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Role of Latent Palm Prints Present on Documents in Establishment of Individuality

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ABSTRACT

Aim: The purpose of this study was to identify role of latent palm prints present on hieroglyphics substances in the establishment of individuality.

Methodology: In this study, 80 samples including male and female were studied from Northern part of India. Identity was established by using four parameters and 12 sub-parameters. All samples were intensified by using appropriate battery of powders/chemicals.

Result: During the observation of parameters, it was observed that variation occurs and provides the correlation between the initials of an individual from line of writing.

Discussion: All samples were analyzed at statistical level at 90% of confidence level. During this study, it was observed that out of 12 sub-parameters, 8 were highly significant and only 4 sub-parameters were demonstratingthe level of variation.

Conclusion: This method can detect the forgery for the fixation the identity of individual. This method can be useful to individualize the person in forgery, smudged prints, anonymous letter and can be put on the par of other evidences.

Key Words: Identification, Questioned documents, Evidence, Latent prints, Individuality, etc.

INTRODUCTION

Personal authentication is the key of security and reliability in society. Reliability of personal identification depends on various sources of evidences recovered from the crime scene. It has been observed that Palm prints, fingerprints are equally valuable evidence. Evidential value of palm print is clear as about 30 percent of the latent recovered from crime scenes are from palms which play a vital role in the identification of an individual[1][2]. The ridges are studded with sweat pores which secrete the sweat. However, it must remember that while writing or preparing works of art, one cannot help touching or holding the surface or part of the hand resting on the writing surface to support and facilitate the movement of hand. Since Palm has raised lines and furrows having sweat pores which keeps ridges moist, and as it touches the surface, it is expected to leave their impressionon writing surface[3][4]. Especially when we sign, Hypothenar area of the palm comes in the contact of the surface. Since sweat is apparently colorless fluid, so the prints left behind are not visible to the naked eye; the visibility of the prints are enhanced by various methods.

This inherent relation of signatures with the lateral palm prints lead the identity & increase the reliability of questioned documents examination[5]. By studying the intensified palm prints and obtained 12 parameters from fresh and old samples[6], it was observed that the identification of subject is possible. Although the natural variation occurs, butparameters were capable to provide the authenticity of an individual[7]. In handwriting examination, when a person try to disguise his handwriting, then the class characteristics are examined, whether For the dilatation of authorship in handwriting, numerous standard signatures are required [8] [9].

Along with the characteristics of forgery, the culprit will also leave their latent palm prints on the document. During the development process numerous prints will be visualize[10][11]. If the author is genuine, then prints are encountered below

the signature.If latent prints are not on paper, it may be cause of disease, weather, atmospheric, age or wearing gloves in hands. It's very rare that latent palm print does not occur on documents and very hard to believe[12]. During examination if such conditions are faced, the identity will be established by these parameters. Some variation in the writing will be observed, which is the indication of genuineness.

METHODOLOGY

Whenan individual write's or put their hand over the paper to support it, palm prints in latent form willtransfer below to the signature on it. All subjects were requested to write/ put their signature over paper after a time interval to examine; that an individual put their signature/ or write in analogous way or not? and identification is possible from the intensified palm prints or not?

Samples collection
In this study, 80 samples including male and female from age group of 15 -55 years were studied. All samples were collected from loacal Jaat's resident of western UP. All samples were selected randomly. Sample collection procedure took place in two phases named fresh and old samples. Old samples were collected in October 2012 while fresh samples were collected in March 2013. All samples werecollected on the white paper sheet written by blue ball pen.

Methods
The selection criteria of all individuals were random, and consent was taken. The details about an individual such as Age, sex, Address, occupation and educational qualification were noticed. Subjects were asked to sit on chair at easeand to put the paper on a table which was upto the height of elbow.Then individuals were requested to put their signatures on the sheet at calm and congenial atmosphere.

After samples collection, samples were preserved in white paper envelope to prevent paper from dust, atmospheric ingredients and other effects at room temperature. All fresh samples were treated by black powder while old samples were treated by ninhydrin method. Intensified palm prints by black powder are given below in figure no-1 & 2-

The intensified palm prints by ninhydrin are given below in figure no.-3 & 4-

STATISTICAL ANALYSIS

Identification of an individual was based on the obtained aggregate information of latent palm prints. Firstly, we allocated three centers of curvatures in intensified palm prints which were correlated with line of writing, where signatures were put on[13][14]. To allocate the center of curvature, firstly, two tangential lines were drawn, where lines intersects each other from that point a corresponding line is also drown. Now from the corresponding line up to the deepest point A, it will be radius of centre of curvatures A. Thus, all three centers (A, B, C) and radius of respective centers were allocated. Now a straight line along with signatures was drawn, which will correlate palm prints with signatures. For all the of three centers A, B, C and their radius, r_a, r_b, r_c, were measured, angle of the centre of curvature from line of writing θ_a, θ_b, and θ_c were taken. Inter-distance of three centers AB, BC, CA was measured, normal distance from line of writing of centers of curvatures la, lb, lc was determined. The correlation of these pointswith respect of writing's line is cumulative and measurable. It's also considered that all the obtainedparameters were enough for identification of an individual[15].

For this study, paired students t- test and SPSS were used. A hypothesis was established that; H_0 will be rejected in favor of H_a.

RESULT

During the observation of parameters, it was seen that variation in angle of center of curvature from line of writing Θ_a, Θ_b, $\&\Theta_c$is up to ($\pm5^0$) in comparison of both samples which is due to natural variation. Angle of center of curvature from line of writings, is noticed higher in male than female,If author is left handed then the angle Θ_a, Θ_b, $\&\Theta_c$ of center of curvature will be more than right handed[16][17]. Details of sample no.-1 is given below in table no.-1.

When mean values both samples of subject no. 1 were taken, it was seen that obtained mean values of radius of Curvature (r_a, r_b, r_c) gives significance of natural variationwhich is in parameters up to (±0.3cm.). In normal distance of center of curvature from line of writing (l_a, l_b, l_c), l_a is always smaller than l_b, l_c, and in comparison of female, obtained distances were higher in male. Variation was noted to the limit (±0.2cm). In parameter of inter distance between centre of curvatures AB, BC & CA, distance between the centers B & C are relatively smaller than AB, CA. Inter-distance may vary, it depends on health of subjects. These variations were observed up to limit of (±0.2cm). Same observations were noted in other subject no. 23's samples also. Error in measured distance is within the limits of (±0.2cm), which can be attributed to instrumental error/constant error and are due to natural variation[18].

During examination of remaining samples, such similarities were observed. As, it can be seen in table no.-2 given below for sample no. 23

Statistical data for all fresh samples is given below in table no.-3, while statistical analysis of old samples were given below in table no. 4.

All samples were analyzed at statistical level at 90% of confidence level. During this study, it was observed that out of 12 sub-parameters,8 were highly significant and only 4 sub-parameters were demonstrating the level of variation. Significance level table no.-5 is given below-

DISCUSSION

Observation of parameter one, all values; p-values for sub-parameters (r_a, r_b, r_c, **0.08, 0.02, 0.001 <p <0.10**) represent that it will remain same and don't change on different type of implementation of hand over any surface. While at second parameter, all values were not significant at **p <0.10.** it may be a cause of special attention during the preparation of letters, distance between writing surface, age, health issues to individual etc. Third parameter represents the significant values at 90% of confidence level. The obtained values of Θ_a, Θ_b, Θ_c (0.09, 0.07 & 0.001 <**p <0.10**) were highly significant and demonstrate that a person cannot change the way how do they put their hand over paper during preparation of work of art. The fourth parameter, is significant at two sub-parameters (**p<0.10**) while at one point, it represents the variation. Obtained values at sub-parameter AB (0.43 > p <0.10) is not significant while at two sub-parameters (BC & CA) are 0.10 0.06 <**p< 0.10** are highly significant.

Based on all the above observation, it was concluded that since human cannot work similar and represent the symbol of natural variation.

CONCLUSION

In this study, it was observed that when an individual writes something, along with handwriting characteristics; lower part of palmar surface comes in the contact. It's very rare that latent palm print doesn't occur on documents and very hard to believe that when we write, a part of palm do not rest on paper. Since, ridges have sweat glands which perspiration sweat, and latent prints are left behind which require a careful intensification by using the appropriate method. Sometime, the smudged prints are also recovered, and identity left questionable? But from this method, the parameters and sub-parameters were capable to identify the author. Even this method can detect forgery for the fixation the identity of individual. In a very few cases it was observed that latent prints were not on the paper that may be a cause of disease, weather, atmospheric, age or wearing gloves in hands. This method can be useful to individualize the person in forgery, smudged prints, anonymous letter and can be put on the par of other evidences. This will help to nab the suspect or minimize the number of suspects during an investigation.

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Table 1: Observation table of intensified palm print on document for sample no. 1.

Subject S.no.	Radius of Curvature(Cm.)				Normal distance of curvature from Line of Writing (cm.)		Angle of centre of curvature from line of writing			Inter-distance ofcentre of curvature (cm.)		
	r_a		$r_b r_c$		la	lblc	θ_a	θ_b	θ_c	AB	BC	A
	1.4	1.9	1.6	4.7	8.7	8.3	73	75	81	3.7	1.6	3.5
Sample No.1	1.2	2.0	1.5	4.7	8.5	8.0	70	73	80	3.8	1.4	3.3
Mean	1.3	1.95	1.55	4.7	8.6	8.15	71.5	74	80.5	3.75	1.5	3.4
Appro.	1.3	1.9	1.6	4.7	8.6	8.2	72	74	82	3.8	1.5	3.4

Table 2: Observation table of intensified palm print on document for sample no. 23.

Subject	Radius of Curvature(Cm.)			Normal distance of curvature from Line of Writing (cm.)			Angle of centre of curvature from line of writing			Inter-distance of centre of curvature (cm.)		
		$r_a r_b r_c$			la	lblc	θ_a	θ_b	θ_c	AB	BC	CA
Sample no.	2.1	3.2	2.4	3.0	7.2	7.5	50	55	68	5.0	1.6	4.6
23	2.1	3.3	2.4	3.1	7.2	7.5	55	59	68	5.1	1.8	4.6
Mean	2.1	3.25	2.4	3.05	7.2	7.5	52.5	57	68	5.05	1.7	4.6
Approx. Mean	2.1	3.2	2.4	3.1	7.2	7.5	53	57	68	5.0	1.7	4.6

## Table 3: Statistical an analysis of intensified fresh samples.

Subjects S.no.	Radius of Curvature(Cm.)			Normal distance of curvature from Line of Writing (cm.)			Angle of centre of curvature from line of writing			Inter-distance ofcentre of curvature (cm.)		
	$r_a r_b r_c$			la	lblc		θ_a	θ_b	θ_c	AB	BC	CA
Mean	1.8	3.0	1.8	5.5	9.9	9.7	70.5	72.5	81.5	4.7	1.8	4.2
Variance	0.15	0.17	0.07	1.10	2.36	1.41	111.99	91.24	89.59	0.24	0.30	0.27
Standard Dev.	0.39	0.41	0.27	1.05	1.53	1.91	10.5	9.55	9.46	0.49	0.55	0.52
Standard Error	0.06	0.13	0.04	0.16	0.24	0.19	1.69	1.52	1.51	0.07	0.08	0.08
Coefficient of var.	0.22	0.13	0.15	0.18	0.15	0.12	0.15	0.13	0.11	0.10	0.29	0.12

**Table 4: Statistical analysis intensified of old samples.**

Subjects	Radius of Curvature(Cm.)			Normal distance of curvature from Line of Writing (cm.)			Angle of centre of curvature from line of writing			Inter-distance ofcentre of curvature (cm.)		
S.no.	$r_a r_b r_c$			la	lblc		θ_a	θ_b	θ_c	AB	BC	CA
Mean	1.8	3.0	1.9	5.6	10	9.7	73.5	76	83	4.8	2	4.3
Variance	0.11	0.19	0.06	1.07	2.21	1.49	94	89	88.7	0.25	0.29	0.29
Standard Dev.	0.34	0.44	0.26	1.03	1.48	1.22	9.69	0.47	9.41	0.50	0.54	0.50
Standard Error	0.05	0.07	0.04	0.16	0.23	0.19	1.55	1.51	1.50	0.08	0.08	0.08
Coefficient of var.	0.18	0.14	0.13	0.18	0.14	0.12	0.13	0.12	0.11	0.10	0.26	0.12

Table 5: Significance level of the palm prints at p<0.10.

Subjects	Radius of Curvature(Cm.)			Normal distance of curvature from Line of Writing (cm.)			Angle of centre of curvature from line of writing			Inter-distance ofcentre of curvature (cm.)		
S.no.	$r_a r_b r_c$			la	lblc		θ_a	θ_b	θ_c	AB	BC	CA
P -Value	-1.39	-0.46	-2.24	-0.25	-0.12	-0.28	-1.29	-1.48	-1.00	-0.17	-1.26	-0.64
T- Value	0.08	.02	0.013	.40	0.45	0.38	.09	0.07	0.015	.43	.10	.06
Significance	Y	Y	Y	N	N	N	Y	Y	Y	N	Y	Y
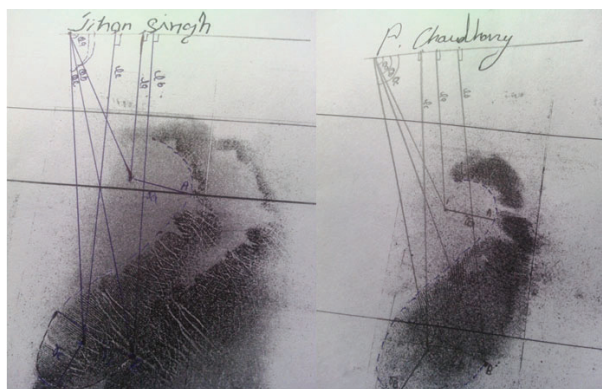
Figures 1 & 2: Intensified palm prints present on documents by black powder.
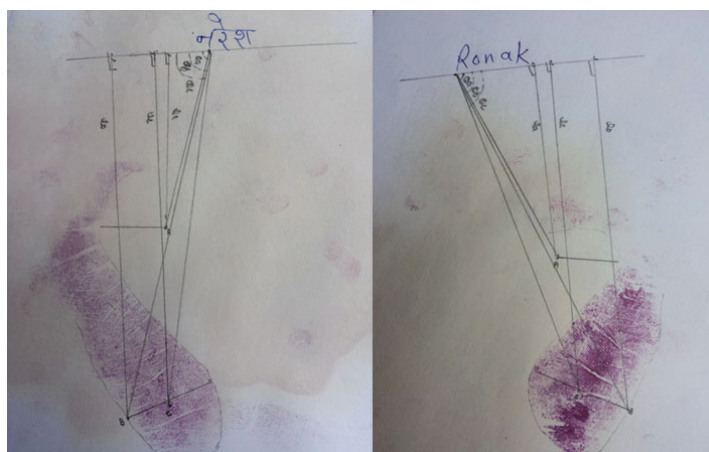
Figures 3 & 4: Intensified palm prints present on documents by ninhydrin.