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## SEX AND HANDEDNESS

### MALE AND FEMALE DIMORPHISM, THE INCIDENCE OF LEFT-HANDEDNESS AND THE SOCIO-CULTURAL ENVIRONMENT

**ABSTRACT.** — *An analysis of 131 published sample-pairs has shown the partition of lefthandedness among male and female members of a population to be dependent on the strength and extent of the social pressure towards conformity lasting on the individuals.*

**KEY WORDS:** *Handedness — Sexual Dimorphism — Environmental Pressures.*

#### INTRODUCTION

As many studies on human handedness have shown, the partition of lefthandedness (*LH*) among the female and the male members of a population is not at all identical (see for ex. Kilshaw et al. 1983). These observations were contradicted by H. W. Siemens (1924) and W. Dennis (1958) who argued for an identical representation.

In preparing a large scale study on human handedness in prehistoric times (Spennemann, 1983, 1984) a data base (currently 720 different samples) was established for an extensive assessment of published data on the representation of *LH* in contemporary modern world. This compilation comprising a total of some 720 samples offered the chance to collect and compare data on male and female handedness on a wider basis than done previously.

The varying sampling methods employed by the different authors might probably bias a data collection on modern handedness. However, they do not affect the proportion of male to female *LH*, as the methods employed by an author within a single set of samples are identical for both sexes.

Those data were not included in the current study, which were gathered by methods with a low level of reliability, namely data obtained by the means of ascertaining hand pressure (grip strength), hand clapping, finger/hand/arm clasping and on hand/arm length.

#### DATA

For documenting the sexual dimorphism a total of 131 sample-pairs fulfilling the aforementioned criteria was checked (see *table 1*). These data were compiled from published sources coming up in the course of the above mentioned assessment of data. As actually all accessible data were included without any restriction to sources (journals, publications) or individuals (scientists), this data base is not biased and may be regarded as a random sample.

In 87,02 % of all sample pairs the observed percentage of *LH* among women was less than among men (*table 1*).



TABLE 1. *Sex difference of human handedness. The evidence of 131 sample pairs. (in %)*

Percentage of lefthandedness among all samples	Distribution of the sex ratio						
0 > 0 0 < 0 87.02 12.98	< 20	20—40	40—60	60—80	80—100	> 100	
	4.58	6.87	18.32	29.77	27.48	12.98	

For quantifying this difference a sex ratio was ascertained for each sample:

$$\text{SEX RATIO} = \frac{\text{Percentage of LH among females} \times 100}{\text{Percentage of LH among males}}$$

Among all samples the ratios range from 0 to 238.88 with an overall mean of 74.10 (SD 33.46).

## DISCUSSION

Several investigators have argued that the partition of handedness in general and the observable sexual dimorphism among the partition of handedness in particular cannot be interpreted due to biological variation only. Moreover, by some authors this dimorphism is primarily regarded as a result of environmental influences (Bryden 1982, Dawson 1972, Dennis 1958, Rhoads and Damon 1973). J. L. M. B. Dawson pointed out that increased social pressures towards conformity are lasting more strongly on female than on male members of a society (Dawson 1977). This view is strengthened by the results of a handedness analysis among some 2300 American school children (Wilson and Dolan 1931) which showed the well known predominance of LH males (LH Males 4.62%; LH Females 2.62%). This analysis gathered the data of "changed" righthanded (i.e. formerly LH) individuals as well, which showed the lefthanded males to be still predominant. This fact might be probably due to a "biological" foundation. A close analysis of this sample, however, revealed an unproportionally increased number of "changed" righthanded females compared to their male counterparts (changed males: 5.23%; changed females 4.14%). These observations were replicated by Rutenfranz, Hettinger, and Hellbrügge (1962) who found both sexes to be roughly equivalent until the onset of female puberty. From that on, the percentage of LH among females decreased more and more rapidly compared with the male subsample. Gottfried and Bathurst (1983) were able to show that the consistency in hand preference starts earlier among females than among males. In finishing the survey of literature, the case for a cultural explanation is currently stronger than for the biological explanation.

This interpretation means that young females are more likely to have got their original handedness broken than young males, who could remain being LH for a longer period or forever.

As it seemed likely that societies with high social pressure towards conformity might show a smaller sex ratio, i.e. significantly less LH among females than among males, the data base was checked accordingly. Societies with no or less social pressures should show the reverse. The descriptions of and definitions for highly and less restrictive societies were given by Barry, Bacon & Child (1957, 1959) and need not to be repeated here. Generalizing it is sufficient to state, that hunter — gatherer societies are much less restrictive than agricultural societies, where the social pressure towards conformity is immense. As these definitions were arrived as completely independent from the status of handedness in the populations, they may be used for classifying the samples as originating from less or highly restrictive societies. As the reference sample the overall mean of westernized societies was taken (table 2).

TABLE 2. *The sex ratio in relation to social restriction*

Sociocultural Status	n	$\bar{x}$	SD	variance
Westernized Societies	119	75.29	26.08	0—133.82
Highly restrictive Societies	3	0.00	0.00	0
Less restrictive Societies	3	138.53	87.26	80.47—238.88

An analysis for statistical significance (Students *t*-test) showed that the difference between the sex ratio of the highly restrictive societies and the westernized societies was not significant ( $P = 1.0$ ;  $t = 0.00$ ). The same applies for the difference between the less restricted societies and the highly restricted societies ( $P = 1.0$ ;  $t = 0.00$ ). The judgement for the highly restrictive societies with a sex ratio of 0 is complicated, as the number 0 jeopardizes all statistical comparison. If it is substituted by 0.0001, both ratio's differences (highly restrictive both to less restrictive and westernized) are not beyond expectation ( $P = 0.5$ ;  $t = 0.458$ ).

The high sex ratio of the less restrictive societies, however, differed significantly from the westernized societies beyond expectation ( $P = 1.0$ ;  $t = 3.833$ ).

There were two sets of further data which could be used: the data on Indians and on American Indians:

Both were tested against the westernized societies. The Indian sample differed significantly at the  $P = 0.01$  level ( $t = 3.164$ ) while the American Indian sample was significant at the  $P = 0.001$  level ( $t = 5.118$ ).

In summing up, this small study was able to show that the sex ratios of the representation of handedness differ significantly between some populations which exhibit traits of different social statuses and social organizations. Contrary to solely



TABLE 3. *The sex ratio among Indian and American Indian samples*

	<i>n</i>	$\bar{x}$	<i>SD</i>	
Indians	3	65.89	9.74	58.92—77.02
American Indians	3	59.90	47.59	21.85—113.26

arguing for the biological foundation a strong case can be made up, that the partition of handedness among the sexes as well as among whole populations (as could be documented at length by various researchers (Bryden 1982, Dawson 1972, 1977, Rhoads and Damon 1973) is regulated by social, cultural and environmental pressures. Thus it seems likely that an analysis of an increased number of samples (i.e. an analysis on a large scale basis) will provide the means for classifying the internal social pressure within a community by the representation of *LH*. If this task can be achieved, this method will probably represent a most powerful tool for the reconstruction of ancient and prehistoric societies. Furthermore it is methodologically absolutely independent from the other archaeological approaches to the same subject (i.e. assessment of manufacturing traces, tool-usage, and iconographic analyses (Spennemann 1983, 1984).

However, it has to be remarked that the initially mentioned compilation of data for a handedness study (forthcoming) has revealed that the non-westernized countries (i.e. not the US, Europe, and Australian and South African Whites) are hopelessly underrepresented in handedness studies.

Therefore it is hoped that this small note will create some further interest for undertaking more laterality studies especially in non-westernized cultural environments. The author welcomes any research and discussion on this matter.

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