A Study to Determine the Inheritance Pattern of Characteristics of Handwriting between Parents and Off-springs

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Abstract

Parents are the children's learning models. A preschooler is influenced by the handwriting of his or her parents. He learns to write letters by imitating or copying the letters formed by the parents. When he is satisfied with the way he writes it, how it looks he will begin to write it without paying attention to its details.

After manually analyzing all the 50 samples, there were similarities found between the parents and the off-springs. While analyzing the general correlation of handwriting characteristics between the parents and the off-springs, it was found that there is highest level of similarity in pen lifts and a low level of similarity was found in the pressure applied while writing.

The characteristics like pen lifts, entry strokes, exit strokes, connecting strokes, alignment and shading that show a high level of similarity are class characteristics whereas the handwriting characteristics such as pressure, diacritic of the letter "t", loop formed by the letter "e", diacritics of the letter "i" and baseline that show a low level of similarity are individualistic i.e. they vary for each person.

Keywords: Inheritance Pattern; Handwriting; Pen lifts; Parents; Off Springs

Introduction

Parents are the children's learning models. A preschooler is influenced by the handwriting of his or her parents. He learns to write letters by imitating or copying the letters formed by the parents. For example, a son may like the shape of a letter written by his father so he practices making that letter until he thinks it is like his father's. When he is satisfied with the way he writes it, how it looks (because it is like his father), he will begin to write it without paying attention to its details. By repeated attempts to copy this basic pattern the child incorporates the peculiarities of writing of his parents into his writing habits. The better his memory of forms and the more time he spends practicing letter forms written by his parents, the more habitual his movement becomes and the closer the new writing form will be to the parental writing model. This tendency also occurs during adolescence, when the writer is developing and experimenting with his/her writing. As a writer matures he incorporates more individuality in his writing but he is still influenced by the previous writing system features and his writing may very well become a combination of the two. How much of a combination depends upon the writing habits he develops (Morris, 2000). Writing habits of the off-springs are also shaped by genetic factors. These writing habits may include handedness, writing posture, pen position, learning and thinking ability. A few studies have also been done on familial resemblance with respect to hand preference, handwriting posture and specific cognitive abilities [1,2].

A study conducted on resemblance of slant in handwriting of closed genotypic family members in a sample of 360 families, using computational method based on MATLAB, followed by the statistical evaluation of the parameters, showed a significant resemblance of slant in handwriting of offspring's of family members. However, handedness, and gender may be involved in the formation of this behavior. Since handwriting is a complex and multi-causal mechanism [3].

In another study, it was seen that handwriting is one of the acquired characteristics of humans. It is a mixture of nature and nurture. Parents play an important part in teaching pre-writing skills to their children. Genetics also has a role in shaping the writing habits of the writer (such as handedness and handwriting positions). The handwritings of parents and their biological off-springs were examined to determine the inheritance of handwriting features from one generation to the next generation. In this scheme, resemblances in the handwriting features of parents off springs were studied using computational features based on MATLAB 8.3 software [4].

Methodology

This study was conducted in Bangalore city belonging to Karnataka of south Indian region. The method used to collect data was snowball technique. To study the inheritance pattern of characteristics of handwritings between parents and siblings members of the family i.e. Father, mother and the off-springs (family with two off-springs was selected for the study) [5,6].
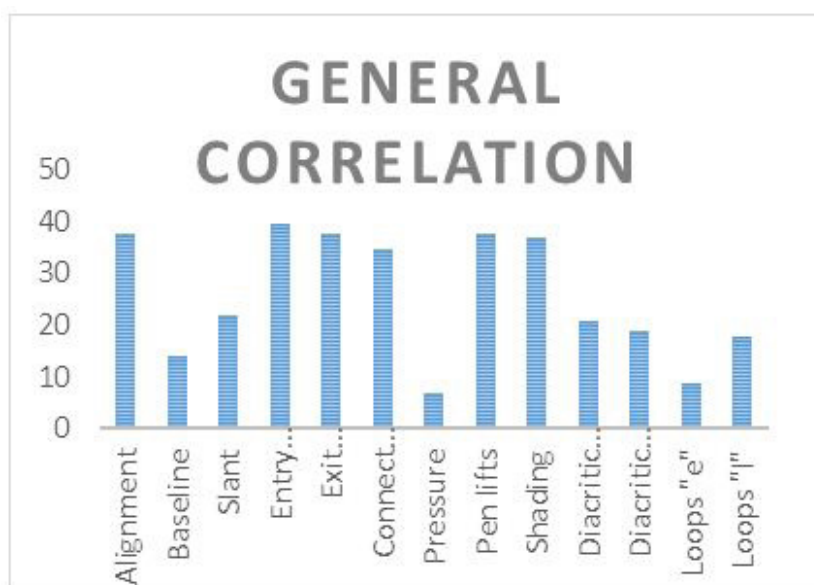
Handwriting samples from 50 families are collected by requesting each member to write a sample paragraph for minimum of three times. The same writing instrument and paper was provided for each respondent. These samples are analyzed manually using different tools such as a hand magnifier and a stereo microscope and scales to check the degree of similarities in handwriting characteristics between parents and off-springs [7-10].

Result

From Table 1 and Figure 1, it was seen that there was 76% similarity in the alignment between the parents and the offsprings. Likewise, similarities were found in characteristics such as baseline (28%), slant (44%), entry stroke (80%), exit stroke (76%), connecting stroke (70%), pressure (14%), pen lifts (76%), shading (74%), diacritic "i" (42%), diacritic "l" (38%), loop "e" (18%) and loop "l" (36%). The highest similarity is found in the entry stroke (initial stroke) whereas the lowest similarity is in the pressure applied while writing.

General Correlation		
Characteristics	**Number**	**Percentage**
Alignment	38	76
Baseline	14	28
Slant	22	44
Entry Stroke	40	80
Exit Stroke	38	76
Connecting Stroke	35	70
Pressure	7	14
Pen lifts	38	76
Shading	37	74
Diacritics "i"	21	42
Diacritics "t"	19	38
Loops "e"	9	18
Loops "l"	18	36

Table 1: Representing general correlation of handwriting characteristics between parents and off-springs

Figure 1: Showing the correlation of various handwriting characteristics between the parents and the offsprings

From Table 2 and Figure 2, it was seen that there was 79.16% similarity in the alignment between the mothers and the daughters. Likewise, similarities were found in characteristics such as baseline (62.5%), slant (75%), entry stroke (83.33%), exit stroke (87.5%), connecting stroke (77.08%), pressure (29.16%), pen lifts (79.16%), shading (79.16%), diacritic "i" (47.91%), diacritic "l" (66.66%), loop "e" (60.41%) and loop "l" (56.25%). The highest similarity is found in the exit stroke (terminal stroke) whereas the lowest similarity is in the pressure applied while writing.

Mother- Daughter		
Characteristics	Number	Percentage
Alignment	38	79.16
Baseline	30	62.5
Slant	36	75
Entry Stroke	40	83.33
Exit Stroke	42	87.5
Connecting Stroke	37	77.08
Pressure	14	29.16
Pen lifts	38	79.16
Shading	38	79.16
Diacritics "i"	23	47.91
Diacritics "t"	32	66.66
Loops "e"	29	60.41
Loops "l"	27	56.25

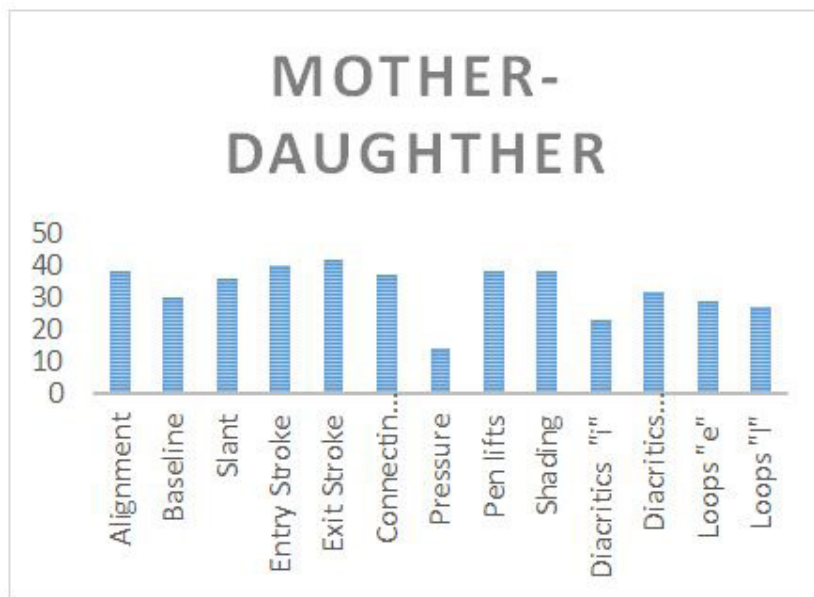**Table 2:** Representing correlation of handwriting characteristics between mother and daughter

Figure 2: Showing the correlation of various handwriting characteristics between Mother and Daughter

From Table 3 and Figure 3, it was seen that there was 88.46% similarity in the alignment between the mothers and the sons. Likewise, similarities were found in characteristics such as baseline (59.96%), slant (65.38%), entry stroke (90.38%), exit stroke (90.38%), connecting stroke (82.69%), pressure (50%), pen lifts (86.53%), shading (86.53%), diacritic "i" (65.38%), diacritic "l" (67.30%), loop "e" (65.38%) and loop "l" (65.38%). The highest similarity is found in the entry and exit strokes whereas the lowest similarity is in the pressure applied while writing.

Mother- Son		
Characteristics	Number	Percentage
Alignment	46	88.46
Baseline	31	59.96
Slant	34	65.38
Entry Stroke	47	90.38

Mother- Son		
Characteristics	Number	Percentage
Exit Stroke	47	90.38
Connecting Stroke	43	82.69
Pressure	26	50
Pen lifts	45	86.53
Shading	45	86.53
Diacritics "i"	34	65.38
Diacritics "t"	35	67.30
Loops "e"	34	65.38
Loops "l"	34	65.38

Table 3: Representing correlation of handwriting characteristics between Mother and Son
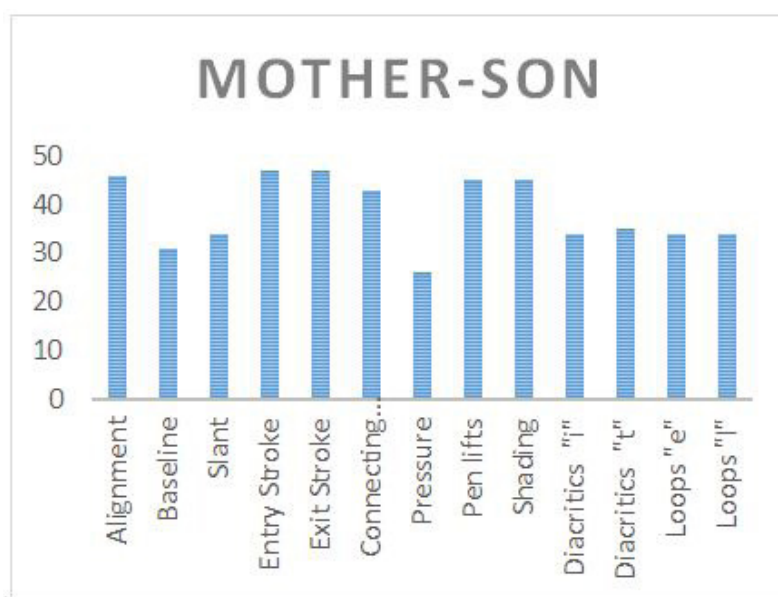

Figure 3: Showing the correlation of various hand writing characteristics between Mother and Son

From Table 4 and Figure 4, it was seen that there was 79.16% similarity in the alignment between the fathers and the daughters. Likewise, similarities were found in characteristics such as baseline (58.33%), slant (66.66%), entry stroke (87.5%), exit stroke (89.58%), connecting stroke (72.9%), pressure (60.41%), pen lifts (87.5%), shading (87.5%), diacritic "i" (64.58%), diacritic "l" (60.41%), loop "e" (43.75%) and loop "l" (52.08%). The highest similarity is found in the exit stroke whereas the lowest similarity is in the loop formed by the letter "e".

Father-Daughter		
Characteristics	Number	Percentage
Alignment	38	79.16
Baseline	28	58.33
Slant	32	66.66
Entry Stroke	42	87.5
Exit Stroke	43	89.58
Connecting Stroke	35	72.9
Pressure	29	60.41
Pen lifts	42	87.5
Shading	42	87.5
Diacritics "i"	31	64.58
Diacritics "t"	29	60.41
Loops "e"	21	43.75
Loops "l"	25	52.08

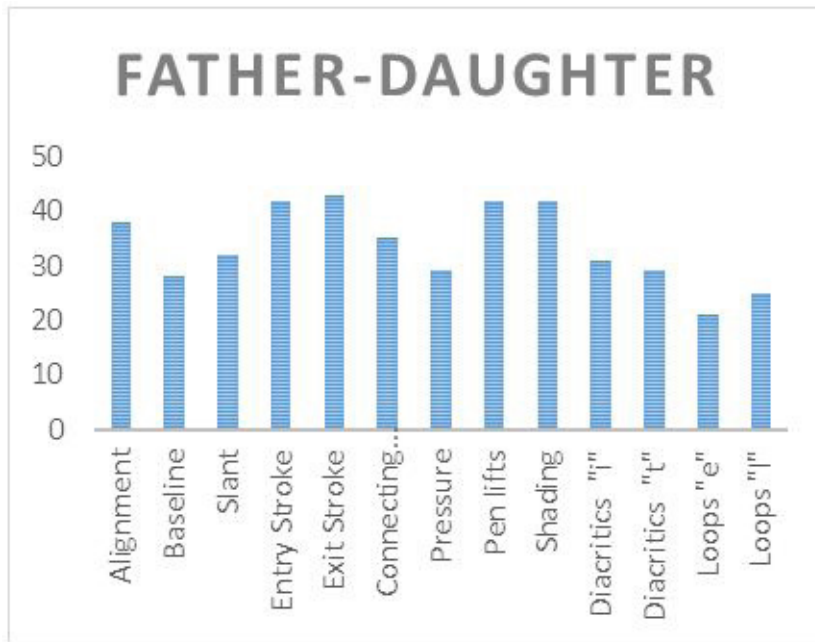**Table 4:** Representing correlation of handwriting characteristics between Father and Daughter

Figure 4: Showing the correlation of various handwriting characteristics between Father and Daughter

From Table 5 and Figure 5, it was seen that there was 84.61% similarity in the alignment between the fathers and the sons. Likewise, similarities were found in characteristics such as baseline (50%), slant (73.07%), entry stroke (92.30%), exit stroke (88.46%), connecting stroke (86.53%), pressure (57.69%), pen lifts (86.53%), shading (84.61%), diacritic "i" (71.15%), diacritic "l" (69.23%), loop "e" (48.07%) and loop "l" (67.30%). The highest similarity is found in the entry strokes whereas the lowest similarity is in the loop formed by the letter "e".
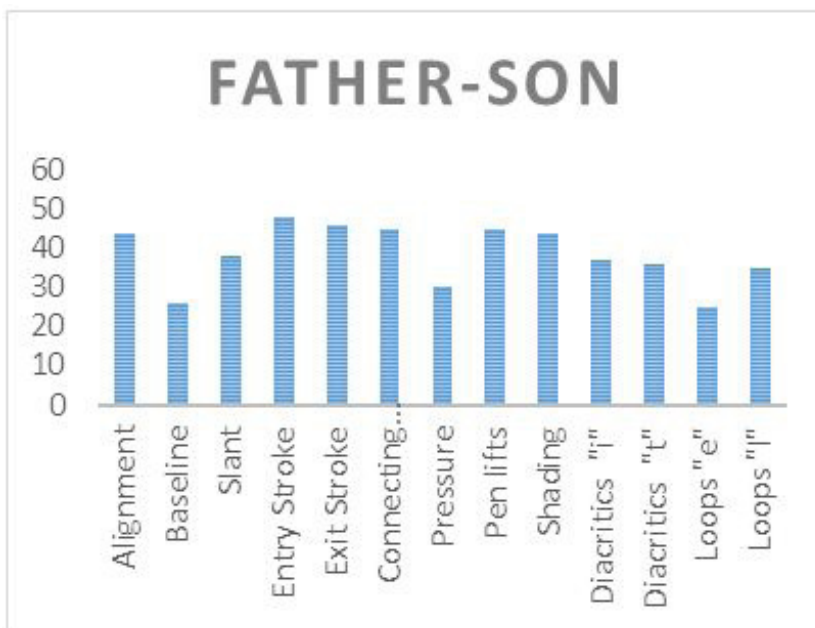

Figure 5: Showing correlation of various handwriting characteristics between Father and Son

Father- Son		
Characteristics	**Number**	**Percentage**
Alignment	44	84.61
Baseline	26	50
Slant	38	73.07
Entry Stroke	48	92.30
Exit Stroke	46	88.46

Father- Son		
Characteristics	Number	Percentage
Connecting Stroke	45	86.53
Pressure	30	57.69
Pen lifts	45	86.53
Shading	44	84.61
Diacritics "i"	37	71.15
Diacritics "t"	36	69.23
Loops "e"	25	48.07
Loops "l"	35	67.30

Table 5: Representing correlation of handwriting characteristics between Father and Son

Discussion

After manually analyzing all the samples of 50 families, there were similarities found between the parents and the off springs.

While analyzing the general correlation of handwriting characteristics between the parents and the off springs, it was found that there is highest level of similarity in entry strokes (80%). Apart from this, the characteristics such as exit stroke, alignment and pen lifts have 76% similarity and shading (74%) also show a high level of similarity. However, there is only 14% similarity in the pressure applied while writing. Likewise, the loop of the letter "e" (18%) and baseline (28%) also show a low level of similarity [11-14].

While analyzing the correlation of handwriting between the Mother and Daughter, it was found that exit strokes show 87.5% and entry strokes show 83.33% similarity. Apart from these, the characteristics such as alignment (79.16%), shading (79.16%) and connecting stroke (77.08%) also show a high level of similarity [15]. However, there was only 29.16% similarity found in pressure applied while writing. Likewise, the diacritic of the letter "i" (47.91%) also shows a low level of similarity [16-17].

While analyzing the correlation between the Mother and Son, it was found that both exit strokes and entry strokes show 90.38% similarity. Apart from these, the characteristics such as alignment (88.46%), shading (86.53%) and connecting strokes (82.69%) also show a high level of similarity. However, there was only 50% similarity found in pressure applied while writing. Likewise, baseline (59.96%) also shows a low level of similarity as compared to other characteristics.

While analyzing the correlation between the Father and Daughter, it was found that exit strokes shows 89% similarity whereas entry strokes and shading show 87.5% similarity. Apart from these, the characteristics such as alignment (79.16%) and connecting strokes (72.9%) also show a high level of similarity. However, loop formed by the letter "e" shows a low level (43.75%) of similarity [18]. Likewise, there was only 52.08% similarity found in loop formed by the letter "l" and 58.33% in the baseline.

While analyzing the correlation between the Father and Son, it was found that entry strokes show 92.30% similarity whereas exit strokes show a similarity of 88.46%. Apart from these, characteristics such as connecting strokes (86.53%), alignment (84.61%) and shading (84.61%) also show a high level of similarity. However, there was only 48.07% similarity found in the loops formed by the letter "e". Likewise, the baseline (50%) and pressure (57.69%) also show a low level of similarity [19].

The characteristics like entry strokes, exit strokes, pen lifts, connecting strokes, alignment and shading that show a high level of similarity are class characteristics whereas the handwriting characteristics such as pressure, diacritic of the letter "t", loop formed by the letter "e", diacritics of the letter "i" and baseline that show a low level of similarity are individualistic i.e. they vary for each person [20-22].

Conclusion

The highest percentage of similarity was found in the characteristics entry stroke among father and son (92.30%) followed by mother and son (90.38%) and then father and daughter (89%) and at last mother and daughter (83.33%).

The lowest percentage of similarity was found among characteristics such as pressure among mother and daughter and mother and son whereas among father and daughter and father and son the characteristic feature loop had least similarity.

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