

**Anatomy.** — *The digital formula in relation to age, sex and constitutional type.* II. By J. HUIZINGA. (Communicated by Prof. M. W. WOERDEMAN.)

(Communicated at the meeting of March 26, 1949.)

7. *Considerations on the causation of differences in prominence.*

ECKER (1875) believed the problem of prominence differences to be connected with the mobility of the metacarpals. As a measure of this mobility he uses the extent to which the capituli can be passively displaced in a volo-dorsal direction. The most laterally situated metacarpals (I and V) are movable to the greatest extent and correspond to the least prominent fingers. Metacarpal III is almost immovable and corresponds to the most prominent finger. In the human hand metacarpal IV is movable to a greater extent than II and should, therefore, correspond to a finger shorter than that belonging to II. If mobility and relative length are really correlated in this way, this suggests that Rd. prominence is typical of man, a conclusion which — as we have already pointed out — WOOD JONES (1944) reached by another route. In the Uln. type of the anthropoids, metacarpal II should, according to this reasoning, be more mobile than metacarpal IV, although ECKER admits 'I do not know whether the index finger in apes is more mobile than the ring finger'.

WEISSENBERG (1895) states that BRAUNE was of the opinion that the Uln. type develops as a result of the action of the considerably stronger flexors, whereby the hand undergoes ulnar reflexion so that the apparent length of the ring finger is increased. WEISSENBERG criticises this view remarking, that Rd. types would then be expected to be the rule in cases where 'the hand position in question has not yet had the opportunity of reaching its full development', e.g. in children 'which is, however, not the case'.

But we have already seen that WOLOTZKOI (1924) states that the Rd. type does actually occur with greater frequency in children, a finding that is confirmed by our own investigations (see below).

WECHSLER (1939) also attempted a functional explanation: as a result of the relatively greater use of the radially-situated fingers, a corresponding growth in breadth of the muscles in this region is to be expected. The stronger are these muscles the more the second metacarpo-phalangeal joint will be pushed thumb-wards, producing a bend in the course of II. Through this bending II becomes shortened as regards prominence and the Uln. type develops. 'It would be of interest in this connection to study the degree of correlation between the L/Br index of the hand with the force of pressure.' WOOD JONES (1944) remarks casually, in connection with the development of the elongated index finger:

'Many have dwelt upon some of the separate outcomes of the human dominance of the index finger, and in a rather topsyturvey way the human ability to point out objects has received certain attention, but there is a grave danger of mixing up physical and psychical specialisations, if the act of pointing is made the mainspring of the development'.

### III. Investigation.

We had the opportunity of studying sexual dimorphism, the variation with age and the connection with constitutional type.

#### A. Subjects.

In 1454 male and 858 female individuals from the age of four years upwards we recorded the age and the mode of prominence of the fingers; in 121 boys and 74 girls aged 7 to 11 years we also determined the constitutional type. (By a child aged 10 years, for instance, we understand one older than 9.6 years and younger than 10.6 etc.).

The groups are shown, together with other data in a table which will be discussed.

In 56 male and 44 females foetuses we made an estimate of the age and determined the prominence type of the right hand.

#### B. Method.

As stated above (see under 6) we used the method described by WOLOTZKOI (1924) for determination of the prominence type.

The observations on foetuses were all checked independently by a medical colleague.

#### C. Results.

Arranged according to age (in months) and prominence types, the (right) hands *before birth* show the following picture:

Mths.	♂♂			♀♀		
	Rd.	Uln.	T.	Rd.	Uln.	T.
3	1	—	—	2	—	—
4	9	—	1	6	—	3
5	6	2	2	6	—	2
6	5	—	1	4	1	—
7	5	3	2	2	1	—
8	6	3	4	5	5	1
9	4	1	1	4	2	—
Total	36	9	11	29	9	6

Although the *ulnar* prominence type occurs in the first six months of gestation, it does not appear in any considerable proportion until the *last three months*. *Increasing age* is accompanied — at any rate during in-*trauterine* life — by *loss of the radial prominence type* in favour of the

ulnar type. The *mean* frequency of the Rd. type before birth for the two sexes is 65 %.

Our results, thus, differ appreciably from those of MIERZECKI (see remarks above); no other data were available for purposes of comparison. Like WOLOTZKOI, we arranged our (post-natal) data in the age-groups proposed by STRATZ.

Our group aged 1—4 years was too small to be of much significance in itself. The percentages calculated for these children (in brackets) fit reasonably well into the general picture when taken in connection with the other age groups (including the foetal group).

## Males.

Age (yrs)	<i>n</i>	Rd.	Uln.	T.	%/0Rd.	%/0Uln.	%/0T.
1 to 4 incl.	13	9	4	—	(69)	(31)	—
5 .. 7 ..	218	111	90	17	51	41	8
8 .. 10 ..	405	191	186	28	47	46	7
11 .. 14 ..	362	148	192	22	41	53	6
15 .. 20 ..	284	108	164	12	38	58	4
21 etc.	172	60	97	15	35	56	9
Total	1454	627	733	94			

## Females.

Age (yrs)	<i>n</i>	Rd.	Uln.	T.	%/0Rd.	%/0Uln.	%/0T.
1 to 4 incl.	7	6	1	—	(86)	(14)	—
5 .. 7 ..	178	102	59	17	57	33	10
8 .. 10 ..	331	206	98	27	62	30	8
11 .. 14 ..	236	139	78	19	59	33	8
15 .. 20 ..	56	23	26	7	41	46	13
21 etc.	50	24	20	6	48	40	12
Total	858	500	281	76			

The frequency of occurrence of the prominence types in the different extrauterine age-groups shows (see also figs. 1 and 2) that our observation on foetuses is not specific for this group. After birth also it appears that increasing age is accompanied by a loss of the Rd. type, but without this type disappearing altogether.

The figures and tables enable us to draw certain conclusions as to sexual dimorphism.

a. *Males.* In the majority of males the Rd. prominence type is present at birth. The number of such types undergoes a (probably gradual) decrease and corresponds to about 50 % in the first extension period (5—7 years).

The radial types, and probably also the T. types, change into ulnar types.

About the 21st. year the phenomenon referred to WOLOTZKOI is found: The number of ulnar forms shows a slight decrease although not, as stated

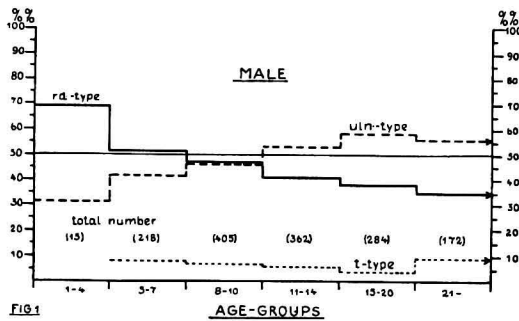


Fig. 1.

by this investigator, in favour of radial types but in favour of the T. types.

If we estimate roughly the percentage of radial forms at birth to be almost 70 %, we see that this falls to 35 % for men over 21 years of age.

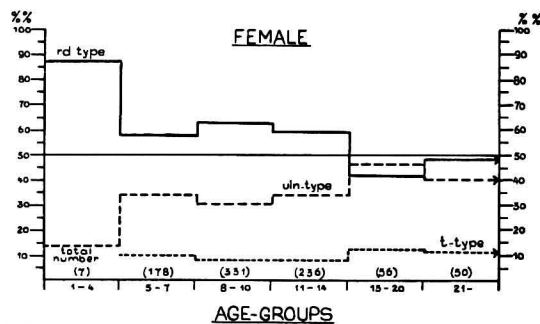


Fig. 2.

#### b. Females.

In the majority of females also, the radial prominence type is present at birth (probably rather more than 70 %).

This proportion remains high for much longer than is found to be the case in boys, passing the 50 % about the middle of the period of puberty.

This longer stay at the level corresponding to childhood in females than in males has also been repeatedly found — at least for physical characters — in our other investigations (1947, 1948).

We have, of course, no intention of asserting that this is necessarily true of all characters (exceptions are known to exist), nor do we wish at this stage to make any statement other than that given above.

The decrease in the number of radial types is less gradual in females.

In the period of maturation (15 to 20) years, we found in our subjects a large difference in frequency of the radial type between males and females (see also fig. 3), after this period the radial type appears to be more frequent in women than in men.

In women too, we see the phenomenon already described in men to appear about the 21st. year: a decrease in the number of ulnar types which, however, in this case does proceed in favour of the radial type.

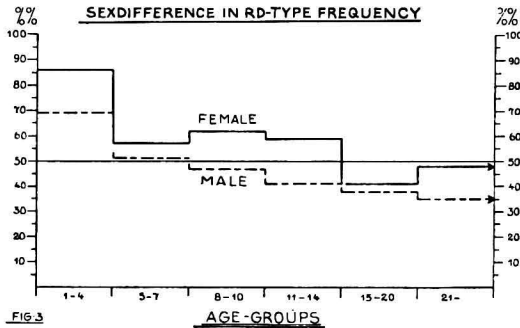


Fig. 3.

If the figures analysed provide us with reliable data, it is presumably the case that the falling-off in the number of radial forms in girls during puberty constitutes a minimum, which is then followed by a rise. In males we have seen that this decrease continues.

Some of the contradictions we have encountered in the literature are undoubtedly to be attributed to age differences in the groups compared.

The possible connection between prominence type and type of physical build has not been sufficiently investigated. Apart from the rather peculiar typology of ROMICH already discussed, we have seen that ECKER was under the impression that he had seen rather more radial types in leptosome individuals.

Using KRETSCHMER's typology with the modern terminology: eurysome (pynic), leptosome and (the intermediate) mesosome, we determined both prominence and physical type in a number of *children*. The results are shown in the following tables.

Boys.					Girls.				
Type	Rd.	Uln.	T.		Type	Rd.	Uln.	T.	
Leptos.	31	21	4	56	Leptos.	15	5	—	20
Mesos.	28	21	—	49	Mesos.	29	16	1	46
Eurys.	10	5	1	16	Eurys.	7	1	—	8
Total	69	47	5	121	Total	51	22	1	74

We find, thus, that in the whole group of *boys* ( $n = 121$ ) the Rd. type appears in 57% ( $n = 69$ ). In the *leptosome* types among these boys ( $n = 56$ ) the Rd. type is present in 55% ( $n = 31$ ), in the *mesosome* types ( $n = 49$ ) in 57% ( $n = 28$ ) and in the *euryosome* types ( $n = 16$ ) in 62% ( $n = 10$ ).

The Uln. type showed an equal absence of preference for a given bodily build.

For the Rd. type in *girls* the percentages are: all girls, 69 %; leptosome, mesosome and euryosome types, 75 %, 63 % and 7 of 8 respectively.

Our study of children, thus, gives *no* indications of any linking of a given type of physical build to a given type of prominence. We believe, however, that this by no means excludes the possibility that an affinity of this kind may be found to exist when larger groups and older persons with fixed physical type are studied (see below).

We have little to add to our remarks on the causation of prominence differences (II, 7). We should, however, like to draw attention to the possibility that a chronological difference in the formation of the bone centres in the carpus may be *partly* responsible for difference in prominence type in men and women. The available data, however, point only vaguely in this direction.

Another problem is that of prominence type in the light of evolution. We have already seen that the literature does not permit any conclusions as to the occurrence or non-occurrence of Rd. forms in the anthropoids. We ourselves were unable to obtain any suitable anthropoid specimens, still less anthropoid foetuses.

A study of the latter would offer possibilities of examining the problem of prominence from the point of view of L. BOLK's retardation and foetalization theory.

This assumes that the rate of development is retarded in man. This retarded development is believed to have the result that the foetal character of man remains more clearly preserved than that of the other primates. BOLK enumerated a number of characters in which this foetal character is indeed shown (see DE FROE, 1948, p. 306).

It is possible that other workers are in possession of sufficient pre- and postnatal data on anthropoids to (1) establish the occurrence or non-occurrence of Rd. forms and, if these forms are found (2) to ascertain to what extent their occurrence is connected with age.

It would, in our opinion, be well worth while to be able to add further characters to the list given by BOLK or — in the case of a 'negative' result — to study the problem of prominence from different points of view.

We should not omit to remark here that PORTMANN (1944) draws attention to the increasing frequency of leptosomia as a progressive type. In the foregoing we left open the possibility that a connection might exist between, e.g., leptosomia and prominence type. In view of BOLK's theory we might perhaps expect to find a low frequency of the Rd. type among leptosome individuals. It is our opinion that considerations of this kind are sufficient reason for including prominence in the morphological part of the anthropological investigation programme.

#### REFERENCES.

1. BAKER, F., Anthropological notes on the human hand. *American Anthropologist*, vol. I, 70 (1888).

2. CASANOVA, Mémoires. T. 6, p. 252, Bruxelles, 1871.
3. ECKER, A., Einige Bemerkungen über einen schwankenden Charakter in der Hand des Menschen. *Archiv f. Anthrop.*, Bnd. 8, 67—75 (1875).
4. FROE, A. DE, Inleiding tot de studie en de beoefening der anthropologie. Amsterdam, 1948.
5. HUIZINGA, J., Structural alterations indicated in the development of the human cranium. *Proc. Kon. Ned. Akad. v. Wetensch.*, Amsterdam, 51, 76—87 (1948).
6. ———, Cephalometrische verwantschap tusschen verwanten van den eersten graad. Amsterdam (1947).
7. JONES, F. WOOD, Principles of anatomy as seen in the hand, London (1944).
8. MANTEGAZZA, P., Della lunghezza relativa dell'indice e dell'anulare nella mano umana. *Arch. per l'Anthrop.*, p. 22 (1877).
9. MIERZECKI, H., Over de morphologie der hand. *Ciba-Tijdschrift*, 18, 573—574 (1946).
10. PFITZNER, W., Anthropologische Beziehungen der Hand- und Fuszmaasse. *Morphologische Arbeiten (Schwalbe)*, Bnd. II, 93—206 (1893).
11. PORTMANN, A., Biologische Fragmente zu einer Lehre vom Menschen. Basel (1944).
12. ROMICH, S., Fingerlängen bei verschiedenen Konstitutionstypen. *Anthrop. Anzeiger.*, IX, 264—267 (1932).
13. RUGGLES, G., Human Finger Types. *The Anat. Record*. Vol. 46, 199—204 (1930).
14. SCHAAFFHAUSEN, Einige Eigentümlichkeiten der Hand. *Corr. Blatt d. dtsh. Gesellsch. f. Anthrop., Ethnol., u. Urgesch.* XV Jhrg., p. 94 (1884).
15. SCHULTZ, A. H., Growthstudies on primates bearing upon man's evolution. *Am. J. of phys. Anthrop.*, vol. VII, 149—165 (1924).
16. STRATZ, C. H., *Der Körper des Kindes*, 1903.
17. WECHSLER, W., *Anthropologische Untersuchung der Handform mit einem familienkundlichen Beitrag*. Zürich, 1939.
18. WEISSENBERG, S., Ueber die Form der Hand und des Fusztes. *Zschr. f. Ethnol.*, 82—111 (1895).
19. WOLOTZKOI, M., Ueber die zwei Formen der menschlichen Hand, *J. Russe d'Anthrop.*, XIII, 3/4, p. 70—81, (German summary), 1924.