

A METHODOLOGICAL ASSESSMENT OF HANDEDNESS AND HAND-CLASPING

A. Sharma and Surinder Nath

Department of Anthropology, University of Delhi

The biological phenomenon of hand-clasping was brought to light by Lutz (1908 : 195) who worked on a sample of families from Scotland. His data suggest the presence of a genetic component, but no simple genetic mechanism fits the data. On theoretical grounds too, a trait like hand-clasping cannot be treated as a genetic one in the strictest sense of the term as the genetic mechanism of its transmission is either of doubtful significance or is imperfectly understood or may even probably still be unknown at the present level of our knowledge despite Curt Stern's (1961 : 441) opinion that "the striking separation of mankind into right-handed and left-handed individuals seems to be a result of interaction between genotype and environment, both external and internal, that results in variable penetrance and expressivity".

However, the observation that the same person can and does clasp the hands differently in different trials gave rise to two schools of thinking. The first group consisting of Lutz (1908 : 195), Downey (1926 : 387-390), Yamaura (1940 : 1-9), Kawabe (1949 : 49-52), Freire-Maia et al. (1958 : 281-291; 1960 : 235-240), Pons (1961a : 141-144; 1961b : 442-446) are in the favour of the hypothesis that the trait is genetically controlled whereas Dahlberg (1926 : 296), Wiener (1932 : 365-370) and Lai and Walsh (1965 : 312-319) believe in the hypothesis that the trait is not determined by hereditary mechanism and suggest that habit rather than the genetic constitution determines the trait. In between these two extreme views, Freire-Maia and Almeida (1966 : 175-179) do not rule out parental influences in the offspring though no simple Mendelian mechanism can explain the family data. Similarly, Beckman and Elston (1962 : 99-103) have inferred that left-handedness is partially genetically determined, whereas Fujiki (1960 : 238-246) on the basis of 296 individuals (142 males and 154 females) contends that the R-situation is inherited as due to a dominant gene but some of the homozygous recessive present R-instead of L-situation. Collins (1964 : 293-318) while writing on the concept of relative limb dominance based on a sample of 917 Americans has found some evidence for association between handedness, handclasp-ing and arm-folding. Non-significant sexual differences have been found by Downey (1926 : 387-390), Saldanha et al. (1960 : 1-42) and Lai and

Walsh (1965 : 12-319), but not by Freire-Maia et al. (1958 : 281-291). Malhotra (1968 : 283-284) has recently contended that "it is premature to emphasise the utility of this trait in inter-population studies". Is it due to deficiency of method ?

Problem

In accordance with the foregoing attitude that the methodological details of hand-clasping are certainly not beyond doubt as well as existence of the notion that handedness is influenced by various environmental factors falling within the domain of social phenomena like habit, element of suggestibility and bias in performance due to imitation, the present study as based on 70 left-handed individuals (47 females and 23 males), is chiefly aimed at (i) settling certain methodological details regarding recording observations on hand-clasping; (ii) ascertaining if hand-clasping and handedness are associated; and (iii) investigating the sex-differences in hand-clasping, if any. Aspect (i) has been investigated mainly because one of the main difficulties experienced by a field-worker is to actually describe it to the subject what is meant by "hand-clasping" or whether to describe it to him/her. It is a common knowledge that when a subject is asked to perform the act of hand-clasping immediately after it has been demonstrated to him/her, he/she does it rather self-consciously. To the present writers, it is a formidable methodological flaw in any work on hand-clasping and consider this factor to be a serious source of error in previous studies. However, they are also aware that the aforesaid error is not totally unavoidable.

Material and Methods

The project has been so designed as to be completed in three trials, each trial recording the type of hand-clasping five times. This makes a total of observations to fifteen for each of the seventy individuals, i.e. 1050 observations in all.

It must be emphasised that before recording results of the first trial each individual had been told very briefly (by a quick demonstration) what is required of him/her without making him/her conscious of the existence of R-and L-type difference. Initially, results of a total of five attempts at hand-clasping in the first trial have been recorded. During the second and third trials also, both performed after an interval of two days each, the results of five attempts for each trial have been faithfully recorded. Labelling of an individual into R- or L- type in each of the three trials has been done on the basis of best-of-five. This point needs a clarification in view of the fact that there has been observed a considerable degree of both intra-trial and inter-trial variability (see Tables 1 and 2).

Discussion

Both intra-and inter-trial variability/differences are noticeable. An

example based on actual observations made on S. No. 1 (vide Appendix) will clarify the point. In the first trial, S. No. 1 has been typed as R-type whereas an L-type in the subsequent trials on the basis of best-of-five attempts.

TABLE 1

<i>Variability for S. No. 1</i>	<i>Trial I</i>		<i>Trial II</i>		<i>Trial III</i>	
	<i>R-type</i>	<i>L-type</i>	<i>R-type</i>	<i>L-type</i>	<i>R-type</i>	<i>L-type</i>
(a) Intra-trial	4	1	2	3	1	4
(b) Inter-trial (Typing by best-of-five) attempts	R-type		L-type		L-type	

Table 2 shows the incidence of intra-trial variability whereas Table 3 reflects upon inter-trial variability as computed on the basis of best-of-five results for each trial, i.e. 3R+0L means that the individual is an R-type in all the three trials, and so on.

TABLE 2
Intra-trial Variability Shown in "Hand-clasping"

<i>Combination of R : L Types</i>	<i>Incidence in different trials</i>		
	<i>Trial I</i>	<i>Trial II</i>	<i>Trial III</i>
Absence of Intra-trial Variability			
5 : 0	5	13	16
0 : 5	13	34	40
Mid-total	(17/70 or 24.29%)	(47/70 or 67.14%)	(56/70 or 80.00%)
Presence of Intra-trial variability			
4 : 1	10	5	2
3 : 2	8	1	—
2 : 3	16	2	1
1 : 4	19	15	11
Mid-total	(53/70 or 75.71%)	(23/70 or 32.86%)	(14/70 or 20.00%)

It is clear from Table 2 that the incidence of presence of intra-trial variability is the least in the third trial (14/70 or 20.00%) than either of the second (23/70 or 32.86%) or first (53/70 or 75.71%) trials. By implication, it is clear that the incidence of individuals clasping their hands in either R- or L- manner is considerably increased from the first trial (17/70 or 24.29%) to the third (56/70 or 80.00%), an increase of more than three times in constancy of performance by individual subjects. Hence, the results of the third trial are the most consistent than those of the first or second.

TABLE 3
Inter-trial variability in "Hand-clasping"

<i>Combination of Three Trials</i>	<i>Incidence</i>	<i>Remarks</i>
3R+0L (R R R)	18 (25.71%)	Constancy of Performance
0R+3L (L L L)	47 (67.15%)	" " "
2R+1L (R R L)	1 (1.43%)	Variable Performance
1R+2L (R L L)	4 (5.71%)	" "
Total	70 (100.00%)	

A casual glance at Table 3 might prompt anybody to conclude almost a complete absence of inter-trial variability, but it will be a superficial impression only as the fact remains that the results presented in Table 3 are based on the best-of-five attempts from each trial, nor upon one attempt in each trial. Hence, RRR might include any combination from 8R+7 L to 15R+0L. This may be amplified if one observes that the incidence of individuals showing R-type or L-type consistently in all the 15 attempts (5R+0L and 0R+5L) is as low as 17/70 or 24.29% thereby leaving a vast segment (53/70 or 75.71%) actually showing the absence of any consistency in the manual behaviour. However, the present writers may in passing mention that despite the results of second and third trials being more consistent than those of the first trial there is a greater degree of reliability if one records hand-clasping five times in the very first trial than only once as has been done to date.

A comparison of Tables 4 and 5 shows that the results of second and third trials (Chi-square=0.3680 : d.f.=1 : 0.90>P>0.80) relatively speaking agree more per individual than those of the first and second trials (Chi-square=0.5450 : d.f.=1 : 0.50>P>0.30) despite the fact that in both the situations the inter-trial differences remain non-significant. A glance at Appendix showing the results of three trials for each of the 70 individuals clearly establishes relatively higher-intra-trial variability for the first trial than for the subsequent ones.

TABLE 4
Chi-square Test Between I and II Trials

<i>Trials</i>	<i>R-type</i>	<i>L-type</i>	<i>Total</i>
I	23	47	70
II	19	51	70
Total	42	98	140
Chi-square=0.5450 : d.f. = 1 : $0.50 > P > 0.30$: Non-significant			

TABLE 5
Chi-square Test Between II and III Trials

<i>Trials</i>	<i>R-type</i>	<i>L-type</i>	<i>Total</i>
II	19	51	70
III	18	52	70
Total	37	103	140
Chi-square=0.3680 : d.f. = 1 : $0.90 > P > 0.80$: Non-significant			

Sex Differences

After establishing that the results of second and third trials are more in agreement with each other relative to those of the first and the second and hence more reliable involving lesser extent of error, the present writers find that the differential trends shown by the two sexes with respect to hand-clasping (by taking the results of the second trial as final) are non-significant (see Table 6) and in agreement with Downey (1926), Saldanha et al. (1960) and Lai and Walsh (1965).

TABLE 6
Chi-square Test Between the Sexes in II Trial

<i>Sex</i>	<i>R-type</i> (based on figures of II trial)	<i>L-type</i>	<i>Total</i>
Male	10	17	27
Females	9	34	43
Total	19	51	70
Chi-square=2.1404 ; d.f. = 1 : $0.20 > P > 0.10$: Non-significant			

Handedness and Hand-Clasping

Table 7 shows the association between handedness and hand-clasping. Results for the right-handed series have been obtained from as yet an unpublished series.

TABLE 7
Chi-Square Test between the Right-handed and Left-handed individuals of
R— and L— Type

<i>Hand-clasping Type</i>	<i>Handedness</i>		<i>Total</i>
	<i>Right-handed (Unpublished)</i>	<i>Left-handed (Trial III)</i>	
L—Type	69	18	87
R—Type	131	52	183
Total	200	70	270

Chi-Square = 1.8829 : d.f. = 1 : $0.20 > P > 0.10$: Non-significant

It is clearly brought about that both the right-handed and left-handed series show a preponderance of L-type, the R : L ratio being 1 : 2 and 1 : 3 (approx.) respectively. But this differential trend is again non-significant (Chi-square = 1.8829 : d.f. = 1 : $0.20 > P > 0.10$) as shown by the association test of independence and undoubtedly indicates hand-clasping and handedness are independent bodily/behavioural traits not associated with each other at all. Thus hand-clasping may more be viewed as a functional and manifest manual behaviour rather than a genetic trait. The authors are nevertheless conscious that the aforesaid results may at best be confirmed by studying twins (MZ, PZ and DZ) and sibs.

Summary

Considering that the methodological details of hand-clasping are not beyond doubt and handedness is influenced by various social phenomena, the present study based on 70 left-handed individuals (27 males and 43 females) aims at testing whether hand-clasping is associated with handedness. Comparative data are from an unpublished right-handed series of 200 individuals.

The experiment was completed in three trials, each recording the type of hand-clasping in five attempts thus making 15 observations per individuals. Before the first trial, each individual was told what was required of him/her by a quick demonstration but without actually clasping the hands physically. In the subsequent trials performed at intervals of two days each subject was asked to repeat his/her earlier performance.

The three major findings are :

1. Results of second and third trials agree more per individual relative to those of the first and it is recommended that the results obtained on a second visit to the initial one be recorded as a sound methodological practice. However, if the recording is to be done on the first visit, it should be based on the best-of-five attempts.
2. The proportional differences of R- and L-hand clasping type shown by the two sexes are non-significant, L-type predominating in both the sexes.
3. The preponderance of L-type holds good irrespective of handedness. It has been demonstrated that hand-clasping and handedness are not associated but independent bodily/behavioural traits.

APPENDIX

S. No.	Sex	I Trial (5-Scores) R-type; L-type		II Trial (5-Scores) R-type; L-type		III Trial (5-Scores) R-type; L-type		Combination of the Three Trials
		(3)	(4)	(5)	(6)	(7)	(8)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	M	4	1	2	3	1	4	R L L
2	F	1	4	—	5	—	5	L L L
3	M	4	1	5	—	5	—	R R R
4	M	2	3	—	5	—	5	L L L
5	F	—	5	—	5	—	5	L L L
6	F	1	4	—	5	—	5	L L L
7	F	2	3	—	5	—	5	L L L
8	M	4	1	5	—	5	—	R R R
9	F	2	3	1	4	1	4	L L L
10	M	3	2	2	3	2	3	R L L
11	F	—	5	—	5	—	5	L L L
12	F	1	4	—	5	—	5	L L L
13	M	—	5	—	5	—	5	L L L
14	M	4	1	5	—	5	—	R R R
15	M	3	2	4	1	4	1	R R R
16	M	—	5	—	5	—	5	L L L
17	M	4	1	5	—	5	—	R R R
18	F	1	4	—	5	—	5	L L L
19	F	2	3	1	4	1	4	L L L

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
20	F	5	—	5	—	5	—	RRR
21	F	1	4	—	5	—	5	LLL
22	M	2	3	1	4	1	4	LLL
23	M	1	4	—	5	—	5	LLL
24	F	2	3	—	5	—	5	LLL
25	M	5	—	5	—	5	—	RRR
26	F	1	4	—	5	—	5	LLL
27	M	5	—	5	—	5	—	RRR
28	M	2	3	1	4	1	4	LLL
29	M	1	4	—	5	—	5	LLL
30	M	—	5	—	5	—	5	LLL
31	F	2	3	1	4	1	4	LLL
32	F	1	4	—	5	—	5	LLL
33	F	3	2	3	2	1	4	RRR
34	F	5	—	5	—	5	—	RRR
35	M	1	4	—	5	—	5	LLL
36	F	2	3	—	5	—	5	LLL
37	F	2	3	1	4	1	4	LLL
38	F	3	2	4	1	4	1	RRR
39	M	1	4	—	5	—	5	LLL
40	M	—	5	—	5	—	5	LLL
41	M	5	—	5	—	5	—	RRR
42	M	1	4	1	4	—	5	LLL
43	F	2	3	—	5	—	5	LLL
44	F	1	4	—	5	—	5	LLL
45	F	2	3	—	5	—	5	LLL
46	F	1	4	1	4	—	5	LLL
47	F	—	5	—	5	—	5	LLL
48	F	4	1	5	—	5	—	RRR
49	F	—	5	—	5	—	5	LLL
50	F	1	4	—	5	—	5	LLL
51	M	3	2	4	1	5	—	RRR
52	M	4	1	5	—	5	—	RRR
53	M	—	5	—	5	—	5	LLL
54	M	1	4	—	5	—	5	LLL
55	M	2	3	1	4	—	5	LLL

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
56	F	3	2	1	4	1	4	R L L
57	F	2	3	1	4	1	4	L L L
58	F	—	5	—	5	—	5	L L L
59	F	2	3	1	4	—	5	L L L
60	F	4	1	5	—	5	—	R R R
61	F	—	5	—	5	—	5	L L L
62	F	1	4	1	4	—	5	L L L
63	F	4	1	4	1	5	—	R R R
64	F	1	4	—	5	—	5	L L L
65	F	3	2	5	—	5	—	R R R
66	F	2	3	1	4	—	5	L L L
67	F	—	5	—	5	—	5	L L L
68	F	1	4	—	5	—	5	L L L
69	F	3	2	1	4	1	4	R L L
70	F	4	1	4	1	5	—	R R R

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A STUDY ON LONGITUDINAL AND TRANSVERSE TRENDS OF LOCALISATION OF SOCIAL TRIRADIUS

Kusum K. Mainigi

Department of Anthropology, University of Delhi

With the X-ray skeletotopic work of Valsik in 1933 (vide Valsik 1935 : 179-183), it became evident that axial triradii not only lie at "different levels in the longitudinal axis" (Cummins and Midlo 1943 and 1961 : 99), i.e. in the proximo-distal direction but the levels also differ in the radio-ulnar direction.

Problem

In the present study, an attempt has been made to find out the proximo-distal (longitudinal) and radio-ulnar (transverse) trends in localisation of axial triradius with the help of (i) frequency distribution and (ii) R-minus-L differences of the same individual and to find out as to which of the two methods brings out a clearer perspective of the actual differences existing in the localisation of axial triradius.

Material

Bilateral inked palmar prints from 500 adult unrelated males obtained *without any bias* form the present sample. Individuals above the age of 18 years (mean = 27.66 ± 0.64 ; S.D. = 10.20 ± 0.46) alone are included mainly because the growth factor, if ignored, can become a serious source of error (Sharma 1963a : 222) in any quantitative dermatoglyphic work.

Methods

The bilateral inked palmar impressions have been obtained in the completely "unextended" position of digital spreading (Mainigi 1971 Fig. 1), a position which is considered apt within the research design of quantitative palmar dermatoglyphics as detailed elsewhere (Taneja 1967 : 53-62, Sharma and Taneja 1968 : 257-260, 1969 : 121-131).

Breadth-Height index and Positional Index at axial triradius are somewhat modified versions of the earlier indices of the same name (Sharma 1963b : 239; 1966 : 81-92). The following formulae have been employed :