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Handedness and schizotypy in a Japanese sample: an association masked by cultural effects on hand usage

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Abstract

Previous research has shown a robust association between schizotypy and mixed/ambiguous-handedness, but little is known about the universality of this relationship outside Western cultures. The present paper examines this issue in a sample of 413 Japanese students administered (in Japan) the Annett handedness questionnaire and a schizotypy scale (STA). Conventional analyses of current hand preference, using several indices derived from the Annett scale, mostly failed to replicate previous findings. However, there was a significant tendency for greater use of either hand in highly schizotypal males. Furthermore, a significant association between schizotypy and non-right-handedness was found—again only in males—after correcting for the effects of early switching of hand usage, presumed to be due to cultural pressure against left-handedness in Japanese society. These results were found to be highly convergent with findings previously reported for clinical schizophrenia.

Keywords: Japan; Handedness; Schizotypy

Atypical cerebral lateralization is considered a risk factor for schizophrenia (Crow et al., 1996; Satz and Green, 1999), and has also been proposed as a possible biological mechanism for schizophrenic symptomatology (Crow, 1990; Flor-Henry, 1969; Gruzelier, 1994; also see Schizophrenia Bulletin (1999) for recent comprehensive reviews). This perspective on schizophrenia would chime well with an emerging view that part of the aetiology of the disorder may lie in a, perhaps quite subtle, deviation in some aspect of early neurodevelopment when asymmetries of the CNS are being established.

Handedness, as one measure of atypical lateralization, has been the subject of many studies in schizophrenia research. Such investigations have used one of two populations: schizophrenic patients, and normal participants assessed for degree of schizotypy (presumed to reflect a genetically determined disposition to schizophrenia). In these latter studies, schizotypy has been assessed using self-report scales that have been developed in the context of schizophrenia risk research (Chapman et al., 1995; Claridge, 1997; Edell, 1995).

Investigations of handedness in clinical samples have yielded a range of results, though a certain consistency is now beginning to emerge. While some studies have reported null findings (Lishman and McMeekan, 1976) and even an increase in righthandedness amongst schizophrenics (Fleminger et al., 1977; Taylor et al., 1982), the majority of studies have reported a shift from dextrality. In some research, schizophrenics have been found to show a greater incidence of sinistrality (Chaugule and Master, 1981; Clementz et al., 1994; Gur, 1997; Nasrallah et al., 1982). However, the more robust finding is that schizophrenics show greater mixed-handedness, without an increase in pure left-handedness (Cannon et al., 1995; Crow et al., 1996; Green et al., 1989; Malesu et al., 1996; Nelson et al., 1993; Shimizu et al., 1985). Possible explanations for these varied results include differences in: diagnostic criteria used to define

schizophrenia; methods to assess and classify handedness; and sample size (see Satz and Green, 1999 for a review).

Schizotypy—construed as an indicator of schizophrenia risk in the general population—has also received attention from a cerebral lateralization viewpoint (Claridge and Broks, 1984; Gruzelier and Richardson, 1994). This, too, has included research on handedness. Indeed, results from studies of schizotypy and handedness in healthy participants have been even more consistent than those in clinical samples: schizotypy has almost invariably been shown to be associated with an increased shift away from full dextrality (Chapman and Chapman, 1987; Claridge et al., 1998; Kim et al., 1992; Poreh, 1994; Richardson, 1994; Shaw et al., 2001). Only one published report to date (Overby, 1993) has claimed no association with schizotypy, but that was based on what could be regarded as a poor measure of handedness: subjects were merely asked to report whether they were right-, left- or mixed-handed, without reference to any action or group of actions, even writing.

As in the clinical studies, although the shift from dextrality has occasionally been observed in the form of greater left-handedness, the predominant finding has been an increased incidence of mixed-handedness among high schizotypes. This was certainly true of one of the largest surveys so far undertaken, that by Shaw et al. (2001), who found schizotypy scores to be actually slightly lower in full left-handers. Two other points should be noted here. First, where an association with handedness in non-clinical samples has been found, this has invariably been with the 'positive symptom' aspects of schizotypy, indexed by scales weighted on items tapping such features as magical ideation and unusual perceptual experiences. Secondly, an emergent theme in both the clinical and non-clinical research is a distinction that needs to be made between two meanings of 'shift from dextrality'. One, which might be judged to refer to 'true' mixed-handedness, is the tendency for individuals to report different hand preferences across different actions. The other is the tendency to be inconsistent in hand usage for the same action on different occasions. This has been described as 'ambiguous'-handedness, and was coined in the early 1980s, when it was noticed that most mixed-handed autistic and non-autistic mentally retarded institutionalised participants showed an absence of directional preference for the use of one hand over another for the majority of tasks (see Satz et al., 1985; Satz and Green, 1999; Soper et al., 1986, 1987). Ambiguoushandedness is sometimes indexed by the number of actions for which the subject reports using either hand. In the studies quoted, both types of shift from dextrality have been reported in schizotypy. All of the information previously collected on nonclinical subjects has been obtained from samples either in North America or in the UK; little is therefore known about the universality of the relationships observed. For that reason alone, it was of interest to take advantage of an opportunity that arose to gather schizotypy and handedness data on a Japanese sample: here we report the results for such a study. However, investigating the question in the Japanese was especially interesting for another, more specific, reason. This concerns the pattern of hand usage in Japan compared with Western countries, and the possible consequences that this might have for observed statistical associations between schizotypy and handedness.

It is well documented that the Japanese population shows a low frequency of left-hand preference. This is generally assumed to be due to cultural pressures within Japanese society against left-handedness, at A.M. Gregory et al. / Schizophrenia Research 65 (2003) 139–145 140 least for certain actions. Although, compared with earlier generations, such pressures now seem to be diminishing (Hatta and Kawakami, 1995), they are still significant. Indeed, for important pedagogical and social functions like writing and eating, left-hand usage remains relatively uncommon (Shimizu and Endo, 1983).

It is already acknowledged, for the clinical population, that these cultural pressures could distort— even wipe out—relationships that might otherwise be observed in the Japanese between handedness and schizophrenia/schizotypy. Thus, Shimizu et al. (1985) demonstrated that there was no difference between normal and schizophrenic subjects on a simple comparison of current hand preference: it was only when a correction was made for early switching of hand usage that a significant effect emerged.

The present study was undertaken with these observations in mind. Given the great consistency with which schizotypy and hand preference have been found to be related in previous investigations, this remained our 'default' prediction here and our initial aim was to try to replicate our own and others' findings on this topic. On the other hand, in view of the evidently strong cultural pressures on hand usage in the Japanese, we planned the study so as to examine its possible effect in the data.

1. Method

Participants

The original subject pool consisted of 439 Japanese students, from a fee-paying university situated on Kyushu Island, studying economics, engineering or teaching. Potential participants were contacted via their halls of residence or at the end of lectures. It is impossible to ascertain the exact response rate as distribution volunteers (teachers and dormitory staff) were each given 200 questionnaires to distribute, but were usually unable to distribute this large number. However, there were no reports of refusals to participate, and from discussions with the distribution volunteers, it was apparent that the refusal rate was extremely low, or even non-existent. Some subjects were eliminated from the study for one of a variety of reasons: incomplete questionnaires (15 subjects); failure to record gender (8 subjects); and falling as extreme outliers on age in a group that we wished to confine to a young student sample (3 subjects). This left a useable sample of 413 participants (229 male, 184 female). The mean age of the sample was 18.8 years (S.D. 1.1).

1.2. Measures

1.2.1. Schizotypy

This was measured using the Oxford schizotypal personality scale (STA; Claridge and Broks, 1984). The STA is a 37-item self-report questionnaire based on the DSM-III diagnostic criteria for Schizotypal Personality Disorder (American Psychiatric Association, 1980). Focussing on assessing the healthy equivalents of the positive symptoms of schizophrenia, the STA has been used in a variety of experimental and clinical studies and is well established as a valid test of schizotypal characteristics (see Claridge, 1997).

1.2.2. Handedness

This was assessed using the Annett (1970) Hand Preference Questionnaire, an instrument that has been widely used in this field (Annett, 1995) and one generally regarded as a reliable self-report measure of handedness (McMeekan and Lishman, 1975). In responding to the questionnaire, participants are required to indicate whether they use their right, left or either hand for six primary and six non-primary common actions. The primary actions are: writing, throwing, wielding a racket, striking a match, hammering, and brushing teeth. The non-primary actions are: using scissors, threading a needle, sweeping with a broom, using a shovel, dealing cards, and opening a jar. In the version used here an additional question was included, enquiring of subjects whether an attempt had been made to change their writing hand during their upbringing.

Following Shaw et al. (2001), we scored the Annett questionnaire in four different ways, as follows:

1. According to Annett's (1985) revised classification system, which divides participants into seven groups. Using a decision tree, participants are first classified according to writing hand and then A.M. Gregory et al. / Schizophrenia Research 65 (2003) 139–145 141 assigned to a class according to the pattern of preferences on other actions. Group 1 designates fully right-handed individuals. Those in groups 2– 4 are right-handed but have an increasing preference for using the left

hand for other activities. Conversely, participants in group 7 are fully lefthanded, while those in groups 6 and 5 are lefthanded but increasingly prefer to use the right hand for other activities. In Annett's scoring method, 'either' responses are treated as a preference for the writing hand.

2. Distributed across three classes ('strong right', 'strong left' and 'mixed'). 'Strong right' and 'strong left' were identical to Annett's groups 1 and 7, respectively. 'Mixed' included all other subjects.

3. According to a simple dichotomy based on preferred writing hand.

4. By quantifying the degree of either hand usage (0–12), as measured by the number of items for which a subject declared a preference for 'either' hand.

1.3. Translation of scales

Both the STA and the Hand Preference Questionnaire were translated from English into Japanese by three professional translators. After a native Japanese speaker had translated the questionnaires into Japanese, these were then 'back-translated' into English by a further Japanese translator. This back-translation highlighted a few errors in the original translation; it was then corrected by a third English translator. Each translator was reminded of the need for a highly accurate translation.

2. Results

2.1. Analyses according to different methods of scoring the Annett questionnaire

2.1.1. By Annett group

Table 1 summarises the STA data across the seven Annett hand preference categories. ANOVA revealed no significant differences in STA score according to Annett category, no gender difference, and no significant gender/hand preference interaction.

2.1.2. By three-way classification of handedness

ANOVA on these data again revealed no significant effects for STA score, and no significant interaction between gender and hand preference.

2.1.3. By writing hand

Two-wayANOVA(writing hand_gender) revealed that there was no significant difference on either factor, and no significant interaction.

2.1.4. 'Either' score

Correlational analysis for the either score against STA showed that there was no significant association between the two measures in the group as a whole ($r(419) = 0.09$, $p = NS$). However, there was here a sex difference, the correlation being significant in males only ($r(226) = 0.15$, $p < 0.05$). In other words, males reporting a greater frequency of either hand use across the Annett items tended to have higher schizotypy scores.

2.2. Further analysis

In light of the failure, in this Japanese sample, to replicate most of the previous findings in the area, the data were explored further, taking into account possible distorting effects of cultural pressure on reported hand usage. First, in order to see whether there was in fact any evidence of

such pressure, we compared the distribution of hand preference in our Japanese sample with that of a similar UK student sample (obtained by Shaw et al., 2001, N = 3443).

Table 1 Mean STA by Annett groups and sex[a]

		Annett group						
		1(R)	2	3	4	5	6	7(L)
Females	Mean	16.47	16.05	14.25	15.09	–	7.00	21.00
	S.D.	6.62	5.21	5.82	6.38	–	–	–
	N	113	41	16	11	0	1	1
Males	Mean	15.92	15.82	16.85	21.00	19.00	21.00	12.50
	S.D.	8.01	8.68	7.29	8.41	0	–	10.61
	N	123	44	34	19	3	1	2
Total	Mean	16.18	15.93	16.02	18.83	19.00	14.00	15.33
	S.D.	7.37	7.18	6.91	8.14	0	9.90	8.96
	N	236	85	50	30	3	2	3

[a] Four subjects claiming to write either hand and who could not be classified under Annett's system are not included here. Their STA scores were 1, 15, 17 and 21, respectively.

2.2.1. Distribution of hand preference

These data are shown in Table 2, where we have used the three-way (right, mixed and left) categories as a way of classifying the subjects. The UK sample represented in the table is that from the study reported by Shaw et al. (2001), who collected hand preference data from a very similar student population to that employed here.

Analysis of the frequency data in Table 2 revealed a highly significant difference in the distribution of hand preference across the UK and Japanese samples ($v_2(2, N = 3856) = 21.3$, $p < 0.0001$). Inspection of the tables reveals that this was mostly due to the very small numbers of full left-handers among Japanese participants: about 1% compared with approximately 5% of UK subjects. Another feature to be noted is that this 'loss' of left-handers in the Japanese was not counterbalanced by an increase in right-handers, who were of roughly equal frequency in both groups. The effect was shown more in an increased incidence of mixed-handedness, which was noticeably more common in the Japanese (42%) than in the British (33%). Given previous studies of handedness in the Japanese, it is safe to assume that the differences observed from the UK sample were due to some nonright- handers in the present sample being forced to switch their hand usage, presumably in childhood. A comparison of these subjects with non-switched subjects was therefore the next logical stage of the analysis.

2.2.2. Switched versus non-switched participants

Inspection of responses to the question asking about early pressure to change hand usage revealed that this was true of 51 subjects (38 male; 13 female), Notably, switched participants had significantly higher STA scores than their non-switched counterparts ($t(411) = 2.42$, $p < 0.02$).

This possibility was examined further by constructing another measure of handedness, following that used by Shimizu et al. (1985) to correct for early hand switching in their schizophrenic sample. Subjects were assigned to one of two groups: full right-handers (Annett group 1) who did not report having been switched and the rest. The latter therefore included some switched subjects (27) who currently reported being fully right-handed but who, by definition, had not originally been so.

Table 2
Frequencies of right-, mixed- and left-handers in Japanese and UK samples (percentages in brackets)

	Japanese sample	UK sample
Right-handed	236 (57.1%)	2115 (61.4%)
Mixed-handed	174 (42.1%)	1145 (33.3%)
Left-handed	3 (0.8%)	183 (5.3%)
Total	413	3443

Table 3
Mean STA score by sex and right hand (RH) versus non-right hand (NRH) classification

	Females		Males		Total	
	RH	NRH	RH	NRH	RH	NRH
Mean	16.34	15.63	15.31	17.54	15.83	16.79
S.D.	6.53	6.00	8.07	7.97	7.34	7.31
N	105	79	104	125	209	204

Table 3 shows the mean STA score for these two hand groups, for the total sample and for males and females separately. Two-way ANOVA (hand group _ sex) revealed that, although there was, overall, no significant difference on either main factor, there was a significant interaction between them. Inspection of the table indicates that this was due to male non-righthanders being significantly higher in schizotypy than full right-handers ($t(225) = 2.09$, $p < 0.04$).

3. Discussion

It is clear from this study that the association between schizotypy and handedness in the Japanese was more difficult to unravel, compared with previous research, carried out exclusively on European and North American participants. Revealing the effect necessitated correcting for the strong tendency in Japan to discourage left-hand usage. However, having made that adjustment, the results confirm yet again that there is a relationship between schizotypy and handedness in healthy subjects.

The effects observed here were confined to males and it is worth noting that in some previous work (e.g. Shaw et al., 2001) the association between schizotypy and handedness has been found to interact slightly with gender. However, in that study the association in women was not entirely eliminated; so the present finding still needs explaining. It was the case that the females in our Japanese sample were atypical. This was true in two respects. First, the ratio of females to males reporting early hand switching was unusually low: only 7.1% of the female, compared with 16.7% of the male, members of the sample. This seems at variance with most previous reports that cultural pressures against left-hand usage have traditionally been greater on Japanese women (Hatta and Kawakami, 1995; Shimizu and Endo, 1983). In which case, we would have expected at least an equal proportion of males and females in our switched subgroup, if we allow for some relaxation of cultural pressures in our young student sample.

The other peculiarity of our Japanese sample was the failure to find a gender difference in schizotypy. It is almost universally reported that females score significantly higher on the measures of the positive features of schizotypy, including the STA (Claridge, 1997). In the present sample there was no such difference: indeed males scored marginally higher. It is difficult to judge whether either of these gender differences in the data influenced our results—and, if so, how. The Japanese translation of the STA seemed psychometrically valid and to work well—as evidenced by the schizotypy/handedness findings in males. However, the items in the scale are rather ‘strong’ and it is just possible that they evoked a degree of defensive responding in some female participants, thus masking other effects in such individuals. A slight methodological flaw should be noted in the final dichotomous classification of handedness— right and non-right—that allowed us to correct for the early switching that had occurred in some subjects. As discussed earlier, the general consensus now is that where schizotypy relates to handedness, it does so, not to left-handedness, but to mixed-handedness. So in assigning all switched subjects to a composite nonright- handed group, we were not able to discriminate between those who might originally have been mixed and those who might originally have been full lefthanders. However,

this is unlikely to have been a substantial source of error, given that the exact number of left-handers, even in a more accurately ascertained sample, would have been extremely small. More crucially, the fact that some full left-handers might unwittingly have been included in our analysis would actually have attenuated the 'true' association with schizotypy, since left-handers are often only average, or even lower, in schizotypy than other handedness groups.

In conclusion, the findings reported here are consistent with the concept that failure of lateralization is a risk factor for certain pathology. This is a wellestablished idea, with early suggestions that lateralization problems incur risk for language delays and deficits including stuttering (Orton, 1937); as well as reading, spelling and drawing difficulties (Zangwill, 1960). More recently—and in line with these earlier studies—a cohort study found academic difficulties to be related to 'hemispheric indecision', viz the point of equal hand skill (Crow et al., 1998). This study also provided evidence for hemispheric indecision in participants who later developed schizophrenia (Crow et al., 1996).

As well as supporting this general concept, there is a satisfying convergence of evidence between that reported here and that described by Shimizu et al. (1985) in clinical schizophrenia specifically. There are two striking similarities. One is the greater frequency of early hand switching found among schizophrenics by Shimizu et al.; this chimes well with the high schizotypy scores of our switched subjects. And, secondly, after correcting for the effects of this early switching, non-right (presumably mixed)-handedness was found to be more often associated with clinical schizophrenia and healthy schizotypy, respectively. The results should encourage further investigation of these associations in the Japanese population.

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