

Comparison of Similarities and Dissimilarities Related with Handwriting Examination among Individual

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Abstract – Among all the characteristic of an individual, handwriting conveys the richest information to pick up the experiences into the physical, mental and emotional condition of the writer. Handwriting is a procured workmanship like painting, dancing or cycling. The beginning periods that go with the learning and rehearsing of writing are described by a cognizant exertion with respect to a learner to recreate standard letter formation. He takes a psychological impression of the muscles of his hand of writing. Because of rehashed utilization of letters, the real formation of every letter and words turns out to be practically automatic. The handwriting is a coordination procedure where, brain is the fundamental component which is manages to execute the topic through handwriting. The muscles additionally assume a significant job in execution of handwriting. The similarities between a gathering of individuals or people showed the equivalent or comparative writing examples or frameworks are known as class characteristics. Class characteristics help to limit the hunt when a questioned writing is contrasted and a few distinct writers. The point of this examination is to break down the class characteristics of handwriting dependent on emotions. The examination was directed on 50 understudies who matured between 18 to 23 years of age. The subjects were incited into three unique conditions of emotions by appearing of a specific feeling and this was confirmed utilizing a psychological scale (EVEA scale). Three models under every feeling were gathered and were examined utilizing hand magnifier, magnoscope and stereoscopic-magnifying instrument. Chi-square test esteems were determined, and it was seen that emotions have less roles on handwriting characteristics.

Keywords: Questioned Documents, Handwriting Analysis, Class Characteristics; Graphology; Emotions, Similarities, Dissimilarities

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1. INTRODUCTION

In criminological field, for distinguishing proof reason; a developed handwriting is useful which gives individualistic characteristics and formation of letters. In its limited structure, handwriting is considered as a composed discourse, each demonstration of it winds up inspired with characteristics impossible to miss of a person. This build up a recognize style, standard stage in writing which might be pretty much shifted every once in a while, either by unintentional causes, for example, scurry lack of regard, position of writing, disease or shortcoming. There is a fleeting period of development between the teenaged and grown-ups handwriting in light of the fact that the young person's handwriting (Formation of letters) is tremendously affected by teacher's handwriting, while the grown-ups make their own formation or standard formation of letters.

Today a noteworthy issue of society is to spare the community from crimes done by fraudsters. In the

changing situation of crime, the criminals are doing sorted out crime accordingly; they may harm, oppress, exploit, abuse society and cost major monetary misfortune. In perspective on these actualities the role of forensic researcher turns into a significant in helping criminal equity framework. The essential point of forensic researcher is to get as much as logical data accessible specifically show of criminal case as proof to clarify the logical interpretation of actuality identified with the crime. When they do this the forensic researcher, during the deposition in the official courtrooms will be agreeable in outfitting verification of proof to the court when different inquiries with respect to the examination and assessment will be inquired. Handwriting analysis is exploration of comparison of questioned with the provided principles. During the procedure of comparison, every one of the standards of handwriting science is connected for distinguishing proof of handwriting characteristics so as to discover the critical trademark includes so as to fix the initiation. After articulation of any

supposition related with criminal case, the achievement of Forensic Document examiners is incredibly needy upon the court manner. Because of uniqueness in nature of examination in the field of questioned document, proof delivered by a specialist during court declaration is significant. The present paper is a definite contextual investigation of one of the significant cases.



Figure 1: Handwriting Examination

Handwriting likewise named as brain-writing is a helpful measure in recognizing the trademark personality traits of a person. Handwriting investigators otherwise called graphologists can examine a person's handwriting to foresee the personality traits of the writer. Computerized handwriting analysis can be utilized to examine individual traits of competitors during meetings precisely as the exactness of an examiner exceptionally relies upon his range of abilities. Likewise procuring a graphologist to break down many samples for recruitment reason will be tedious and not be achievable economically.

Handwriting is remarkable personality of an individual, albeit a few characteristics might be gained when they figure out how to write by copying letters and expressions of teachers, yet as per the time of writer the handwriting tends and demonstrates extra changes which is considered developing stage. It's extremely difficult to decide the sex and time of individual from writing analysis. In the event that any debates discovered, at that point the estimation of development can be making a difference. Based on forensic examination, specialists can limit the quantities of suspects by disposing of others.

Hardly any characteristics of handwriting are Line quality, Alignment, Size, Spacing, Connecting strokes, Pen lifts, Pen pressure and Slant. Class characteristics may distinguish an animal category, however not a person. The instances of questioned documents may incorporate marks on wills, handwritten anonymous letters, figures and writing on checks, understandings and contracts. Each questioned handwriting case is one of a kind and is assessed with an end goal to achieve a satisfactory conclusion.

Since the initiation of forensic science and its application in criminal examination one key branch

concocted its surprising goal of deciphering the creation of handwriting just as the authenticity of documents. Accurately, the requesting of logical standards and strategies for the goals of issues identified with contested documents are secured under the part of questioned document examination. It might be seen by a layman about the reluctance in regards to the significance of handwriting and its conspicuousness however handwriting is a projective system like peculiarities which may typify human conduct in the breadths of social abilities, intellectual etiquettes, operational behaviours and potential behaviors of managing assumptions. Handwriting characteristics and formations of letters are for the most part impacted by the writing framework which the writer has obtained in the proper way of learning process. Handwriting isn't a natural element; be that as it may, person's capacity or privation of coordination might be a piece of such component. As needs be, the important writing grasps plentiful segments of automatic example, trademark example, and development of muscles which are the piece of specific individual as close to home propensity as the brain is key component which controls the muscles to execute handwriting. As per Kelly, similarities in handwriting highlights delivered by relatives do on occasion exist when a writer replicates the characteristics of various friends and relatives or even a known associate. Handwriting isn't a reaction procedure coordinated by remote condition factors. Since the neural and neuromuscular transmission intervals, handwriting would be too much intentional in the event that it depends on continuous reaction.

By and large, it has been seen that a writer has an inclination of testing and building up claim handwriting characteristics and as the writer keeps on writing liberally, in this procedure the writer would obtain similarity with either copybook model or some perceived model. Handwriting could be a cognizant demonstration however, because of rehearsed use, the real formation of each letter and word turns out to be practically automatic, so the writer thinks a large portion of the sentient idea on the topic as opposed to on the writing procedure itself. Fairly, the brain goes about as a planning grouping of intuitive strokes ahead in time in a feed-forward way. Thusly, handwriting ends up subliminal constant patterns which are as much a piece of the person as any of other characteristic individual propensities or idiosyncrasies. Handwriting is affected by a perceptual portrayal of copybook structure, adjusted by individual perception what's more, the writer's bent to imitate it. It has a physiological just as a psychological relationship in the brain that is to state that it is a cognizant demonstration however on the other hand in light of its tedious practice the detectable formation of every letter and words become practically instinctual. This singularity of handwriting makes it a type of physical proof and for the recognizable proof of handwriting there are some essential standards. The handwriting that is

normal for an individual is the result of various impacting factors, every one of which adds to the last structure, styles and characteristics of the writer. In numerous nations' signatures, extensively handwriting, are representative in nature and are not made out of person letterforms, but instead representative structures or ideograms. The accentuation is upon the possibility that when a writer is made familiar with certain model of letters which are reliable through his/her procedure of learning; the writer would execute the scholarly letters in a particular way. It must be valued that each learning procedure of letter formation is extraordinary or marginally unique in relation to the copybook model because of which writer not just secures the new way of letter formation yet in addition hold and move to different writers. One of the said reasons is different demographic distribution of writers, i.e., the area or nation to which they have a place. In fact, each nation has its very own system of education which encourages the moving of gained highlights of handwriting as tuition.

2. LITERATURE REVIEW

Kedar, Seema & Bormane, D & Dhadwal, Aaditi & Alone, Shiwali & Agarwal, Rashi. (2015) - Handwriting analysis is the procedure used to comprehend an individual in a superior manner through his/her handwriting. By inspecting the handwriting, we can build up a sketch which mirrors the writer's emotional outlays, fears, honesty, mental state and numerous other personality traits. Emotions incorporate the interpretation, perception and reaction of the sentiments identified with the experience of a specific circumstance. They are the ones which extension contemplations, sentiments and activities. The principle goal of this paper is to dissect the handwriting characteristics like Baseline, Slant, Pen-Pressure, Size, Margin and Zone to decide the feeling dimensions of an individual. This will help distinguishing those individuals who are emotionally irritated or discouraged and need psychological assistance to defeat such negative emotions.

Farhana Rizvi (2017) – Handwriting analysis can be mean of writer's personality expectation. It will mirror the human personality, through the hello tech handwriting analyzer. Handwriting analysis can be performed by various classifications for instance age, sexual orientation, social status, such order encourages us to concentrate on certain classifications. Classification Which will be conceivable based on certain highlights alongside human measurements (physical, Mental, Emotional) and attempting to discover the personality traits by utilizing the various highlights of handwriting. These highlights are characterized in the parameters structure, with figurings and a few geometric equations to fill the presentation of various highlights. These various highlights are removed in all respects cautiously after it classifies. Classifications rely upon

highlight mining and enhancements of the framework rely on highlights. These elements to play out the classification of handwritings in regards to age, sexual orientation and social status. Such highlights are utilized to recognize the personality of the writer. Personality forecast through client characterize Handwriting Analyzer well-ordered analysis. This Handwriting Analyzer will be structured by a practical situation.

Hemlata & Sachan, Manoj & Singh, Shailendra. (2018) - Handwriting is one of the one of a unique characteristic to speak to what is in our minds, to speak with others. Handwriting demonstrates the genuine personality including conduct, emotional cost, confidence, outrage, creative mind, honesty, fears, resistances and numerous other personality traits. It is normally known as Graphology. Graphology is the logical technique for perceiving, surveying and to comprehend writer's personality through the shapes and word patterns in the handwriting. Personality can be distinguished through different handwriting highlights, for example, zone, pattern, incline, measure, dispersing, edge, weight and so forth. Handwriting analysis has wide application in the different fields such brain research, medicinal conclusion, enlistment of staff, profession guiding, writer distinguishing proof, forensics contemplates and so forth. This paper gives a blueprint of handwriting analysis, highlights of handwriting, its related personality traits, review of the handwriting analysis framework (HAS) and a writing study of the current papers on handwriting analysis.

3. RESEARCH METHODOLOGY

The examination was directed in Bangalore City having a place with Karnataka of South Indian district. The strategy used to gather data was helpful sampling technique. Handwriting samples were gathered from 50 people of age group 18-23 years. The assent of the people was taken. The people were made to seat comfortably and brief guidelines were given. Diverse video clips dependent on three unique emotions (Happy, sad and aggressive) were appeared three changed days. Following viewing the video clip the subjects were given with EVEA psychological scale to check the condition of feeling at that moment. Quickly the subjects were furnished with three sample sheets. A control section was directed to the subject with the goal that the subject writes in his or her own handwriting just as so as to keep up the standard convention that is pursued while gathering models. The handwriting sample of the subject was gathered on the second and third sheet in a similar way. Subject whose EVEA score was critical for a specific feeling was just chosen. The samples were investigated physically utilizing various instruments, for example, a hand magnifier, magno-scope, stereo microscope and scales to check the level of similarities and dissimilarities in handwriting

characteristics between various emotions (happy sad, happy– aggressive and sad–aggressive).

4. DATA ANALYSIS AND RESULT

Chi Square test

$$\Sigma_{44} = \frac{50 \times 124}{150} = 41.3 \quad \Sigma_2 = \frac{50 \times 10}{150} = 3.3 \quad \Sigma_4 = \frac{50 \times 16}{150} = 5.3$$

$$\Sigma_{38} = \frac{50 \times 124}{150} = 41.3 \quad \Sigma_5 = \frac{50 \times 10}{150} = 3.3 \quad \Sigma_7 = \frac{50 \times 10}{150} = 5.3$$

$$\Sigma_{42} = \frac{50 \times 124}{150} = 41.3 \quad \Sigma_3 = \frac{50 \times 10}{150} = 3.3 \quad \Sigma_6 = \frac{50 \times 10}{150} = 3.3$$

DF (5%) = 9.488

Table 1 Chi square test for Line quality

Emotion	Smooth	Shaky	Juvenile	Row Total
Happy	44	2	4	50
Sad	38	5	7	50
Aggressive	42	3	5	50
Column total	124	10	16	150

O	E	O-E	(O-E) ² /E
44	41.3	2.7	0.17
2	3.3	-1.3	0.51
4	5.3	-1.3	0.31
38	41.3	-3.3	0.26
5	3.3	1.7	0.87
7	5.3	1.7	0.54
42	41.3	0.7	0.01
3	3.3	-0.3	0.02
5	5.3	-0.3	0.01
			X ² = 2.7

The chi square for the line quality is 2.7 (Table 1). what's more, the DF (Degree of opportunity) value is 9.4888. The DF value is more than the X² value which means there are no adjustments in the line quality character of hand writing.

$$\Sigma_{24} = \frac{50 \times 72}{150} = 24 \quad \Sigma_9 = \frac{50 \times 27}{150} = 9 \quad \Sigma_9 = \frac{50 \times 14}{150} = 4.6$$

$$\Sigma_{23} = \frac{50 \times 72}{150} = 24 \quad \Sigma_{11} = \frac{50 \times 27}{150} = 9 \quad \Sigma_5 = \frac{50 \times 14}{150} = 4.6$$

$$\Sigma_{25} = \frac{50 \times 72}{150} = 24 \quad \Sigma_7 = \frac{50 \times 27}{150} = 9 \quad \Sigma_0 = \frac{50 \times 14}{150} = 4.6$$

$$\Sigma_8 = \frac{50 \times 26}{150} = 12 \quad \Sigma_0 = \frac{50 \times 1}{150} = 0.33 \quad \Sigma_0 = \frac{50 \times 0}{150} = 0$$

$$\Sigma_8 = \frac{50 \times 26}{150} = 12 \quad \Sigma_1 = \frac{50 \times 1}{150} = 0.33 \quad \Sigma_0 = \frac{50 \times 0}{150} = 0$$

$$\Sigma_8 = \frac{50 \times 26}{150} = 12 \quad \Sigma_0 = \frac{50 \times 1}{150} = 0.33 \quad \Sigma_0 = \frac{50 \times 0}{150} = 0$$

DF (5%) = 18.31

The chi square for the line quality is 16.44 (Table 2). furthermore, the DF (Degree of opportunity) value is 18.31. The DF value is more than the X² value which

means there are no adjustments in the Alignment character of hand writing (Table 3).

$$\Sigma_{28} = \frac{50 \times 84}{150} = 28 \quad \Sigma_{12} = \frac{50 \times 37}{150} = 12.3 \quad \Sigma_{10} = \frac{50 \times 29}{150} = 9.6$$

$$\Sigma_{28} = \frac{50 \times 84}{150} = 28 \quad \Sigma_{14} = \frac{50 \times 37}{150} = 12.3 \quad \Sigma_8 = \frac{50 \times 29}{150} = 9.6$$

$$\Sigma_{28} = \frac{50 \times 84}{150} = 28 \quad \Sigma_{11} = \frac{50 \times 37}{150} = 12.3 \quad \Sigma_{11} = \frac{50 \times 29}{150} = 9.6$$

$$\Sigma_5 = \frac{50 \times 17}{150} = 5.6 \quad \Sigma_{10} = \frac{50 \times 27}{150} = 8 \quad \Sigma_{35} = \frac{50 \times 109}{150} = 36.3$$

$$\Sigma_6 = \frac{50 \times 17}{150} = 5.6 \quad \Sigma_8 = \frac{50 \times 27}{150} = 8 \quad \Sigma_{36} = \frac{50 \times 109}{150} = 36.3$$

$$\Sigma_6 = \frac{50 \times 17}{150} = 5.6 \quad \Sigma_6 = \frac{50 \times 27}{150} = 8 \quad \Sigma_{38} = \frac{50 \times 109}{150} = 36.3$$

DF (5%) = 9.49

Table 2 Chi square test for Line quality

Emotion	Up-hill	Downhill	Horizontal	Irregular	Garland	Arch	Row Total
Happy	24	9	9	8	0	0	50
Sad	23	11	5	10	1	0	50
Aggressive	25	7	0	18	0	0	50
Column total	72	27	14	36	1	0	150

O	E	O-E	(O-E) ² /E
24	24	0	0
9	9	0	0
9	4.6	4.4	4.2
8	12	-4	1.3
0	0.33	-0.33	0.33
0	0	0	0
23	24	-1	0.05
11	9	2	0.44
5	4.6	0.4	0.03
10	12	-2	0.33
1	0.33	0.67	1.36
0	0	0	0
25	24	1	0.04
7	9	-2	0.44
0	4.6	-4.6	4.6
18	12	6	3
0	0.33	-0.33	0.33
0	0	0	0
			X ² = 16.44

The chi square for the line quality is 1.212 (Table 4). also, the DF (Degree of opportunity) value is 9.49 The DF value is more than the X² value which means there are no adjustments in the size character of hand writing.

$$\Sigma_{17} = \frac{50 \times 32}{150} = 10.6 \quad \Sigma_{33} = \frac{50 \times 118}{150} = 39.3$$

$$\Sigma_{10} = \frac{50 \times 32}{150} = 10.6 \quad \Sigma_{40} = \frac{50 \times 118}{150} = 39.3$$

$$\Sigma_5 = \frac{50 \times 32}{150} = 10.6 \quad \Sigma_{45} = \frac{50 \times 118}{150} = 39.3$$

DF (5%) = 5.99

Table 3 Chi square test for pen pressure

Emotions	Moderate	High	Light	Row total
Happy	28	12	10	50
Sad	28	14	8	50
Aggressive	28	11	11	50
Column total	84	37	29	150

O	E	O-E	(O-E) ² /E
28	28	0	0
12	12.3	-0.3	0.007
10	9.6	0.4	0.01
28	28	0	0
14	12.3	1.7	0.23
8	9.6	-1.6	0.26
28	28	0	0
11	12.3	-1.3	0.13
11	9.6	1.4	0.20
X ² = 0.9			

Table 4 Chi square test for size

Emotions	Moderate	High	Light	Row total
Happy	5	10	35	50
Sad	6	8	36	50
Aggressive	6	6	38	50
Column total	17	24	109	150

O	E	O-E	E
5	5.6	-0.6	0.06
10	8	2	0.5
35	36.3	-1.3	0.04
6	5.6	0.4	0.02
8	8	0	0
36	36.3	-0.3	0.002
6	5.6	0.4	0.02
6	8	-2	0.5
38	36.3	1.7	0.07
X ² = 1.212			

The chi square for the line quality is 8.61 (Table 5). what's more, the DF (Degree of opportunity) value is 5.99 The DF value is not exactly the X² value which means there are changes in the spacing character of hand writing.

$$\begin{aligned}\Sigma_{17} &= \frac{50 \times 45}{150} = 15 \quad \Sigma_{13} = \frac{50 \times 21}{150} = 10.3 \quad \Sigma_6 = \frac{50 \times 18}{150} = 6 \\ \Sigma_{17} &= \frac{50 \times 45}{150} = 15 \quad \Sigma_{11} = \frac{50 \times 21}{150} = 10.33 \quad \Sigma_6 = \frac{50 \times 18}{150} = 6 \\ \Sigma_{11} &= \frac{50 \times 45}{150} = 15 \quad \Sigma_7 = \frac{50 \times 21}{150} = 10.33 \quad \Sigma_6 = \frac{50 \times 18}{150} = 6 \\ \Sigma_{14} &= \frac{50 \times 56}{150} = 18.6 \\ \Sigma_{16} &= \frac{50 \times 56}{150} = 18.6 \\ \Sigma_{26} &= \frac{50 \times 56}{150} = 18.6\end{aligned}$$

DF (5%) = 12.59

Table 5 Chi square test for spacing

Emotion	Even	Uneven	Row total
Happy	17	33	50
Sad	10	40	50
Aggressive	5	45	50
Column total	32	118	150

O	E	O-E	E
17	10.6	6.4	3.8
33	39.3	6.3	1
10	10.6	-0.6	0.03
40	39.3	0.7	0.01
5	10.6	-5.6	2.95
45	39.3	5.7	0.82
X ² = 8.61			

Table 6 Chi square test for slant

Emotion	Left	Right	Vertical	Varied	Row total
Happy	17	13	6	14	50
Sad	17	11	6	16	50
Aggressive	11	7	6	26	50
Column total	45	31	18	56	150

O	E	O-E	E
17	15	2	0.26
13	10.33	2.67	0.69
6	6	0	0
14	18.6	-4.6	1.13
17	15	2	0.26
11	10.33	0.67	0.04
6	6	0	0
16	18.6	-2.6	0.36
11	15	-4	1.06
7	10.33	-3.33	1.07
6	6	0	0
26	18.6	7.4	2.94
X ² = 7.81			

The chi square for the line quality is 7.81 (Table 6). what's more, the DF (Degree of opportunity) value is 12.59 The DF value is more than the X² value which means there are no adjustments in the slant character of hand writing.

$$\begin{aligned}\Sigma_1 &= \frac{50 \times 3}{150} = 1 \quad \Sigma_{49} = \frac{50 \times 147}{150} = 49 \\ \Sigma_1 &= \frac{50 \times 3}{150} = 1 \quad \Sigma_{49} = \frac{50 \times 147}{150} = 49 \\ \Sigma_1 &= \frac{50 \times 3}{150} = 1 \quad \Sigma_{49} = \frac{50 \times 147}{150} = 49\end{aligned}$$

DF (5%) = 5.99

Table 7 Chi square test for pen lifts

Emotions	Continuous	Discontinuous	Row total
Happy	1	49	50
Sad	1	49	50
Aggressive	1	49	50
Column total	3	147	150

O	E	O-E	E
1	1	0	0
49	49	0	0
1	1	0	0
49	49	0	0
1	1	0	0
49	49	0	0
X ² = 0			

The chi square for the line quality is 0 (Table 7). what's more, the DF (Degree of opportunity) value is 5.99 The DF value is more than the X² value which means there are no adjustments in the pen lifts character of hand writing. There was no significant change in the class characters line quality, alignment, pen weight, size, slant and pen lifts. Be that as it may, there were significant changes in the dispersing character of the handwriting dependent on the happy, sad and aggressive emotions.

The similarities and dissimilarities in handwriting samples between happy, sad and aggressive emotions were looked at. What's more, founded on the outcomes acquired, chi square test values were found. The chi square test value for the character line quality was observed to be 2.7, alignment is observed to be 16.44, pen weight is gotten as 0.9, estimate is observed to be 1.212, spacing is acquired as 8.61, slant value is of 7.81 and pen lifts value is observed to be as 0. The chi square values got for the characters line quality, alignment, pen weight, size, slant and pen lifts did not surpass the table value. This demonstrates there were no significant changes in the above characters, however in the separating character the chi square value surpasses the table value which demonstrates that there are significant changes in the characters of dividing character. As the determined chi square value of dividing character surpasses the table value, we dismiss the invalid speculation and acknowledge the alternative hypothesis.

5. CONCLUSION

Handwriting is an unpredictable undertaking that requires consideration and memory, just as phonetic and engine abilities. It is entrenched that handwriting is a procured conduct, definitely which implies that one figures out how to frame a letter either from a copybook model or from a familiar model. In either case, the learner would understand the pattern formation of the letter and endeavor to practice the equivalent. In such a course the learner, in one way or other, designs a model which is a half and half of the scholarly copybook model highlights just as

person's inborn thoughts. From the above depiction and result it is presumed that There were insignificant changes seen in the alignment, line quality, pen weight, size, slant and pen lifts characters of the handwriting and significant changes were found in the dividing character of handwriting dependent on happy, sad and aggressive emotions. The present framework has limitations as far as number of highlights and exactness. Future work incorporates acquiring more exact in foreseeing emotions. Perceiving human emotions from handwritten documents is one of the dynamic research zones for couple of decades. The principle challenge of impersonating the errand of a graphologist is the inalienable complexity nature of the handwriting and the content utilized. Throughout the years a few techniques have been taken to improve the acknowledgment of handwriting and location of emotions. The present framework can be reached out to keen framework in which a large portion of the handwriting highlights and furthermore signature highlights can be separated. With the goal that personality can be perceived from comparing separated highlights.

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