Dept. of Forensic-Anthropological Genetics, Karolinska Institutet. Stockholm (Sverige)
(Head: Dr. T. Romanus)

Palm Prints
The Patterns in the Interdigital Spaces

B. Brismar

Introduction

The papillary line pattern of the palm can be divided, with regard to its location, into different areas, e. g. thenar, hypothenar and interdigital areas. The patterns of the thenar and the hypothenar area have been examined, amongst others, by Eriksson & Norinder (1958). Wilder (1902, 1904, 1922, 1925, 1926) has in several works studied prints of palms and soles above all from a systematic point of view. Thus he has indicated four digital triradii situated at the bases of digitii II-V (see Fig. 1). A radiant from each triradius crosses the palm and gives the four main lines A-D which (mostly line D) rarely can meet a lower triradius t. Wilder also mentions that in the three of the main lines circumscribed palmar spaces (interdigital areas II-IV), patterns of two types can occur:

1. False patterns (loops) — mainly formed through recurving of main line C;
2. True patterns with one further triradius forming the pattern, except the digital triradius.

He also puts forward, in a work of 1922, that this division is possibly indicated in the interdigital area IV, while in the other interdigital areas it is completely satisfactory only to indicate possible occurrence of pattern.

Martin-Saller (1923-1962), like Wilder, try to sum up the palm prints in a formula where numbers and letters codify the appearance of the pattern. As regards the interdigital patterns, Martin-Saller agree considerably with Wilder's systematics as later also Cummins and Midlo (1961). However, these two authors have outdifferentiated Wilder's systematics and propose a division in accordance with: 1) whorls — small and of rare occurrence; 2) loops (which generally open in nearest interdigital space); 3) vestiges — conspicuous patterns or rather incomplete patterns; 4) openfield — completely undifferentiated patterns.

The above works show that the study of the papillary line patterns of the palm has mainly been undertaken from a systematic point of view; the pattern of the interdigital areas having, however, been treated very summarily. The author has therefore found it important, as in earlier works (Brismar, 1965), more thoroughly to analyse these patterns in order to try to clarify their possible heredity.

Methodology

The author has examined the papillary line patterns in interdigital areas III-IV and has found that, partly dependent on the extension of the radiant from digital tri-radius 3 (main line C), four different types of pattern can develop.
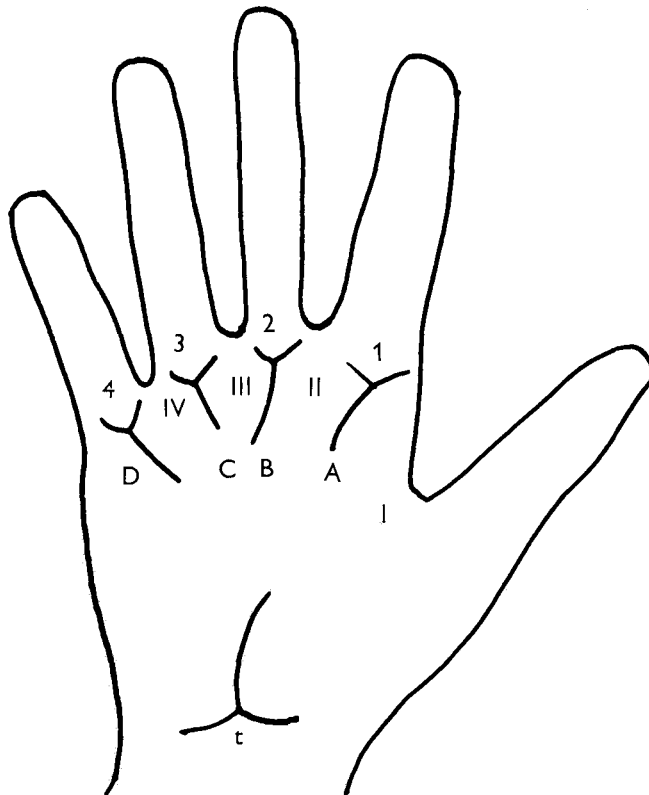

Fig. 1. 1-4 digital triradii, I-IV interdigital areas, A-D main lines

    1. Radial loop (R) situated on the radial side of line C which bends off radially (the pattern is situated in interdigital area III);
    2. Ulnar loop (U) situated on the ulnar side of line C which bends off ulnarly (the pattern is situated in interdigital area IV);
    3. Open-field pattern (O) which crosses line C which is short and extends in the longitudinal direction of the hand;
    4. Vestiges (V) — different forms of indications of patterns and " special " patterns.

This systematics differs from those earlier put forward in the fact that the patterns of interdigital areas III and IV are not considered as separate units but as integrating parts of one single pattern complex based on the structure of triradius 3 and the extension of line C.

Material

The material which consists of palm prints from 287 women, 287 children and 439 men (2,026 prints in all) has been collected in connection with paternity investigations at the Government Institute for Forensic Medicine, Stockholm. Parallel with the paternity investigation, also a maternity investigation is carried out on routine. For investigation at the Institute only such cases come where the blood analyses have not given any clue in the question of paternity — this should however not influence the material from a dactyloscopic point of view but the material should be considered to represent a normal Swedish population.

Frequency determination

Tab. 1 shows that a limited number of palm prints have not been possible to analyse. This is above all due to defects in the reception of the prints and in some case to a hurt or amputated hand. The low number — totally 25 prints corresponding to 1.2% of the material — should not influence the continued study of the same.

Tab. 1 also shows a not inconsiderable difference of frequency for the occurrence

Tab. 1

		U	O	R	V	Total	Not analysed
				Right			
♂	n	108	169	125	25	427	12
	%	25.3	39.5	29.3	5.9	100.0	
♀	n	78	101	90	16	285	2
	%	27.4	35.4	31.6	5.6	100.0	
Children	n	87	108	80	12	287	—
	%	30.3	37.6	27.9	4.2	100.0	
Total	n	273	378	295	53	999	14
	%	27.3	37.9	29.5	5.3	100.0	
				Left			
♂	n	141	232	35	24	432	7
	%	32.6	53.7	8.1	5.6	100.0	
♀	n	98	148	26	12	284	3
	%	34.5	52.1	9.2	4.2	100.0	
Children	n	100	142	32	12	286	1
	%	35.0	49.6	11.2	4.2	100.0	
Total	n	339	522	93	48	1002	11
	%	33.8	52.1	9.3	4.8	100.0	

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of patterns in the two hands (see Tab. 2). While O-pattern and U-pattern show 14.3 and respectively 6.5% higher frequency in the left hand, R-pattern show a 20.2% higher frequency in the right hand. The difference in frequency is significant

Tab. 2

	Right	Left	Difference %
U	27.3	33.8	— 6.5 ± 2.05
O	37.8	52.1	— 14.3 ± 2,21
R	29.5	9.3	+ 20.2 ± 1.71
V	5.3	4.8	+ 0.5 ± 0.98
Total	100.0	100.0	

for both U, O and R-patterns. This difference in pattern distribution between the two hands is remarkable, and the basis for it is being examined at the Institute.

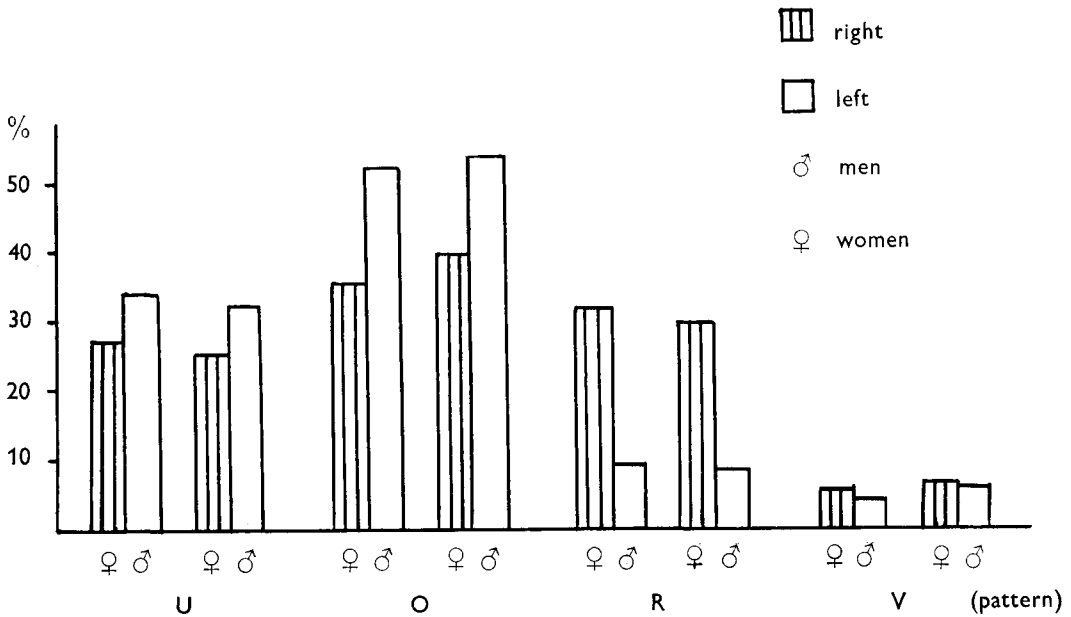There is no significant difference between the two sexes in the distribution of patterns (see Fig. 2).

Fig. 2

Calculations of correlations

Calculations of correlations have been carried out on the mother/child material consisting of 287 women and 287 children (see Tab. 3). The calculations which were carried out in tetrachoric tables gave the following results:

Right hand:	*Left hand:*
U/R χ^2 = 16.03 (r = 0.39 ± 0.08)	U/R χ^2 = 12.57 (r = 0.43 ± 0.10)
U/O χ^2 = 4.57 (r = 0.18 ± 0.06)	U/O χ^2 = 8.12 (r = 0.19 ± 0.04)
R/O χ^2 = 5.20 (r = 0.19 ± 0.05)	R/O χ^2 = 13.03 (r = 0.33 ± 0.08)

Thus it appears from the correlation analyses that, with regard to U-pattern contrasted with R-pattern, there is a strong mother/child correlation on the 99.9% level for both right and left hand. The fact that there is no stronger correlation for U-

Tab. 3

Right hand					Left hand				
Children	Mother				Children	Mother			
	U	O	R	V		U	O	R	V
U	35	31	12	1	U	45	42	6	5
O	24	45	26	5	O	41	86	15	6
R	20	29	37	5	R	8	8	9	0
V	7	3	4	1	V	6	5	1	1

pattern set against O-pattern respectively for R-pattern set against O-pattern is in agreement with what could be expected with regard to the fact that O-pattern could actually be seen as a transition pattern between the U-pattern and the R-pattern.

Summary

1. The author has worked out a new systematics for the interdigital patterns of the palm based on the building up of digital triradius 3 and the extension of main line C with the following types of pattern as result: U (ulnar loops), R (radial loops), O (open-field pattern) and V (vestiges — incomplete patterns or " special " patterns).

2. A significant difference in frequency for the pattern distribution between the two hands has been found for U, R as well as for O-patterns (U-patterns and O-patterns appear with 6.5 respectively 14.3% higher frequency on the left hand, while R-patterns appear with 20.2% higher frequency on the right hand.).

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3. The pattern distribution does not show any difference between the two sexes.

4. Calculations of correlations in tetrachoric tables have shown a strong mother-child correlation on the 99.9% level for U-pattern set against R-pattern for both the right and the left hand (r = 0.39-0.43).

Literature

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RIASSUNTO

1. L'autore ha elaborato un nuovo sistema per lo studio della configurazione delle aree inter-digitali del palmo, basato sulla costruzione del terzo triradio e sulla estensione della linea principale C, ottenendo come risultato i seguenti tipi: U (curve ulnari), R (curve radiali), O (configurazione a campo aperto) e V (vestigia-disegni incompleti o « speciali »).

2. È stata trovata una differenza significativa nella frequenza di distribuzione dei disegni tra le due mani per quanto riguarda sia i tipi U e R che quello O. (I tipi U e O si presentano nella mano sinistra con una frequenza maggiore di 6,5% e di 14,3% rispettivamente, mentre i tipi R si presentano con una frequenza maggiore di 20,2% nella mano destra).

3. La distribuzione di tali tipi non dimostra differenza alcuna tra i due sessi.

4. Il calcolo delle correlazioni mediante tavole tetracoriche ha dimostrato una forte correlazione madre-figlio a livello del 99,9% per il tipo U nei confronti del tipo R sia per la destra che per la sinistra (r = 0,39-0,43).

RÉSUMÉ

1. L'auteur a préparé un nouveau système concernant les traits interdigitaux des paumes, basé sur la construction du triradius 3 et l'extension de la ligne principale C avec les suivants types de traits comme résultats: U (boucles ulnaires), R (boucles radiales), O (« open-field ») et V (vestiges-traits incomplets ou traits « spéciaux »).

2. Une différence de fréquence significative concernant la distribution des traits entre les deux mains a été trouvée pour les traits U, R et O. (Les traits U et O se présentent avec une fréquence plus élevée respectivement de 6,5% et 14,3% sur la main gauche, tandis que les traits R se présentent avec une différence plus élevée de 20,2% sur la main droite).

3. La distribution des traits ne montre aucune différence entre les deux sexes.

4. Des calculs de corrélation en tables tétra-choriques ont montré une corrélation élevée entre mère et enfant sur le niveau de 99,9% concernant les traits U contre les traits R des deux mains (r = 0,39-0,43).

ZUSAMMENFASSUNG

1. Der Verfasser hat eine neue Systematik, was betrifft die Interdigitalmuster der Hand-fläche, herausarbeitet, auf die Bildung der Triradius 3 und der Lauf der Hauptlinie C ge-gründet, mit den folgenden Mustertypen als Resultat: U (Ulnare Schlingen), R (Radiale Schlin-gen), O « Open-field » Muster) und V (Vestiges-unvollständige Muster oder « Specialmuster »).

2. Ein bedeutender Frequenzunterschied für die Musterverteilung zwischen die beiden Händer ist sowie für U-, R- und O-Muster vorhanden. (U- und O-Muster kommen mit 6,5 respektive 14,3% höhere Frequenz auf der linke Hand vor, weil R-Muster kommen mit 20,2% höhere Frequenz auf der rechte Hand vor).

3. Die Musterverteilung zeigt kein Unterschied zwischen den Geschlechtern.

4. Korrelationsberechnungen in tetrachorischen Tabellen haben eine starke Mutter-Kind Kor-relation auf dem 99,9% Niveau für U-Muster vs. R-Muster sowie für die rechte als die linke Hand (r=0,39-0,43).