

A sinister plot? Facts, beliefs, and stereotypes about the left-handed personality

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Is there a left-handed personality? Is there a left-handed stereotype? Although psychologists have enthusiastically compared left- and right-handers across myriad cognitive, behavioural, and neuropsychological domains, there has been very little empirical investigation of the relationship between handedness and personality. In Study 1 we assessed the Big 5 personality traits (extraversion, agreeableness, conscientiousness, emotionality, and openness to experience) in a sample of 662 young adults in New Zealand. Left- and right-handers did not differ on any factor. However, there was a curvilinear relationship between hand preference and extraversion; mixed-handers were more introverted than either left- or right-handers. This finding is consistent with other research indicating that degree may be of more psychological consequence than direction of handedness. In Study 2 we assessed beliefs and stereotypes about the left-handed personality. Both left- and right-handers shared the belief that left-handers are more introverted and open to experience than right-handers. This stereotype is not negative, and argues against the status of left-handers as a stigmatised group in modern Western culture.

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Hand preference is a relatively salient individual difference that has been noted throughout human history. The archaeological record points to a predominance of right-handers in the early Palaeolithic (reviewed in Steele, 2000), and many scholars suggest that right-handers have made up about 90% of the population (with minor geographical and cultural variations) since at least the emergence of *Homo sapiens* (e.g., Corballis, 1991; Coren & Porac, 1977). Over the past century psychologists have displayed a fascination with differences between left- and right-handers. A cursory search in PSYCinfo (retrieved 16 February 2011) for empirical journal

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articles that included both the terms “left-handers” and “right-handers” in the abstract revealed 435 studies (most certainly an underestimate) that have expressly compared left- and right-handers on some behavioural or neurological measure. Handedness has been examined in relation to an array of cognitive, perceptual, and motor skills; to risk for physical illness, mental disorders, and accidents; to occupational and aesthetic preference; to sexual orientation; and to neuroanatomy and function.

Given this wealth of information it is surprising that almost nothing is known about the relationship between hand preference and personality. This relationship is of interest for two reasons. First, hand preference is a behavioural marker of functional brain asymmetry. The best-studied neural correlate of hand preference is language lateralisation. Although almost all right-handers have left hemisphere specialisation for language processing, only about 70% of left-handers do, with the remainder demonstrating either right hemisphere or bilateral specialisation (Pujol, Deus, Losilla, & Capdev; Szaflarski et al., 2002; Warrington & Pratt, 1973). Mixed handedness (different hand preference for different activities) has also been demonstrated to reflect neurological function, with mixed-handers thought to have greater connectivity between the hemispheres than either left- or right-handers (Christman, 2001). The advent of social neuroscience has renewed interest in hemispheric contributions to personality. Although the popularisation of “hemisphericity” in the 1970s and 1980s that classified people as “left-brained” or “right-brained” was overly simplistic (e.g., Ornstein, 1977), a robust literature now indicates that stable individual differences in asymmetric frontal activity (typically measured with EEG) are related to a number of personality variables (reviewed in Coan & Allen, 2004). Specifically, greater left than right frontal activity is related to approach-related traits including behavioural activation (Coan & Allen, 2003; Sutton & Davidson, 1997), sociability (Schmidt, 1999), positive affect (Pauls, Wacker & Crost, 2005), and anger (Harmon-Jones & Allen, 1998; Peterson, Gravens, & Harmon-Jones, 2011), whereas greater right than left frontal activity is related to withdrawal-related traits including behavioural inhibition (Diego, Field, & Hernandez-Reif, 2001), shyness (Beaton et al., 2008; Schmidt, 1999), and emotional reactivity (Tomarken, Davidson, & Henriques, 1990; Wheeler, Davidson, & Tomarken, 1993). Although the relationship between handedness and asymmetries in frontal activity is unknown, the clear relationship between asymmetries in neurological function and individual differences in personality warrants further investigation of personality correlates of handedness.

A second rationale for understanding the relationship between hand preference and personality is that left-handers constitute a visible minority in any population. The population-level preference for the right hand likely accounts for the positive and negative connotations of the right and left sides

across cultures. In the Pythagorean Table of Opposites (described in Aristotle's *Metaphysics*, trans. Taylor, 1907), the right side is associated with *light, straight, good, and masculine*, and the left side with *dark, curved, evil, and feminine*. In the Book of Matthew (25:32), Jesus places the sheep (who will enter heaven) on his right hand, and the goats (who are damned to hell) on his left. In several Asian countries, and amongst Muslims worldwide, eating is restricted to the right hand and hygiene to the left, both historically (Wieschhoff, 1938) and in current times (Singh & Kundu, 1994). Our bias against the left is also entrenched in our languages. In many European languages the word for *right* (as the opposite of *left*) is also synonymous with *correct, nice, or good*; the Latin word *sinestra*¹ means both *left* and *unlucky*, the French word *gauche* means both *left* and *ugly*, and the English word *left* is derived from the Anglo-Saxon word *lyft*, which means weak or broken.

Negative connotations of the left appear also to apply to left-handers. In his book *The Left-hander Syndrome* Coren (1976) describes several languages (including English, German, Italian, Russian, and Polish) in which to be called *left-handed* is an insult. Coren goes on to argue that left-handers are negatively stereotyped. They certainly face discrimination from the designers of tools and other household objects, a bias that has been proposed to contribute to their premature deaths (Aggleton, Kentridge & Neave, 1993; Coren & Halpern, 1991; but see Harris, 1993). In several cultures today left-handers are encouraged (sometimes forcefully) to switch to the right. In a detailed analysis of rates of left-handedness across the last two centuries using archival data, McManus, Freegard, Moore, and Rawles (2010) found that the nadir in the incidence of left-handedness in Great Britain (about 3%) occurred in the 1880s, a dip that they attribute largely to the advent of public education and the zealous attentions of Victorian schoolteachers.

It is less clear that negative attitudes towards left-handers exist in modern Western cultures. Explicit discrimination against left-handers has been all but eliminated from the educational system; historical trends show an increase in rates of left-handedness in most Western cultures that reached an asymptote of 12–13% by about 1980 (Brackenridge, 1981; Levy, 1974). However, activists maintain that implicit discrimination still exists, primarily in ergonomic and other human factors domains. For example, The Handedness Research Institute (www.handedness.org) aims to “alleviate

¹The derivation of “sinister” is debated. Some etymologists tie it to the Sumerian word “winestra” which means lucky. Winestra was used in Old English to denote the left hand, but is usually considered ironic. Apparently even when connotations of the left seem positive, they are actually negative.

the social and educational discrimination of [*sic*] left-handers worldwide through research and education”.

One way to assess beliefs about left-handers in modern Western culture is to examine the media. The popular press paints a fairly positive picture of the left-hander. Much has been made, for example, of the fact that five of the past seven American presidents (and a number of their opposing candidates) have been left-handed (e.g., Levitt & Dubner, 2009; Wang & Aamodt, 2008). To the extent that the media both reflect and shape what a society thinks about, one might therefore expect to see positive attitudes towards left-handers in modern Western culture. Internet discussion forums provide other clues (e.g., www.left-hand.org). The existence of these forums is a clear indication that left-handers consider themselves to be a sub-group within society. Discussions typically focus on three themes: ergonomic discrimination (scissors, tools, school desks, guitars), forced switching to the right-hand (although the age or nationality of the poster is often unclear), and enhanced creative skills among left-handers (often linked to their “right-brain dominance”). Of course the accuracy of this information is not the issue here; rather the discussions provide an indication of *beliefs* about left-handers, at least among left-handers themselves.

Data on the relationship between handedness and personality are scarce, and studies that do exist have relied on very small samples, have targeted only specific (often pathological) traits, or have assessed handedness poorly. Of nine published studies, two have revealed no relationship between handedness and personality (Camposano, Corail & Lolas, 1991; Killgore, DellaPietra & Casasanto, 1999). Two have revealed relations with extraversion but in opposing directions; Furnham (1983) found left-handers (men only) to be more extraverted than right-handers, but Lester (1987) found left-handers (women only) to be more introverted than right-handers. Coren (1994), using the International Adjective Scales in a large sample, found left-handers to be low in nurturance and high in dominance, a negative personality type that Coren attributes to their minority status. This finding conflicts with that of Etaugh (1972) who found left-handers to be higher in trust. Three studies point to the importance of considering mixed-handers as a separate group. Bryson, Grimshaw, and Wilson (2009) found openness to experience to be related to degree, but not direction of, handedness. In their study weak or mixed handedness was associated with greater openness, but left- and right-handers did not differ. Hicks and Pellegrini (1978) found mixed-handers to have a more internal locus of control than either left- or right-handers. Using a behavioural measure of asymmetry in hand skill, Palmer (1963) found reduced asymmetry associated with anxiety and awkwardness. Combined, these studies hardly provide a coherent picture of the relationship between handedness and personality. Notably, none has

used a comprehensive measure of personality combined with a continuous measure of handedness, in an adequately large sample.

A notable exception to the dearth of data on handedness and personality are a number of studies showing increased levels of schizotypy in mixed- (but not left- or right-) handers (Annett & Moran, 2006; Chapman, Grimshaw & Nicholls, 2011; Somers, Sommer, Boks & Kahn, 2009). Schizotypy refers to a constellation of personality and cognitive traits that are often seen as odd or eccentric; these include magical ideation, ideas of reference, mild perceptual aberrations, suspiciousness, social anxiety, anhedonia, and odd speech and behaviour (Raine, 1991). The relationship between schizotypy and handedness has been well explored because schizotypy is thought to reflect vulnerability to psychosis, and may therefore provide a window into neuropsychological processes that have been hypothesised to play a role in schizophrenia (Crow, 1997; Sommer, Aleman, Ramsey, Bouma, & Khan, 2001). Given that schizotypy reflects some aspects of personality, one might expect personality to be related to degree, and not direction, of handedness. Of the personality studies described above, two explicitly eliminated mixed-handers (Camposano et al., 1991; Coren, 1994), and three did not assess handedness in a way that could reveal any curvilinear relationships between handedness and personality (Furnham, 1973; Killgore et al., 1999; Lester, 1987). Three of the four studies that considered mixed-handers separately found personality correlates of degree, and not direction (Bryson et al., 2009, Hicks & Pelligrini, 1978; Palmer, 1963), although each assessed different aspects of personality, finding mixed or weak handedness to be related to increased openness, awkwardness, and locus of control, respectively.

This research had two goals. In Study 1 we determined the relationship between handedness and the Big Five personality traits (extraversion, agreeableness, conscientiousness, emotionality, and openness to experience). In Study 2 we assessed beliefs and stereotypes about left-handers to determine whether they can be considered socially stigmatised in modern Western culture, and whether beliefs and stereotypes reflect the actual relationship between handedness and personality as empirically determined in Study 1.

STUDY 1

The goal of Study 1 was to examine relationships between the Big 5 personality factors and both degree and direction of handedness. Over the past two decades the Big Five has become the dominant conceptualisation of personality, distilling these five traits from thousands of studies of personality (Digman, 1990; McCrae & Costa, 1997). We assessed handedness as a continuous measure to allow us to examine both linear and curvilinear relationships across the handedness continuum. The use of a continuous

measure allowed us to avoid the problematic use of arbitrary cut-points that are often used to classify individuals as left- right- or mixed-handed.

Method

Participants. Participants were 662 undergraduate students in an introductory psychology course in New Zealand. There were 456 women and 206 men, with a mean age of 19.55 years ($SD = 4.18$). The ethnic composition of the sample included 78% who identified themselves as New Zealanders of European descent (or Pakeha), 7% Maori or Pasifika, 6% who identified as other, and 9% who failed to identify themselves. All were native speakers of English. Students completed an online survey as part of a mass testing session, which included the personality inventory and hand preference questionnaire as part of a larger package. Surveys were completed by groups of 12–16 students, with each seated at a computer in an individual cubicle. At the time of data collection, students had not received any class instruction in personality, handedness, or hemispheric specialisation.

Materials. The Big Five personality traits of extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience were assessed using Goldberg's 50-item International Personality Item Pool (IPIP; Goldberg, 2001; Goldberg et al., 2006). Each trait is measured using 10 balanced items, asking participants to indicate on a 7-point scale (1 = very inaccurate, 7 = very accurate) the extent to which each item describes them (e.g., *I am the life of the party*). Scores on each dimension are transformed to a scale that varies from 0 (low) to 10 (high). Previous research has found the scales to be suitably reliable (e.g., Gow, Whiteman, Pattie, & Deary, 2005). Participants also completed the Annett Handedness Questionnaire (AHQ; Annett, 1970), modified by the use of a 5-item response format. The questionnaire consists of 12 common activities (writing, throwing, using a hammer, striking a match, swinging a racquet, threading a needle, using scissors, dealing cards, sweeping, using a toothbrush, using a shovel, and unscrewing a jar lid). For each activity participants indicated if they use the left hand always or usually, use both hands equally, or use the right hand usually or always. The questionnaire was scored with values ranging from -2 to $+2$, yielding a total score that ranged from -24 to $+24$. This was then transformed to a score that ranged from -100 (left-handed) to $+100$ (right-handed).

Results and discussion

Throughout these analyses we adopted an alpha of $p = .01$ to reflect the fact that all analyses were repeated for each of the five personality factors. Mean

personality scores on each of the Big 5 factors and hand preference scores are reported for men and women in Table 1. Sex differences were observed in four of the five factors, with women reporting higher scores on extraversion, agreeableness, and conscientiousness, and lower scores on openness (all $ps < .001$). Men and women did not differ in hand preference.

Multiple regression was used to examine the relationship between hand preference and each of the personality factors (Table 2). Because both linear (direction) and quadratic (degree) relations between hand preference and personality were of interest, both were included. A three-step regression procedure was used, with sex entered at Step 1, followed by the linear and quadratic measures of handedness at Step 2, and the interactions of the handedness measures with sex at Step 3. The interaction terms allowed us to determine whether the relationship between hand preference and personality differed for men and women. None of the interaction terms was significant, and so all results are reported for men and women combined. Although many effects of sex were observed at Step 1 (as reflected in the sex differences reported above), the only effect of hand preference was observed for extraversion. The quadratic measure of hand preference accounted for a significant amount of the variance in extraversion, $\beta = .118$, $t = 2.221$, $p = .009$. Strong left- and right-handers were more extraverted than mixed-handers (see Figure 1, which shows the relationship between hand preference and extraversion, after controlling for sex).

No linear effects of hand preference were observed, indicating that left- and right-handers did not differ on any personality factor. However, the curvilinear relationship between extraversion and hand preference, with lower rates of extraversion in mixed-handers, mirrors the relationship between schizotypy and hand preference (Chapman et al., 2011; Somers et al., 2009). This finding adds to a growing research literature indicating

TABLE 1
Personality and hand preference variables for men and women

	<i>Men</i>		<i>Women</i>	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Extraversion*	3.95	0.74	4.16	0.76
Agreeableness*	4.56	0.75	4.97	0.63
Conscientiousness*	3.84	0.74	4.08	0.71
Emotionality	3.79	0.77	3.68	0.83
Openness to Experience*	4.56	0.81	4.34	0.74
Hand Preference	54.29	49.94	61.08	42.90

Personality measures range from 0 (low) to 10 (high) on each factor. Hand preference scores range from -100 (left-handed) to +100 (right-handed).

*Significant sex differences, $p < .001$.

TABLE 2
Hierarchical multiple regression analyses predicting personality factors from sex and hand preference

	<i>Personality factor</i>									
	<i>Extraversion</i>		<i>Agreeableness</i>		<i>Conscientiousness</i>		<i>Emotionality</i>		<i>Openness</i>	
	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
Step 1	.017*		.080**		.025**		.004		.017*	
Sex		.171		.281*		.207		-.042		.011
Step 2	.014*		.004		.009		.003		.006	
Linear Pref.		.024		.068		-.077		-.017		.073
Quadratic Pref.		.118*		0		.099		.061		-.055
Step 3	0		.003		.001		0		.005	
Sex x Linear Pref.		-.003		-.084		-.029		-.032		-.041
Sex x Quadratic Pref.		-.050		.069		-.025		0		-.130

For sex, positive values of β indicate higher trait scores for women than men. For linear hand preference, positive values of β indicate higher trait scores for right-handers than for left-handers. For quadratic hand preference, positive values of β indicate higher trait scores for strongly handed than for mixed handed individuals.

* $p < .01$, ** $p < .001$.

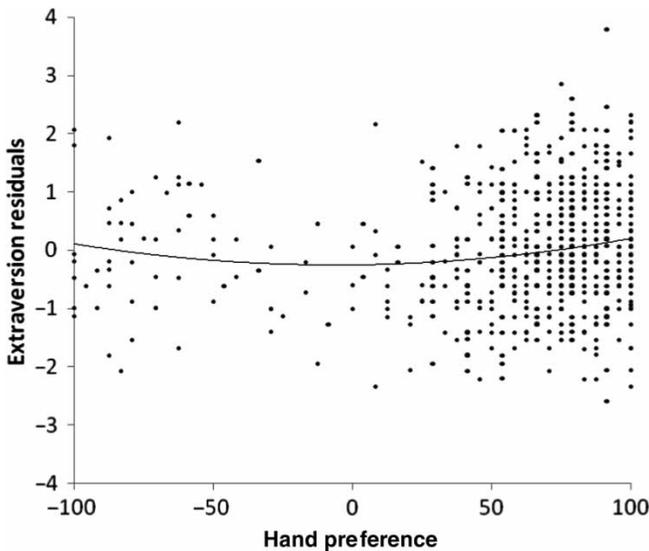


Figure 1. Quadratic relationship between hand preference and extraversion. Extraversion scores are standardised residuals, after controlling for sex. Positive values of the residuals indicate that an individual is more extraverted than the mean for their sex; negative values indicate that an individual is more introverted than the mean for their sex.

that mixed-handers differ psychologically from both left- and right-handers. Other correlates of mixed-handedness have been reported in the domains of episodic memory (Propper, Christman, & Phaneuf, 2005), intelligence (Nicholls, Chapman, Loetscher & Grimshaw, 2010), and updating of belief (Christman, Henning, Geers, Propper & Niebauer, 2008). These findings suggest that the common practice of combining left-handers and mixed-handers (to form a group of non-right-handers) may well obscure important psychological relationships.

The parallel between schizotypy and extraversion reveals an interesting paradox. There is overlap between the constructs of extraversion and schizotypy, with introversion being one of the key traits associated with the negative dimension of schizotypy. However, a number of studies indicate that mixed-handers have higher rates of positive and disorganised schizotypy, but not negative schizotypy (Chapman et al., 2011; Schurhoff, Laguerre, Roy, Beaumont & Leboyer, 2008; Stefanis et al., 2006). Such findings call for a comprehensive examination of the relationships among hand preference, personality, and schizotypy (see also Bryson et al., 2009).

Two previous studies have reported a relationship between handedness and extraversion, but with conflicting results. Furnham (1983) assessed handedness by self-report, and found that left-handed men were more

extraverted than right-handed men (as assessed with the Eysenck Personality Questionnaire). Notably, none of the 210 participants (who were all adolescents) reported themselves to be mixed-handed. In contrast, Lester (1987) assessed handedness as writing hand (again, no mixed-handers), and found that left-handed women were more introverted than right-handed women (as assessed by the Maudsley Personality Inventory). It is not clear how mixed-handers would have been classified in each study, but it is possible that the conflicting results reflect differences in the distribution of mixed-handers among the handedness groups.

Findings of the present study are also at odds with those reported by Coren (1994), who used the Interpersonal Adjective Scale (IAS) to assess the personality dimensions of dominance and nurturance in a sample of 1171 university students. Handedness was assessed with the four-item Lateral Preference Inventory and only the 930 participants who reported concordant hand use across all four items were included (thus mixed-handers were excluded from the study). Coren found left-handers to be higher in dominance and lower in nurturance than right-handers. Differences were specific to the subscales that found left-handers to be more arrogant/calculating and cold-hearted than right-handers. These traits map most closely onto the agreeableness dimension of personality. In the present study, agreeableness was not related to either direction or degree of handedness. Coren's use of the IAS was motivated by the hypothesis that left-handers would demonstrate a negative personality type because of their minority status and position as targets of discrimination. But are left-handers a stigmatised minority in modern Western society? Are they the victims of "low level negative societal attitudes"? (Coren, 1994, p. 218).

STUDY 2

The goal of Study 2 was to examine explicit stereotypes and beliefs about left-handers among the same cohort in which we assessed personality. We were particularly interested in the hypothesis that left-handers might be a stigmatised minority, bearing a negative stereotype. We assessed beliefs and stereotypes using the same items that were used to assess personality in Study 1. This allowed us to make direct comparisons between the actual and stereotypical personalities of left-handers. Two different approaches were taken to assess beliefs and stereotypes (Devine, 1989). Half the participants were asked to indicate whether each statement was more true of left-handers, more true of right-handers, or applied to both equally. Similar responses across individuals reflect a shared belief about left- or right-handers. The other half of participants were asked to indicate whether each statement was more true of stereotypical left-handers, more true of stereotypical right-handers, or applied to both equally. This approach allows participants to

report their knowledge of the stereotype in their culture, without endorsing the stereotype themselves.

Method

Participants. Participants were 171 students (51 men and 120 women) in an introductory psychology class who completed the experiment for course credit, 165 of whom had participated in Study 1. The time between studies 1 and 2 ranged from 4 to 12 weeks. A total of 19 participants (11.1%) were self-reported left-handers.

Materials. The 50-statement IPIP questionnaire was modified to change each of the descriptive statements to third person instead of first person (e.g. *is the life of the party*, instead of *am the life of the party*). There were two versions of the questionnaire. One version (personal belief) asked participants to “*indicate, for each statement, if it is more descriptive of left-handers, more descriptive of right-handers, or applies to left- and right-handers equally*”. In the alternate version (stereotype) the instructions included the statement that “*Stereotypes are beliefs about groups of people . . . We are interested in stereotypes of left- and right-handers. For each statement, indicate if it is more descriptive of a stereotypical left-hander, a stereotypical right-hander, or applies to left- and right-handers equally.*” The questionnaires were identical in all other respects.

Questionnaires were scored by applying scores of -1 for a left-handed response, $+1$ to a right-handed response, and 0 for an equal response (reverse-scored items were appropriately adjusted). The mean was then calculated for each personality factor to yield a handedness bias score that varied from -1 to $+1$, with negative values indicating that high scores on the personality factor were more typical of left-handers, and positive scores indicating that high scores were more typical of right-handers.

Participants were randomly assigned one of the questionnaires, with 91 completing the personal belief questionnaire, and 80 completing the stereotype questionnaire.

Results and discussion

Mean handedness bias scores were calculated for each personality factor, and appear in Table 3. As in Study 1, an alpha of .01 was adopted to control for multiple comparisons. There were no sex differences in either beliefs or stereotypes about handedness, and so all reported results are collapsed across sex.

One-sample *t*-tests were computed to compare each handedness bias score to zero (which would reflect belief that left- and right-handers did not differ).

TABLE 3
Beliefs and stereotypes about left- and right-handers

	<i>Belief</i>		<i>Stereotype</i>	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Extraversion	.16**	.37	.31**	.47
Agreeableness	.05	.26	.04	.39
Conscientiousness	.01	.38	.00	.51
Emotionality	.03	.28	.02	.31
Openness	-.11*	.33	-.18**	.34

Handedness bias scores vary from -1 to $+1$, with negative values reflecting the belief that the trait is more typical of left-handers, and positive values reflecting the belief that the trait is more typical of right-handers.

* $p < .01$, ** $p < .001$.

Among participants who reported on their personal beliefs, right-handers were believed to be more extraverted, $t(90) = 4.132$, $p < .001$, and less open to experience, $t(90) = -3.496$, $p = .001$, than left-handers. Findings for participants who reported on the stereotype revealed the same pattern, with the stereotypical right-hander thought to be more extraverted, $t(79) = 5.886$, $p < .001$, and less open to experience, $t(79) = -5.067$, $p < .001$, than the stereotypical left-hander. Independent t -tests comparing participants who reported on beliefs vs stereotypes indicated no significant differences between them on any personality factor, although the difference between beliefs and stereotypes about extraversion approached significance, $t(169) = -2.390$, $p = .018$, with the stereotype being stronger than the personal belief that right-handers are more extraverted than left-handers. Thus individual beliefs about left- and right-handers largely reflect the shared cultural stereotype.

Because 165 participants had also completed the handedness survey in Study 1 we were able to examine the relationship between handedness and beliefs about handedness. Correlations were calculated between hand preference and belief about each personality factor. Because the personal belief and stereotype conditions yielded similar results belief was collapsed across both conditions. Hand preference was not related to beliefs about extraversion ($r = .08$) or openness ($r = .11$); that is, the stereotype was endorsed by both left- and right-handers.

The conceptualisation of left-handers as introverted and open to experience is most consistent with the “*artistic*” personality stereotype, and can hardly be considered negative. Although it is difficult to find concrete evidence that the “lefty as artist” stereotype exists, a cursory examination of the Internet as a proxy of popular belief reveals a number of “myths about left-handers” sites (e.g., www.lefthander.com/myths.htm; www.hubpages.com).

com/hub/Lefties-the-myths-and-the-facts). Interestingly some of these sites claim the artistic left-hander is a myth, and others that it is a fact (usually because left-handers are thought to rely on their creative right hemispheres). Again, the important point is not the accuracy of the belief, but its existence. Discussion forums also show frequent linking of handedness and artistic ability (as in “*I’m a lefty and I’m very artistic*” or “*I’m a lefty and I’m not at all artistic*”). Although opinions about the relationship between left-handedness and artistic creativity may vary, it is clear that the two concepts are linked.

We found no evidence that left-handers are a stigmatised minority in our young Western population. Negative personality traits are most likely to emerge in the agreeableness and conscientiousness factors of personality, where no effects were observed. Furthermore, left- and right-handers did not differ in their endorsement of the stereotype, as would be expected if left-handers formed an outgroup.

GENERAL DISCUSSION

The present study revealed no personality differences between left- and right-handers across the Big Five personality dimensions. However, a curvilinear relationship was observed, in that mixed handedness was related to lower levels of extraversion. This finding adds to a growing body of research indicating that degree may be of more psychological relevance than direction of handedness. It should be noted, however, that the hand preference accounts for only a very small proportion of the variance in extraversion (.014) beyond that accounted for by sex.

The belief and stereotype that left-handers are more introverted and open to experience than right-handers was not reflected in the empirical data, which argues against a left-handed personality arising as either a reflection of, or a reaction against, societal beliefs. Of course we did not assess beliefs or stereotypes about mixed-handers, and so we cannot be certain that there is not a stereotype or belief about the introverted mixed-hander. However, we think this is not the case for two reasons. First, mixed-handers are not a visible minority distinct from either left- or right-handers. In fact, analysis of the item responses on the handedness questionnaire reveals that most mixed-handers write with the right hand (the most visible marker of hand preference) and so will not appear to be in the minority at all. Second, beliefs about mixed-handers are not expressed in popular culture, either through media reports, websites, or discussion groups. Given that most handedness researchers do not think of mixed-handers as a distinct subgroup, it seems unlikely that the lay public would do so.

Although our findings argue against a negative stereotype of left-handers in modern Western culture, we do not deny that there has been overt discrimination against left-handers in the past. Attitudes towards handedness

have changed remarkably over the past century (e.g., Brackenridge, 1981; Levy, 1974; McManus et al., 2010), seemingly without large-scale public awareness campaigns or outright revolt (but see Harris, 2003). Social psychologists might well examine the transformation of the left-hander from dim-witted social pariah to tortured artist as a model of rapid social change.

Similarly, we do not deny that negative attitudes and overt discrimination continue in many cultures today (reviewed in Mandal & Dutta, 2001). Several of these societies are currently witnessing the liberalisation of attitudes towards handedness that has already occurred across Western culture, and provide unique opportunities for researchers to assess the interplay of cultural and biological factors in determining hand preference. Indeed, cross-cultural research may be a particularly effective way to determine whether there are aspects of personality related to handedness that arise through social mores that are distinct from those that are a function of neuropsychological organisation.

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