, 2014; Westfall, Jasper, & Christman, 2012; Westfall, Corser, & Jasper, 2014), median group sizes were 63.5 and 73 (ranges: 13–98 and 14–129) for inconsistent and consistent-handers, respectively. These sample sizes would be sufficient for the detection of medium-sized effects (Cohen, 1977). However, as many of the studies contained several experimental conditions, relevant group comparisons were ultimately less powered. All these studies relied on null-hypothesis significance testing (NHST) to make a case for their preferred hypothesis, and often reported no measures of effect size or confidence intervals. NHST has been criticized throughout the years as an insufficient procedure for identifying the relevance, reliability, and generalizability of study outcomes (Cohen, 1977, 1994). In addition to NHST, a measure of effect size and its corresponding confidence interval should be evaluated, in order to assess statistical results beyond mere nominal significance (Asendorpf et al., 2013; Cohen, 1994). Also, the samples of the available studies in this area mostly consisted of introductory psychology students. This casts doubt on the generalizability of reported findings to the general population (Henrich, Heine, & Norenzayan, 2010). Independent replications are currently lacking.

There is evidence of low replicability of research findings in psychology (e.g., Open Science Collaboration, 2015). Statistically significant findings are overrepresented in the literature, as there is a tendency to publish only significant results. However, a majority of these findings might be false positives (Ioannidis, 2005; see also Button et al., 2013). Small sample size is a major causal factor for such false-positive findings, as it negatively affects analytic power of a study. The lower the a priori chances of obtaining a significant result (because of low statistical power), the higher the a posteriori chances are that a published significant result in fact is a Type I error.

Replication studies are thus increasingly recognized as important building blocks of reproducible science. In order to address the question of whether an original finding appears to be replicable or not, one recently developed method, the small-telescopes analysis (Simonsohn, 2015), shifts the focus to the precision of the effect estimate of the original (i.e., to-be-replicated) study. It recommends using a sample size for the replication study that is sufficiently large to detect an effect for which the original study merely had a power of 33% to obtain a significant result. If the sufficiently powered replication study is not able to detect even this smaller effect, then it may be concluded that the original study was too underpowered to reliably detect a larger effect in the first place: An effect

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which cannot be detected with a more precise (larger) telescope (the replication study), could not have been detected reliably with a less precise (smaller) telescope (the original study). Relatedly, further research progress might be gained from extending results of prior studies in the course of a replication (replication-extension studies; Bonett, 2012). Thereby, the generalizability of results and possible moderator effects may be assessed, and misleading findings exposed.

Against this substantive and methodological background, this study pursued three goals. First, we attempted to replicate the findings of Experiment 1 of Westfall et al. (2014) regarding the associations of the status quo bias with handedness. This experiment was chosen as it appears representative of the field of research on degree of handedness and belief updating in terms of the employed methods.[1] Most studies in this field of research (1) were experiments, (2) utilized the median-split classification, (3) were based on relatively small samples not representative of the general population (i.e., students), and (4) excluded left-handers. Experiment 1 of Westfall et al. (2014) is representative with regards to all of these points (however, belief updating in other studies pertained not only to the status quo bias).

The status quo bias refers to a disproportionate tendency to remain with one's current state of affairs (Samuelson & Zeckhauser, 1988). Westfall et al. (2014) hypothesized that due to the supposedly higher tendency of inconsistent-handers to update their beliefs, they should stay with, or switch from the status quo more often, depending on the valence (positive or negative) of newly presented information. Contrasting the decisions of 23 (21) inconsistent and 25 (21) consistent right-handers in a positively (negatively) valenced scenario (see Supplementary Materials), Westfall et al. (2014) reported a significant effect for the positively (p = .01), but not the negatively (p = .65), valenced condition. Calculating odds ratios (*OR*s) from the provided tables, one finds that inconsistent-handers were 10.5 (95% confidence interval: 1.18–93.70) times more likely to stick with the status quo than consistent-handers when presented with positive information. In other words, next to nothing is known about the likely magnitude of the effect, as the *OR* in the population might range from a virtually non-existent effect to one that could be best described as off the charts; the point estimate itself appears to be conspicuously large (Chen, Cohen, & Chen, 2010). The *OR* in the negatively valenced condition was 1.41, 95% CI = [0.32–6.16]. Even though not significant, the authors contended that the direction of the effect was still in line with their hypothesis that inconsistent-handers more often switched from the status quo than consistent-handers when presented with negative information. Inspection of the confidence limits however makes this conclusion doubtful.

Second, in order to go beyond a simple replication, we employed an empirically grounded classification scheme for handedness (Tran, Stieger, & Voracek, 2014), besides the median-split technique. This replication-extension also included left-handers, as opposed to Westfall et al. (2014), who looked at right-handers only. The median-split technique used in extant prior studies has not been validated yet. Westfall et al. (2014) contended in a footnote that this technique was used "largely for descriptive and legacy reasons," but provided no empirical data regarding its validity. There is psychometric evidence that handedness is probably best described as having three qualitatively distinct manifestations: Right, mixed, and left (e.g., Dragovic, Milenkovic, & Hammond, 2008). Mixed-handedness closely matches the notion of inconsistent-handedness, as it implies the lack of a clear or strong hand preference for various manual tasks. A more integrative approach suggests that the distinct categories of right, left, and mixed not only account for hand preference, but also for foot, eye, and ear preference; there is even evidence of an overarching (i.e., general) factor of sidedness that includes a mixed category as well (Tran et al., 2014). Westfall et al. (2014) deliberately left out left-handers from their study. We were interested in finding out whether the reported results could also be found using an alternative, empirically grounded, method of handedness classification, including the left-handed participants in our study as well.

Third, we examined associations with footedness, in order to widen the scope and to include another domain of lateral preference where an effect in principle might be observable. There is reason to believe that handedness is biased due to social customs and conditioning (e.g., Zverev & Mipando, 2007). Footedness has thus been proposed as a better (i.e., culturally unbiased) predictor of cerebral lateralization (Elias & Bryden, 1998; Elias, Bryden, & Bulman-Fleming, 1998). Footedness shows associations with handedness (Tran et al., 2014), but appears to be best understood as a two-dimensional, rather than a one-dimensional, construct. One dimension comprises skilled unipedal tasks (skilled footedness), whereas the second dimension unskilled bipedal tasks (movement footedness; Tran & Voracek, 2016).

We used data from a vastly larger and more heterogeneous sample in the current study to re-assess the effects of inconsistent handedness on belief updating. This allowed us to test this association of degree of handedness with belief updating with higher statistical power, as well as to estimate the size of this effect also with higher precision, compared to the original study. Westfall et al. (2014) deliberately left out left-handers from their study. We were interested in finding out whether the reported results generalized to all consistent- and inconsistent-handers, rather than right-handers alone, and whether they might be replicated with alternative, empirically grounded, methods of handedness classification as well. Finally, we were interested in finding out whether the reported associations of belief updating with handedness also generalized to footedness. We hypothesized that, regardless of classification scheme, inconsistent-handers should be more susceptible to the valence of additional information in a status quo choice paradigm, as opposed to consistent-handers. This difference in choice behavior should also be observable when comparing inconsistent- to consistent-footers.

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Method

Participants

A total of 1243 participants were recruited for this study. Sample demographics are set out in **Table 1**. Overall, the sample comprised slightly more women than men and had a broad age range. The majority of participants either were of Austrian or German nationality. Approximately half of the participants either held a degree from a post-secondary educational institution or were attending some form of undergraduate program at the time the data were collected.

Procedure

The recruitment of the participants was crowdsourced to a larger number of research assistants, who contacted participants through word-of-mouth and personal contacts. This approach aimed at obtaining a large sample, while simultaneously decreasing recruitment bias and increasing sample heterogeneity. Exclusion criteria were insufficient knowledge of the German language and being under 18 years of age. Participation was voluntary, anonymous, and without monetary compensation. Written informed consent was obtained from all participants. The survey form was completed by each participant individually. All procedures performed in this study adhered to the ethical standards of the 1964 Helsinki Declaration and its later amendments, and with institutional guidelines of the School of Psychology, University of Vienna. Study participation did not affect the physical or psychological integrity, the right for privacy, or other personal rights or interests of the participants. Such being the case, according to national laws (Austrian Universities Act 2002), this study was exempt from formal ethical approval.

For the experimental manipulation of the status quo bias, two different versions of the hypothetical scenario were presented in separate, but otherwise exactly identical, survey forms A and B: One included a positively valenced, the other a negatively valenced, scenario (see below and the Supplementary Materials). Participants were randomly assigned one of the two forms. A total of 608 participants received survey form A and 635 participants received survey form B.

Table 1: Sample description.

n	1243
Women, *n* (%)[a]	659 (53%)
Age, range (years)[b]	18–86
Interquartile range	23–51
Mean (*SD*)	36.77 (15.74)
Education[c]	
Graduates, *n* (%)	377 (30.6%)
Undergraduates, *n* (%)	277 (22.5%)
Other, *n* (%)	577 (46.9%)
Nationality[d]	
Austrian	778 (63%)
German	392 (31.7%)
Other	65 (5.3%)

Note: [a] $n = 1235$, [b] $n = 1233$, [c] $n = 1231$, [d] $n = 1235$ (due to missing data).

Measures

Status quo bias

A German translation of the status-quo scenario, as described in Westfall et al. (2014), was derived by means of the parallel-blind technique (Behling & Law, 2000). In this scenario, individuals had to choose between remaining with their current electric company (i.e., the status quo) versus accepting being randomly assigned to an alternative electric company by the government (i.e., non-status quo). Experimental manipulation was induced by investing the status quo with a positive prior experience in one condition and a negative prior experience in the other condition (see Supplementary Materials).

Handedness and footedness

For the assessment of handedness and footedness, validated 10-item and 8-item scales (Tran et al., 2014; Tran & Voracek, 2016) were utilized. The handedness scale differed from the Edinburgh Handedness Inventory (EHI; Oldfield, 1971) which was used in Westfall et al. (2014) with respect to four items, which had been replaced by items stemming from the Lateral Preference Inventory (Coren, 1993) for their better psychometric properties (Tran et al., 2014). The footedness scale consisted of two subscales: Skilled footedness (5 items), which comprised items like "picking up a pebble with one's toes", and movement footedness (3 items), which comprised items like "stepping onto a chair." Response options were always right, sometimes right, no preference, sometimes left and always left, which were coded as +2, +1, 0, –1 and –2, respectively. Sample reliability (Cronbach α) was .97 for handedness, .87 for skilled footedness, and .85 for movement footedness. Only participants with fewer than three missing scores in the handedness items were included in the analysis. For the footedness items, only participants who had no missing values were included. Thus, the resulting analysis *n* for handedness and footedness was 1216 and 1171, respectively.

Handedness and footedness classification

Two classification schemes were used to categorize hand and foot preferences. Following Westfall et al. (2014), the response options of the handedness items were recoded into $+2 = +10, +1 = +5, 0 = 0, -1 = -5, -2 = -10$ to compute a sum score ranging from –100 (strong left preference) to +100 (strong right preference). As in Westfall et al. (2014), only right-handers (i.e., participants with scores from 0 to 100) were kept for further analysis. Among these 1109 participants we then applied a median split ($Mdn = 100$), which resulted in 471 inconsistent-handers (scores below the median) and 638 consistent-handers (scores at the median). We proceeded similarly with regard to the footedness items. For skilled footedness the median of the right-footers ($n = 1075$) was 30, for movement footedness ($n = 995$ right-footers), it was 15. There were finally 419

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inconsistent-footers and 656 consistent-footers with regard to skilled footedness, and 374 inconsistent-footers and 621 consistent-footers with regard to movement footedness.

The alternative, empirically grounded, classification scheme was taken from Tran et al. (2014). Response options +2 and –2 of all handedness and footedness items were recoded into +1 and –1, respectively. We then computed a laterality quotient for handedness, with the sum of the signed item ratings in the numerator and the sum of the unsigned item ratings plus two times the number of items scored '0' in the denominator (Kelley, 2012). The resulting score was multiplied by 100 to yield a number between –100 (strong left preference) and +100 (strong right preference). Validated cutoffs (Tran et al., 2014) were then employed to categorize right- (scores 73 to 100, $n = 1009$), mixed- (–7 to 72, $n = 105$), and left-handers (–100 to –8, $n = 102$). Right- and left-handers were merged, making up the group of consistent-handers, while mixed-handers were equated with the group of inconsistent-handers. In total, 105 participants were categorized as inconsistent-handers and 1111 as consistent-handers.

For the classification of the two dimensions of footedness, we drew on cutoffs from Tran and Voracek (2016): Skilled footedness: Right (sum scores 4 to 5, $n = 745$), mixed (1 to 3, $n = 296$), left (–5 to 0, $n = 130$); movement footedness: Right (2 to 3, $n = 706$), mixed (0 to 1, $n = 289$), left (–3 to –1, $n = 176$). ROC curve analyses indicated highly reliable classifications using these score ranges (area under the curve, AUC ≥ .96 for all classifications). Right- and left-footers were again merged, resulting in 296 inconsistent-footers and 875 consistent footers for skilled footedness, and 289 inconsistent-footers and 882 consistent footers for movement footedness.

Power Considerations

The minimally required sample size (α = 5%, power = 80%) for the difference in proportions (sticking with the status quo in the positive scenario) of 96.0%–69.6% = 26.4%, as reported in Westfall et al. (2014), was 29 per group. With group differences that large, the power of the χ^2 test in the current study approached 100%, due to the larger group sizes.

For the small-telescopes analysis (Simonsohn, 2015), we used G*Power (Faul, Erdfelder, Buchner, & Lang, 2009) to calculate the effect size for which the original study would have had a power 33%, $OR_{33\%}$. This resulted in a value of 2.93, which can be interpreted as the lower limit of an effect size for which the original study would have had at least a 1:2 chance of obtaining a significant result for the positive experience condition. For an effect of $OR = 2.93$, about 167 participants in total would be required to attain a power of at least 80%.

Statistical Analysis

As in Westfall et al. (2014), separate χ^2 analyses were conducted for handedness for each experimental condition, in addition for skilled and movement-footedness, and for each classification scheme, thus resulting in a total of 12 χ^2 tests (whereas the original study had two such tests). Additionally, *OR*s were computed. We further checked whether the positively and negatively valenced scenarios elicited overall differences in the tendency to switch from an option representing the status quo (Inman, & Zeelenberg, 2002). In order to reconcile the current results obtained by using the median-split classification for handedness with the results of Westfall et al. (2014), we conducted a small-telescopes analysis (Simonsohn, 2015). Post-hoc analyses investigated whether results in the χ^2 tests were different for a subsample of the current study, which more closely matched the age range of the Westfall et al. (2014) sample, and examined the influence of participant age and sex on belief updating in the total sample with correlation and logistic regression analyses. Significance was set to $p < .05$.

Results

Handedness

Table 2 presents the frequency distributions for the two experience conditions and the two categorization schemes. The results of the χ^2 analyses are listed in **Table 3**. Contrasting the positively and negatively valenced conditions, overall more participants switched from the status quo in the negatively (469 of 572 participants) than in the positively valenced condition (69 of 537 participants; $\chi^2(1, 1109) = 530.14$, $p < .001$, $OR = 30.88$, 95% CI = [22.19–42.99]). This confirms that the positively and negatively valenced scenarios elicited overall differences in the tendency to switch from an option representing the status quo (Inman, & Zeelenberg, 2002).

Median-split classification

In the positive experience condition, the finding of a greater tendency of inconsistent-handers, compared to consistent-handers, to stick with the status quo, reported by Westfall et al. (2014), could not be replicated, $OR = 0.82$, 95% CI = [0.49–1.37]. In the negative condition, the χ^2 analysis revealed a significantly higher proportion of inconsistent-handers than consistent-handers to switch away from the status quo. This difference was not significant in Westfall et al. (2014), but directionally is consistent with their original hypothesis. The corresponding effect size was small to medium, $OR = 1.96$, 95% CI = [1.24–3.09] (Chen et al., 2010: $OR \sim 1.46$ small effect, $OR \sim 2.50$ medium effect for event rates ≥10%).

Laterality quotients and validated cutoffs

Utilizing validated cutoffs, there were no significant differences between inconsistent and consistent-handers, neither in the positive nor in the negative experience condition. Effect sizes (*OR*s in **Table 3**) were close to unity in both experience conditions, thus indicating practically irrelevant effects. Further, we re-ran these analyses excluding left-handers. The results did not change in any meaningful way (see Supplementary Materials).

Footedness

Frequency distributions for the two experience conditions, the two categorization schemes, and the two dimensions of footedness are presented in the Supplementary Materials (Table S1). The results of the χ^2 analyses are listed in **Table 3**. None of the eight χ^2 analyses yielded a significant *p* value, irrespective of classification scheme,

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Table 2: Frequencies of inconsistent and consistent-handers by classification scheme and valence condition.

Classification	Valence	Choice	Inconsistent-handers		Consistent-handers	
			n	**%**	***n***	**%**
Median split	Positive	Status quo	188	85.8	280	88.1
		Non-status quo	31	14.2	38	11.9
	Negative	Status quo	32	12.7	71	22.2
		Non-status quo	220	87.3	249	77.8
Empirical cutoffs	Positive	Status quo	43	86.0	471	86.4
		Non-status quo	7	14.0	74	13.6
	Negative	Status quo	10	18.2	100	17.7
		Non-status quo	45	81.8	466	82.3

Table 3: Results of χ^2-analyses for the relationship between degree of handedness/footedness and status quo choice.

Classification	Lateral preference	Valence	$\chi^2(df, n)$	*p*	*OR*	95% CI
Median split	Handedness	Positive	0.56 (1, 537)	.453	0.82	[0.49–1.37]
		Negative	8.60 (1, 572)	.003	1.96	[1.24–3.09]
	Skilled-Footedness	Positive	0.18 (1, 523)	.668	1.12	[0.67–1.88]
		Negative	0.28 (1, 552)	.595	1.13	[0.71–1.80]
	Movement-Footedness	Positive	1.21 (1, 491)	.272	0.74	[0.44–1.26]
		Negative	0.51 (1, 504)	.475	1.20	[0.73–1.96]
Empirical cutoffs	Handedness	Positive	0.01 (1, 595)	.934	0.97	[0.42–2.23]
		Negative	0.01 (1, 621)	.924	0.97	[0.47–1.98]
	Skilled-Footedness	Positive	0.31 (1, 573)	.576	0.86	[0.51–1.46]
		Negative	1.55 (1, 598)	.213	1.40	[0.82–2.37]
	Movement-Footedness	Positive	0.17 (1, 573)	.680	1.13	[0.64–1.98]
		Negative	0.44 (1, 598)	.510	1.19	[0.71–1.96]

Note: Results of χ^2 tests by classification scheme, domain of lateral preference, and valence condition. *OR* = odds ratio, CI = confidence interval. *OR*s are poled into the direction of the original hypothesis; i.e., *OR*s > 1 indicate that inconsistent-handers (and inconsistent-footers) more readily stayed with the status quo in the positively valenced condition, and more readily switched from the status quo in the negatively valenced condition, compared to consistent-handers (and consistent-footers).

dimension of footedness, or valence of experience. Effect sizes (*OR*s in **Table 3**) indicated that these statistically non-significant results also were practically irrelevant.

Small-Telescopes Analysis

The effect size, for which the original study would have had a power of 33%, $OR_{33\%}$, was 2.93. This is the lower limit of effect size for which the original study would have had at least a 1:2 chance of obtaining a significant result for the positive experience condition. The effect size in the current replication was *OR* = 0.82, 95% CI = [0.49–1.37]. In order to test whether the effect size estimate from the current study (*OR* = 0.82) was significantly different from $OR_{33\%}$ = 2.93, we first logarithmized the *OR*s and conducted a *z* test for the difference between the logarithmized *OR*s. The natural logarithms of *OR* = 0.82 and $OR_{33\%}$ = 2.93, were –0.20 and 1.08, respectively (*SE* = 0.31). The *z* transformation ($z = [-0.20-1.08]/0.31$) yielded $z = -4.16$, $p < .001$ (i.e., the confidence interval of the replication did not include $OR_{33\%}$, as calculated for the design of the original study; see **Figure 1**), thus suggesting that the original study's sample size was too small to investigate the effect of interest in a meaningful way.

Post-hoc Analyses

Restricting the sample to a subsample with an age range that approximated the age range of Westfall et al. (2014), i.e., 18 to 26 (=*M* + 2**SD* of Westfall et al., 2014) years of age, did not substantially alter the main null results of the current study (for the χ^2 tests, all *p*s ≥ .269). The formerly significant effect of inconsistent handedness (median-split classification) on switching from the status quo in the negatively valenced condition only closely missed nominal significance, *OR* = 2.51 [0.97–6.46], *p* = .051.

Since the hypothesized difference in sensitivity to additional, differently valenced, information was only

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found in the negative experience condition in the present study, and exclusively when degree of handedness was classified using a median-split, we suspected that this significant finding could be the result of a potentially confounding variable. Tran et al. (2014) reported that mixed-handedness (and thus inconsistent handedness likely as well) is more frequent among men than women, and among younger than older individuals. Thus, participant age and sex lent themselves as prime candidates for further elucidating a possibly spurious association.

In the negatively valenced condition, participant age was negatively associated with switching away from the status quo, $r = -.25$, $p < .001$; i.e., younger participants switched more often than older ones. The strength of this association was stronger than the association of switching with inconsistent handedness, $r = -.12$, $p = .003$. The correlation between participant sex and switching was virtually zero, $r = -.013$, $p = .754$. Thus, participant sex was dismissed as irrelevant.

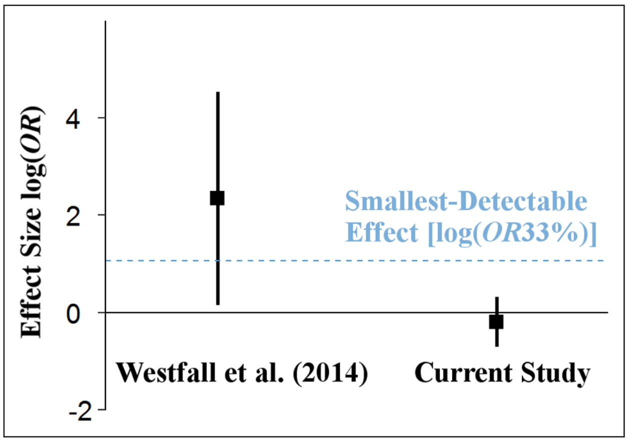

Figure 1: Small Telescopes Analysis.
Corresponding effects from the original study (Westfall et al. 2014, Experiment 1, positively valenced condition), and the replication-extension study. The square markers indicate the effect-size estimates, in the metric of log(*OR*), along with their 95% confidence intervals. The dashed horizontal reference line indicates the magnitude of the effect for which the original study, by its design, would have had 33% power to detect it.

Considering these results, a logistic regression analysis was conducted (see **Table 4**). We built three models: one model with participant age as the sole predictor, a second model with the sole predictor handedness as classified by the median split, and a third model with both predictors. Switching away from the status quo was used as outcome. The two one-predictor models each explained significant amounts of variance (**Table 4**). The attributable variance (Nagelkerke R^2) was higher in the former model than the latter, thus suggesting that participant age was a more important predictor than handedness. The direction of the *OR* indicated that younger participants switched more often than older participants did. In the final model, which included both predictors, handedness was no longer significant, while participant age remained significant. It thus appears likely that lower participant age was the driving factor behind the observed statistically significant result in the negative experience condition, rather than inconsistent-handedness itself.

Discussion

The aim of this study was threefold: First, we tried to replicate the findings of Westfall et al. (2014) which suggested that inconsistent-handers are more sensitive to new information due to a greater propensity to update their beliefs. In order to achieve this aim, we used the dichotomization of consistent versus inconsistent handers, excluded left-handers, utilized the same experimental manipulations (positive/negative valence), and carried out the same analyses. Second, to extend upon this replication, we investigated whether the results could be corroborated using an empirically grounded classification scheme for lateral preferences, besides the median-split technique. Furthermore, we examined whether effects generalized to another domain of lateral preference, footedness, as well. Out of twelve χ^2 tests, only one yielded a result consistent with the original hypothesis of Westfall et al. (2014). However, post-hoc analyses called this sole positive finding into question. Small-telescopes analysis suggested that the original effect could not have been meaningfully examined in the study of Westfall et al. (2014). In sum, these results do not support the original findings of Westfall et al. (2014). Drawing on the "time-reversal heuristic" (Gelman, 2018), i.e., assuming in a thought experiment that the current higher-powered

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Table 4: Results of logistic regression analyses, predicting switching from the status quo in the negatively valenced condition.

Predictor	Predictor			Model		
	B **(*SE*)**	***p***	***OR*** **[95% CI]**	**Nagelkerke R^2**	**χ^2 (*df*)**	***p***
Age only	–0.04 (0.01)	<.001	0.96 [0.95–0.97]	.09	35.30 (1)	<.001
Handedness only	0.67 (0.23)	.004	1.95 [1.23–3.10]	.03	8.59 (1)	.003
Age and handedness combined						
Age	–0.04 (0.01)	<.001	0.96 [0.95–0.98]	.10	35.81 (2)	<.001
Handedness	0.37 (0.25)	.130	1.45 [0.90–2.34]			

Note: *OR* = odds ratio, CI = confidence interval.

study preceded the Westfall et al. (2014) study in time, it appears fair to conclude that Westfall et al. (2014) provided no convincing evidence for an association of inconsistent handedness with belief updating. To the extent that other studies in this field of research used the same methods, their results also might appear to be doubtful and may be in need of independent replication. We discuss problems with the median-split technique and conflicting evidence on the neuropsychological level in more detail below.

The only significant difference between inconsistent- and consistent-handers was found in the negative experience condition when degree of handedness was classified using the median-split technique. This finding was consistent with the original hypothesis: Inconsistent-handers showed a greater tendency to switch away from the status quo when their (hypothetical) previous experience with it had been negative. As indicated by the odds ratio and its 95% confidence interval, this effect was of small-to-medium size. We found no evidence for a difference between inconsistent-handers and consistent-handers in the positive condition. The data of Westfall et al. (2014) suggested a large effect, $OR = 10.5$, qualified through an overly broad 95% confidence interval, [1.18–93.70], which is uninformative as to the likely magnitude of the effect. The results of the small-telescopes analysis suggest that, by its design, the original study was underpowered, thus increasing the probability that the statistically significant result reported by Westfall et al. (2014) constituted a chance finding. Taking into account the small and non-significant effects that were obtained by using a psychometrically validated classification scheme (Tran et al., 2014), the previous result clearly failed to replicate in our ten-times larger replication-extension study.

Additional post-hoc analysis revealed that the effect of degree of handedness on choice behavior in the negatively valenced condition was no longer statistically significant or of a relevant magnitude when both degree of handedness and participant age were included in the regression model. However, age remained a statistically significant predictor. This result is in line with previous findings of a negative relationship between age and impulsivity (Steinberg et al., 2008). On these grounds one could hypothetically suspect that the younger participants in the negative condition of the current study could have been less able to inhibit the urge to act out primed resentments against the electric company. However, these considerations are purely speculative at this point. Further studies are needed to examine the effects of participant age and impulsivity in the status-quo paradigm more closely.

Footedness

Footedness had never been examined as a predictor of individual differences in belief updating before, so one might argue that the current results do not contradict Westfall et al. (2014). However, upon considering the theoretical account according to which individual differences in the readiness to integrate contextual information with pre-existing beliefs is a function of cerebral lateralization (e.g., Christman & Prichard, 2016), this argument does not hold. It would imply that these differences are a function of the degree of handedness per se. Given the relationship between handedness and footedness (Tran et al., 2014), both of which are considered indicators of cerebral lateralization (e.g., Elias & Bryden, 1998), individual differences in the process of belief updating should be observable as a function of inconsistent- versus consistent-footedness as well. Thus, if handedness truly predicted belief updating (Westfall et al., 2014), footedness should be a similarly valid predictor, too.

Both classification methods yielded no significant effects for footedness in the current study. Yet, it is important to emphasize that this does not imply that both classification schemes are equally valid. There are some major issues pertaining to the median-split technique, besides its lack of psychometric validation, which are discussed below.

The Median-Split Technique Revisited

The practice of employing the median-split technique to discern different handedness groups had no concrete justification until recently (Christman & Prichard, 2016): Since the ratio of approximately 9-to-1 for right- versus left-handedness has persisted for thousands of years (see Frayer et al., 2012), left-handedness does not pose an evolutionary disadvantage; otherwise, the percentage of right-handers should reach 100% over time. Consequently, a regression to a 50:50 equilibrium should be observable when considering the direction of handedness (or lateral preference in general). As this apparently is also not the case, Christman and Prichard (2016) argue that degree, rather than direction, of handedness is the more relevant descriptor. Degree of handedness shows a 50:50 equilibrium. This claim is backed by evidence from a representative sample in which the median roughly divided the population into 50% consistent-handers and 50% inconsistent-handers (Christman and Prichard, 2016; Prichard et al., 2013).

Yet, this reasoning appears to be circular. By definition, the median-split technique will lead to equally sized groups in reasonably large and heterogeneous samples, irrespective of the trait (and its genetic underpinnings) to which it is applied. The theory of a 50:50 equilibrium cannot be backed by a method, which can only result in a 50:50 split when it is applied to reasonably large and heterogeneous samples. Other methods are needed here. Consequently, the claim of a 50:50 equilibrium cannot provide a justification for the use of the median-split technique that has been utilized for more than two decades without any theoretical or empirical justification as to why. Also, in the absence of systematic environmental influences, genotype, and hence phenotype, frequencies may well stay the same over time (Hardy, 1908; Stern, 1943). The assumption of a regression to a 50:50 equilibrium hence appears neither necessary, nor well-founded. Also, splitting a continuous variable at the median has repeatedly been criticized for leading to a loss of information and thus of statistical power, which in turn can lead to spurious significant findings (e.g., Altman & Royston, 2006; Cohen, 1983; MacCallum, Zhang, Preacher, & Rucker, 2002). Currently, the distinction of 'consistent' and 'inconsistent' handedness appears to be in need of a stronger empirical basis and better-validated

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methods for classification. Future research should resort to available empirically grounded methods and cutoffs provided by large-sample psychometric studies (e.g., Tran et al., 2014). Mixed-handers bear a close conceptual resemblance to inconsistent-handers, but are empirically (i.e., psychometrically) more clearly defined.

Interhemispheric Interaction, Lateral Preferences, and Belief Updating

The most often presented neuropsychological explanation for individual differences in belief updating as a function of the degree of handedness states that the left and right cerebral hemispheres communicate more efficiently in inconsistent handers than consistent handers (e.g., Prichard et al., 2013). This difference is theorized to result in greater access to right-hemisphere-based processes, which facilitate belief updating in inconsistent handers. The increased interhemispheric interaction is assumed to arise from a larger corpus callosum in inconsistent handers (Luders et al., 2010). However, other large studies found no differences in corpus callosum volume between consistent and inconsistent-handers (McDowell et al., 2016), but instead differences in global and regional hemisphere asymmetries. Yet, these differences cannot be readily linked to behavioral differences of belief updating. Further, even if there were converging results, it still remains unclear how precisely this would affect brain activity, and thus cognitive abilities, as different types of brain organization could lead to equally effective information processing (McDowell et al., 2016).

Other studies examined the functional lateralization of cognitive processes across the cerebral hemispheres with regard to degree of handedness (Bourne, 2008; Davidson & Trembley 2013; Propper et al., 2012). However, these studies focused on tasks that were not directly related to belief updating, such as corticospinal excitability (Davidson & Trembley, 2013), recognition of facial emotions (Bourne, 2008), or resting alpha activity (Propper et al., 2012). Davidson and Trembley (2013) additionally found evidence of greater interhemispheric inhibition in inconsistent handers. Yet, this finding, as well as that of Propper et al. (2012), was based on very small samples (n = 31 and n = 17), a fact which calls the robustness of their results into question (Button et al., 2013). In total, these various findings do not appear to provide substantive evidence for a link between degree of handedness, interhemispheric interaction, and higher-order cognitive processes, such as belief updating.

The current results do not support the hypothetical link between degree of handedness, cerebral lateralization, and belief updating. Future research needs to ascertain whether this is due to a lack of a link between cerebral lateralization/interhemispheric interaction and belief updating, or between degree of handedness and cerebral lateralization/interhemispheric interaction.

Strengths and Weaknesses

The current study improved on many statistical and methodological shortcomings of the Westfall et al. (2014) study. Compared to this predecessor study, the composition of the present sample was more heterogeneous and its size was large enough to confine effect sizes to reasonable margins, as evidenced by the narrowness of the confidence intervals in the current study. The statistical power of the current study also rendered the probability of type II errors highly unlikely. Thus an effect with a magnitude of OR = 10.5 should have been detected with a statistically significant result. Finally, the current study employed empirically grounded methods for the classification of handedness and footedness, in addition to the median-split technique.

The main limitation of the current, but also of the original, study lay in the experimental manipulation itself. The electrical power company scenario assesses decision making in a purely hypothetical and isolated situation, thus it is not known how well it can actually predict everyday decisions.[2] Furthermore, the scenario deals with the topic of economic monopolies and governmental intervention, which might give rise to effects of political and economic views to become confounding variables. As a result, it is conceivable that depending on the individual opinion about monopolies and the right of governments to regulate them, participants tend to choose one option over the other, regardless of the valence of the hypothetical past experience with the company. This needs to be investigated in future research.

Lastly, a neutral control condition was missing in the current study. The original Experiment 1 in Westfall et al. (2014) also utilized a neutral control condition, in which the information on the electric company was presented without any positive or negative valence. This condition served as a manipulation check for the status quo bias (i.e., the disproportional overall tendency to remain with the status quo in the absence of valenced information and irrespective of handedness). This bias has been empirically studied and corroborated multiple times before (e.g., Samuelson & Zeckhauser, 1988; Kahneman, Knetsch & Thaler, 1991; with a scenario similar to the scenario in the current study: Inman & Zeelenberg, 2002). We thus conclude that this overall bias also would have been likely in our study. However, the effect of interest did not depend on this neutral condition, but only on the positively and negatively valenced conditions. Hence, a control condition was omitted from the current study. This does not render the presented results invalid, but precludes the investigation of the prevalence of the status quo bias itself, when the scenario is presented without any valenced information.

Conclusion

The results of the current replication-extension study do not support the original findings of Westfall et al. (2014). Hence, caution is warranted with regards to the claim that inconsistent and consistent-handers react differently in the status-quo paradigm, or that they may differ in belief updating more generally. Considering the problems that are inherent in the application of the median-split technique, we emphasize that its use is unwarranted and uninformative. The distinction of 'consistent' and 'inconsistent' handedness needs a stronger empirical basis and better-validated

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methods for classification. We recommend the use of empirically grounded cutoffs to classify lateral preferences also in future research. Replication studies are needed for other studies in this line of research that have applied the median-split technique as well.

Data Accessibility Statements

The dataset analyzed for this study can be found on figshare.com, https://figshare.com/articles/Status_quo_bias/6683013.

Notes

[1] We adopted Experiment 1 of Westfall et al. (2014), as it presented the simplest scenario, which elicited the hypothesized difference between inconsistent and consistent-handers within that study. In contrast, Experiment 2 was less straightforward, as it entailed not two, but four conditions of relevance for differences in the status quo bias.

[2] The same limitation applies to Experiment 2 in Westfall et al. (2014) as well, even though it was designed to be "closer to the real world."

Additional File

The additional file for this article can be found as follows:

- **Text S1.** No Evidence That Lateral Preferences Predict Individual Differences in the Tendency to Update Mental Representations: A Replication-Extension Study. DOI: https://doi.org/10.1525/collabra.227.s1

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Competing Interests

The authors have no competing interests to declare.

Author Contributions

MG and JV contributed equally to the conception and design of the study. MG and JV organized the database, performed the statistical analyses, and wrote the first draft of the manuscript. JV contributed to the creation of graphical displays. The order in which MG and JV are listed as authors is based on the alphabetical order of their names. MV provided critical revisions of manuscript drafts and suggested the small-telescopes analysis. UST supervised the project, provided critical revisions of manuscript drafts, and contributed to the statistical analyses and the creation of graphical displays. All authors discussed the results, contributed to, and approved the final manuscript.

References

Altman, D. G., & **Royston, P.** (2006). The cost of dichotomizing continuous variables. *The British Medical Journal*, *332*, 1080. DOI: https://doi.org/10.1136/bmj.332.7549.1080

Asendorpf, J. B., Conner, M., De Fruyt, F., De Houwer, J., Denissen, J. J., Fiedler, K., Wicherts, J. M., et al. (2013). Recommendations for increasing replicability in psychology. *European Journal of Personality*, *27*, 108–19. DOI: https://doi.org/10.1002/per.1919

Behling, O., & **Law, K.** (2000). *Translating questionnaires and other research instruments: Problems and Solutions*. Thousand Oaks, CA: Sage. DOI: https://doi.org/10.4135/9781412986373

Bhattacharya, C., & **Jasper, J. D.** (2018). Degree of handedness: A unique individual differences factor for predicting and understanding hindsight bias. *Personality and Individual Differences*, *125*, 97–101. DOI: https://doi.org/10.1016/j.paid.2017.12.036

Bonett, D. G. (2012). Replication-extension studies. *Current Directions in Psychological Science*, *21*, 409–412. DOI: https://doi.org/10.1177/0963721412459512

Bourne, V. J. (2008). Examining the relationship between degree of handedness and degree of cerebral lateralization for processing facial emotion. *Neuropsychology*, *22*, 350–56. DOI: https://doi.org/10.1037/0894-4105.22.3.350

Button, K. S., Ioannidis, J. P. A., Mokrysz, C., Nosek, B. A., Flint, J., Robinson, E. S. J., & **Munafò, M. R.** (2013). Power failure: Why small sample size undermines the reliability of neuroscience. *Nature Reviews Neuroscience*, *14*, 365–376. DOI: https://doi.org/10.1038/nrn3475

Cacioppo, J. T., Petty, R. E., & **Quintanar, L. R.** (1982). Individual differences in relative hemispheric alpha abundance and cognitive responses to persuasive communications. *Journal of Personality and Social Psychology*, *43*, 623–636. DOI: https://doi.org/10.1037/0022-3514.43.3.623

Chen, H., Cohen, P., & **Chen, S.** (2010). How big is a big odds ratio? Interpreting the magnitudes of odds ratios in epidemiological studies. *Communications in Statistics – Simulation and Computation*, *39*, 860–64. DOI: https://doi.org/10.1080/03610911003650383

Christman, S. D., Bentle, M., & **Niebauer, C. L.** (2007). Handedness differences in body image distortion and eating disorder symptomatology. *International Journal of Eating Disorders*, *40*, 247–56. DOI: https://doi.org/10.1002/eat.20357

Christman, S. D., Henning, B. R., Geers, A. L., Propper, R. E., & **Niebauer, C. L.** (2008). Mixed-handed persons are more easily persuaded and are more gullible: Interhemispheric interaction and belief updating. *Laterality*, *13*, 403–26. DOI: https://doi.org/10.1080/13576500802079646

Christman, S. D., Jasper, J. D., Sontam, V., & **Cooil, B.** (2007). Individual differences in risk perception versus risk taking: Handedness and interhemispheric interaction. *Brain and Cognition*, *63*, 51–58. DOI: https://doi.org/10.1016/j.bandc.2006.08.001

Christman, S. D., & **Prichard, E. C.** (2016). Half oaks, half willows: Degree, not direction, of handedness underlies both stable prevalence in the human population and species-beneficial variations in cognitive flexibility. *Evolutionary Psychological Science*, *2*, 228–36. DOI: https://doi.org/10.1007/s40806-016-0047-7

Christman, S. D., Sontam, V., & **Jasper, J. D.** (2009). Individual differences in ambiguous-figure perception: Degree of handedness and interhemispheric interaction. *Perception*, *38*, 1183–98. DOI: https://doi.org/10.1068/p6131

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Cohen, J. (1977). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Cohen, J. (1983). The cost of dichotomization. *Applied Psychological Measurement*, *7*, 249–253. DOI: https://doi.org/10.1177/014662168300700301

Cohen, J. (1994). The earth is round (p < .05). *American Psychologist*, *49*, 997–1003. DOI: https://doi.org/10.1037/0003-066X.49.12.997

Coren, S. (1993). *The left-hander syndrome: The causes and consequences of left-handedness*. New York: Vintage Books.

Davidson, T., & **Tremblay, F.** (2013). Hemispheric differences in corticospinal excitability and in transcallosal inhibition in relation to degree of handedness. *PLoS ONE*, *8*, e70286. DOI: https://doi.org/10.1371/journal.pone.0070286

Dragovic, M., Milenkovic, S., & **Hammond, G.** (2008). The distribution of hand preference is discrete: A taxometric examination. *British Journal of Psychology*, *99*, 445–59. DOI: https://doi.org/10.1348/000712608X304450

Drake, R. A. (1991). Processing persuasive arguments: Recall and recognition as a function of agreement and manipulated activation asymmetry. *Brain and Cognition*, *15*, 83–94. DOI: https://doi.org/10.1016/0278-2626(91)90017-3

Drake, R. A., & **Bingham, B. R.** (1985). Induced lateral orientation and persuasability. *Brain and Cognition*, *4*, 156–164. DOI: https://doi.org/10.1016/0278-2626(85)90067-3

Elias, L. J., & **Bryden, M. P.** (1998). Footedness is a better predictor of language lateralisation than handedness. *Laterality*, *3*, 41–52. DOI: https://doi.org/10.1080/713754287

Elias, L. J., Bryden, M. P., & **Bulman-Fleming, M. B.** (1998). Footedness is a better predictor than is handedness of emotional lateralization. *Neuropsychologia*, *36*, 37–43. DOI: https://doi.org/10.1016/S0028-3932(97)00107-3

Faul, F., Erdfelder, E., Buchner, A., & **Lang, A. G.** (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*, 1149–1160. DOI: https://doi.org/10.3758/BRM.41.4.1149

Frayer, D. W., Lozano, M., Bermúdez de Castro, J. M., Carbonell, E., Arsuaga, J. L., Radovčić, J., Fiore, I., et al. (2012). More than 500,000 years of right-handedness in Europe. *Laterality*, *17*, 51–69. DOI: https://doi.org/10.1080/1357650X.2010.529451

Gazzaniga, M. S. (2000). Cerebral specialization and interhemispheric communication- Does the corpus callosum enable the human condition. *Brain*, *123*, 1293–1326. DOI: https://doi.org/10.1093/brain/123.7.1293

Gelman, A. (2018). Don't characterize replications as successes of failures. *Behavioral and Brain Sciences*, *41*, e128. DOI: https://doi.org/10.1017/S0140525X18000638

Hardy, G. H. (1908). Mendelian proportions in a mixed population. *Science*, *28*, 49–50. DOI: https://doi.org/10.1126/science.28.706.49

Henrich, J., Heine, S. J., & **Norenzayan, A.** (2010). The weirdest people in the world? *Behavioral and Brain Sciences*, *33*, 61–83. DOI: https://doi.org/10.1017/S0140525X0999152X

Inman, J. J., & **Zeelenberg, M.** (2002). Regret in repeat purchase versus switching decisions: The attenuating role of decision justifiability. *Journal of Consumer Research*, *29*, 116–128. DOI: https://doi.org/10.1086/339925

Ioannidis, J. P. A. (2005). Why most research findings are false. *PLOS Medicine*, *2*, e124. DOI: https://doi.org/10.1371/journal.pmed.0020124

Jasper, J. D., & **Christman, S. D.** (2005). A neuropsychological dimension for anchoring effects. *Journal of Behavioral Decision Making*, *18*, 343–69. DOI: https://doi.org/10.1002/bdm.511

Jasper, J. D., Fournier, C., & **Christman, S. D.** (2014). Handedness differences in information framing. *Brain and Cognition*, *84*, 85–89. DOI: https://doi.org/10.1016/j.bandc.2013.11.006

Jasper, J. D., Kunzler, J. S., Prichard, E. C., & **Christman, S. D.** (2014). Individual differences in information order effects: The importance of right-hemisphere access in belief updating. *Acta Psychologica*, *148*, 115–22. DOI: https://doi.org/10.1016/j.actpsy.2014.01.004

Jasper, J. D., Prothero, M., & **Christman, S. D.** (2009). I'm not sexist!!! Cognitive dissonance and the differing cries of mixed- and strong-handers. *Personality and Individual Differences*, *47*, 268–272. DOI: https://doi.org/10.1016/j.paid.2009.03.010

Jasper, J. D., Woolf, J., & **Christman, S. D.** (2014). Responding to framed health messages: Different strokes for different (handedness) folks. *Psychology & Health*, *29*, 671–686. DOI: https://doi.org/10.1080/08870446.2014.881999

Kahneman, D., Knetsch, J. L., & **Thaler, R. H.** (1991). Anomalies: The endowment effect, loss aversion, and status quo bias. *Journal of Economic Perspectives*, *5*, 193–206. DOI: https://doi.org/10.1257/jep.5.1.193

Kelley, M. P. (2012). Lateral preference and schizotypy revisited: Comparison of handedness measurement and classification methods. *Laterality*, *17*, 150–168. DOI: https://doi.org/10.1080/1357650X.2010.546798

Luders, E., Cherbuin, N., Thompson, P. M., Gutman, B., Anstey, K. J., Sachdev, P., & **Toga, A. W.** (2010). When more is less: Associations between corpus callosum size and handedness lateralization. *NeuroImage*, *52*, 43–49. DOI: https://doi.org/10.1016/j.neuroimage.2010.04.016

MacCallum, R. C., Zhang, S., Preacher, K. J., & **Rucker, D. D.** (2002). On the practice of dichotomization of quantitative variables. *Psychological Methods*, *7*, 19–40. DOI: https://doi.org/10.1037/1082-989X.7.1.19

Martin, K., Jacobs, S., & **Frey, S. H.** (2011). Handedness-dependent and -independent cerebral asymmetries in the anterior intraparietal sulcus and ventral premotor cortex during grasp planning. *NeuroImage*, *57*, 502–512. DOI: https://doi.org/10.1016/j.neuroimage.2011.04.036

McDowell, A., Felton, A., Vazquez, D., & **Chiarello, C.** (2016). Neurostructural correlates of consistent

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and weak handedness. *Laterality*, *21*, 348–370. DOI: https://doi.org/10.1080/1357650X.2015.1096939
Niebauer, C. L., Aselage, J., & **Schutte, C.** (2002). Hemispheric interaction and consciousness: Degree of handedness predicts the intensity of a sensory illusion. *Laterality*, *7*, 85–96. DOI: https://doi.org/10.1080/13576500143000159
Niebauer, C. L., Christman, S., Reid, S., & **Garvey, K.** (2004). Interhemispheric interaction and beliefs on our origin: Degree of handedness predicts beliefs in creationism versus evolution. *Laterality*, *9*, 433–447. DOI: https://doi.org/10.1080/13576500342000266
Oldfield, R. C. (1971). The assessment and analysis of handedness: The Edinburgh inventory. *Neuropsychologia*, *9*, 97–113. DOI: https://doi.org/10.1016/0028-3932(71)90067-4
Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, *349*, aac4716–aac4716. DOI: https://doi.org/10.1126/science.aac4716
Prichard, E., Propper, R. E., & **Christman, S. D.** (2013). Degree of handedness, but not direction, is a systematic predictor of cognitive performance. *Frontiers in Psychology*, *4*, 9. DOI: https://doi.org/10.3389/fpsyg.2013.00009
Propper, R. E., Pierce, J., Geisler, M. W., Christman, S. D., & **Bellorado, N.** (2012). Asymmetry in resting alpha activity: Effects of handedness. *Open Journal of Medical Psychology*, *1*, 86–90. DOI: https://doi.org/10.4236/ojmp.2012.14014
Ramachandran, V. S. (1995). Anosognosia in parietal lobe syndrome. *Consciousness and Cognition*, *4*, 22–51. DOI: https://doi.org/10.1006/ccog.1995.1002
Samuelson, W., & **Zeckhauser, R.** (1988). Status quo bias in decision making. *Journal of Risk and Uncertainty*, *1*, 7–59. DOI: https://doi.org/10.1007/BF00055564
Simonsohn, U. (2015). Small telescopes: Detectability and the evaluation of replication results. *Psychological Science*, *26*, 559–569. DOI: https://doi.org/10.1177/0956797614567341
Steinberg, L., Albert, D., Cauffman, E., Banich, M., Graham, S., & **Woolard, J.** (2008). Age differences in sensation seeking and impulsivity as indexed by behavior and self-report: Evidence for a dual systems model. *Developmental Psychology*, *44*, 1764–1778. DOI: https://doi.org/10.1037/a0012955
Stern, C. (1943). The Hardy-Weinberg law. *Science*, *97*, 137–138. DOI: https://doi.org/10.1126/science.97.2510.137
Szaflarski, J. P., Rajagopal, A., Altaye, M., Byars, A. W., Jacola, L., Schmithorst, V. J., et al. (2012). Left-Handedness and Language Lateralization in Children. *Brain Research*, *1433*, 85–97. DOI: https://doi.org/10.1016/j.brainres.2011.11.026
Tran, U. S., Stieger, S., & **Voracek, M.** (2014). Evidence for general right-, mixed-, and left-sidedness in self-reported handedness, footedness, eyedness, and earedness, and a primacy of footedness in a large-sample latent variable analysis. *Neuropsychologia*, *62*, 220–232. DOI: https://doi.org/10.1016/j.neuropsychologia.2014.07.027
Tran, U. S., & **Voracek, M.** (2016). Footedness is associated with self-reported sporting performance and motor abilities in the general population. *Frontiers in Psychology*, *7*, 1199. DOI: https://doi.org/10.3389/fpsyg.2016.01199
Westfall, J. E., Corser, R., & **Jasper, J. D.** (2014). Handedness predicts motivation to switch from the status quo. *Laterality*, *19*, 745–764. DOI: https://doi.org/10.1080/1357650X.2014.912657
Westfall, J. E., Jasper, J. D., & **Christman, S. D.** (2012). Inaction inertia, the sunk cost effect, and handedness: Avoiding the losses of past decisions. *Brain and Cognition*, *80*, 192–200. DOI: https://doi.org/10.1016/j.bandc.2012.06.003
Willems, R. M., Peelen, M. V., & **Hagoort, P.** (2010). Cerebral lateralization of face-selective and body-selective visual areas depends on handedness. *Cerebral Cortex*, *20*, 1719–25. DOI: https://doi.org/10.1093/cercor/bhp234
Zverev, Y. P., & **Mipando, M.** (2007). Cultural and environmental influences on footedness: Cross-sectional study in urban and semi-urban Malawi. *Brain and Cognition*, *65*, 177–183. DOI: https://doi.org/10.1016/j.bandc.2007.07.008

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