

Individuality of Numerals in Disguised Handwriting

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Abstract

The aim of the study was to determine to which extent numerals can be disguised when an individual tries to attempt disguise in order to conceal their identity. For this purpose, 100 samples having both normal and disguised handwriting of an individual between the age 18-30 years were collected. The samples were studied thoroughly to examine the class characteristics. Also, different formations and individual characteristics of numerals were analysed using Visualizer and Clear Scanner App. The findings suggested that the numeral which is most disguised within the population is numeral '3' and the least disguised numeral is '0'. Also, the most disguised percentage among the population was 30% which indicates that out of 10 numerals people usually disguise 3 of the numerals.

Keywords: Handwriting; Disguise handwriting; Individual characteristic; Numerals

Introduction

Forensic document examination is now part of many crime laboratories in the nation and across the globe. The term 'Forensic' means simply, "having to do with the law or basically it means application of different sciences in criminal investigation to present reliable evidences in the court of law for judicial proceedings. The examination of questioned documents was one of the first disciplines recognized as a part of Forensic science. Since late 1800s, handwriting has been used as the main medium of communication so the earliest reported criminal cases were usually of forgery [5].

Handwriting is a neuromuscular co-ordination where CNS guides the muscle in order to execute the subject matter on the writing surface with the help of various writing instruments. It is initially a conscious act during the learning stage but with its repeated use formation of each word and letter becomes almost sub-conscious so that writer concentrates more on the thoughts of subject matter other than the design of letters.

Principles of Handwriting

The fundamental principles of Handwriting as given by FBI Laboratory, US Service laboratory, and the Wisconsin State Crime Laboratory in Milwaukee are:

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- Handwriting is individual.

This principle enables document examiners to differentiate between genuine and non-genuine writing as in case of Forgery (act of simulating another individual's handwriting) and Disguise (act of departing from own handwriting features).

- Each person has natural variations in his/her handwriting. The document examiner must learn to distinguish between natural variation and a different writer.
- Each person has a skill level that he/she generally cannot surpass.
- It is not possible to determine age/sex from handwriting [3].

The work of the forensic examiner of questioned documents is described as, person practicing the profession or doing it as an occupation are referred to as a Forensic Scientist, Forensic Document Examiner, Document Expert or Handwriting Expert [2].

Forensic Document Examiners (FDEs) can differentiate well between forgeries and disguises as their examination includes consideration of multiple aspects within the document which increases the authenticity of their work [4].

Problems Involving Numbers

Document examiners are also asked to solve problems involving forged or counterfeit cheques. When examining any kind of document, scrutinize every part of it carefully, especially any numbers that appear on the document. Most people do not alter their numbers when disguising their handwriting. Thus, many cases identification have been made through the comparison of numbers. One of the most common problems involving numbers entails raising the amount. 1 can be made into 4, 7, or 9; 2 can be turned into 3 or 5; 0 can be added to increase amounts by tens or hundreds. Digits can be placed before other numbers to raise amounts. Occasionally a date is changed on a document or a false date is given [1].

In addition to studying the numbers, comparing the signs associated with numbers; the dollar sign (\$), the ampersand (&), the comma that separates thousand (,), and the decimal point (.) can be significant. Search for peculiarities there as these signs will vary from writer to writer but remain consistent for a writer.

Objectives

- To study the different formations of numerals.
- To determine the most and least disguised numeral.
- To determine the Disguised Percentage.

Methodology

The research began with going through the literature work that had been done till date in the field of Questioned documents. On the basis of our literature review it was found that numerals were the rarely disguised features in the case of disguised handwriting and also the least studied.

For a careful and appropriate research, we carried out our work in the following manner:

❖ *Collection*

For our research work we had to collect enough handwriting samples so we took a target of around 100 samples of individuals between the age group of 18-30 years for both the genders. The sample we framed contained a paragraph in which we tried to put each numeral in the content repeatedly (Fig. 1).

❖ *Analysis*

First we analyzed the samples for the class characteristics like alignment, pen pressure, slant, skill and so on. Then we moved on to the careful analysis of different numerals in the following manner:

- Different formations of numerals by different individuals in their handwriting sample. Let's consider the formation of the numeral '9' in which we found the maximum variations.
- Comparison of each sample for individual characteristics within the numerals of their normal handwriting and disguised handwriting under the *Visualizer* and scanned each numeral separately using *Clear Scanner App* (Fig. 2).

Observation

For more careful observations we made

observation sheets for each sample in which we added the scanned photographs of normal and disguised numerals from their handwriting samples. Further in our observation sheets, we checked and mentioned the disguise percentage of each individual (Fig. 3 & 4) (Table 1 & 2).

After arranging our observations in the form of statistical data for better understanding and visual representation we converted the above data in graphical form (Graph 1 -10) (Fig. 5 and Grpah 11).

Results and Discussion

During the careful analysis of our samples first we checked for the individual characteristics of the numerals and then for the disguised ratio in different handwriting samples from which we concluded the following data:

After arranging our observations in the form of statistical data for better understanding and visual representation we converted the above data in graphical form.

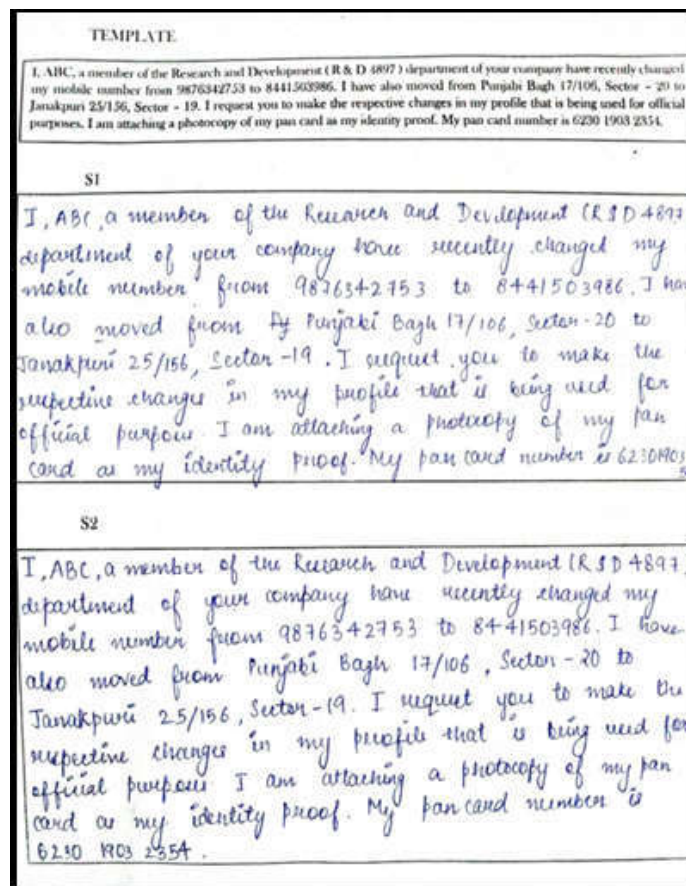
Table 1: Disguise Percentage

Numerals	Disguised Population	Non-Disguised Population
0	5	95
1	23	77
2	36	64
3	43	57
4	37	63
5	39	61
6	12	88
7	30	70
8	18	82
9	27	73

Table 2: Disguised Percentage of 100 handwriting samples

Disguised Percentage	No. of Individuals
0	17
10	13
20	17
30	18
40	15
50	8
60	5
70	5
80	1
90	1

Fig. 1 A: handwritten collected sample for research purpose



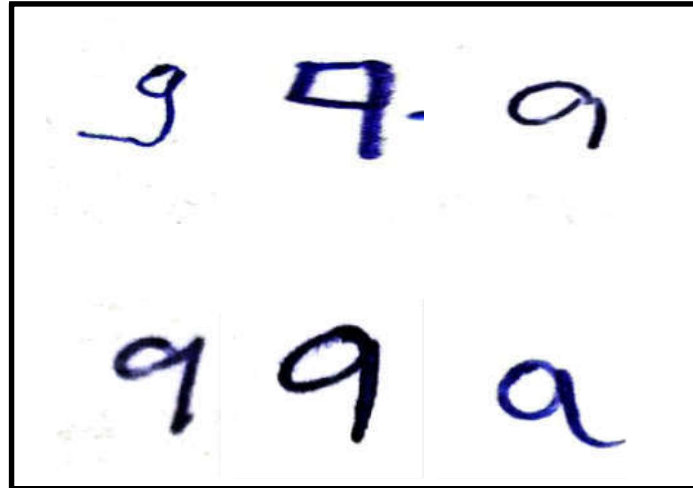


Fig. 2: Different Formations of Numeral '9'

EXAMINATION SHEET			
NAME: ABC GENDER: Female		AGE: 24 Years Disguised Percentage: 60%	
NUMERALS	NORMAL HANDWRITING	DISGUISED HANDWRITING	DISGUISEMENT
0	0	0	X
1	1	1	X
2	2	2	✓
3	3	3	✓
4	4	4	✓
5	5	5	✓
6	6	6	X
7	7	7	✓
8	8	8	X
9	9	9	✓

Fig. 3: Observation sheet prepared for a sample showing 6 disguised numerals out of 10

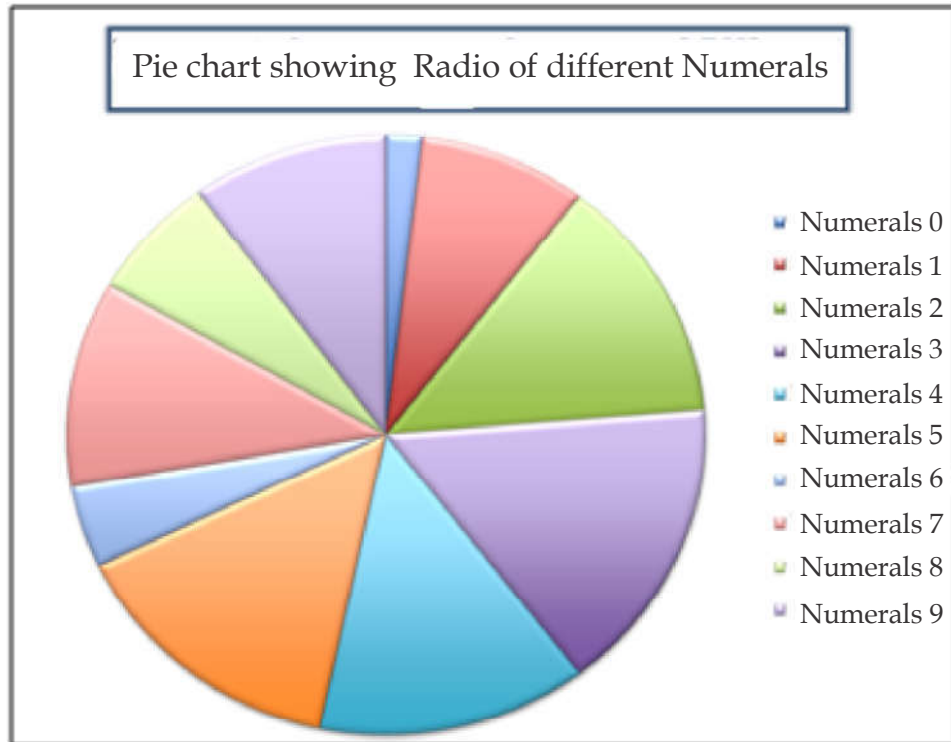


Fig. 4: The Pie Chart showing the sector area of different numerals out of which the area of numeral '3' is maximum

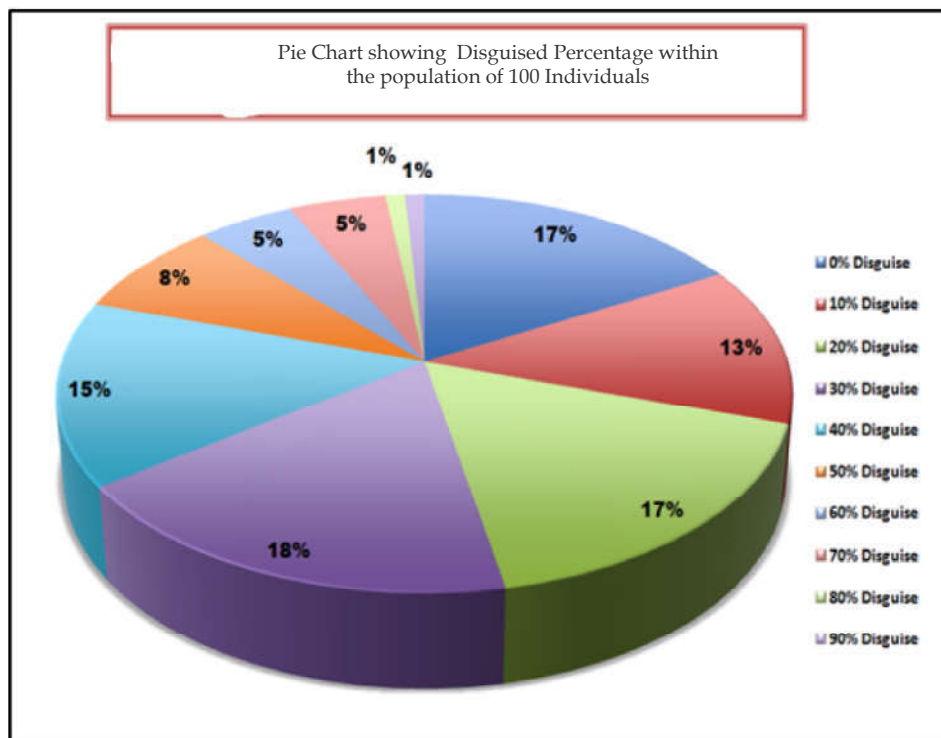
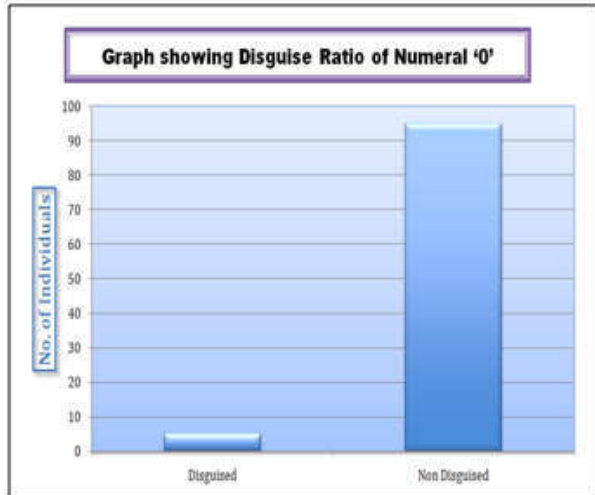
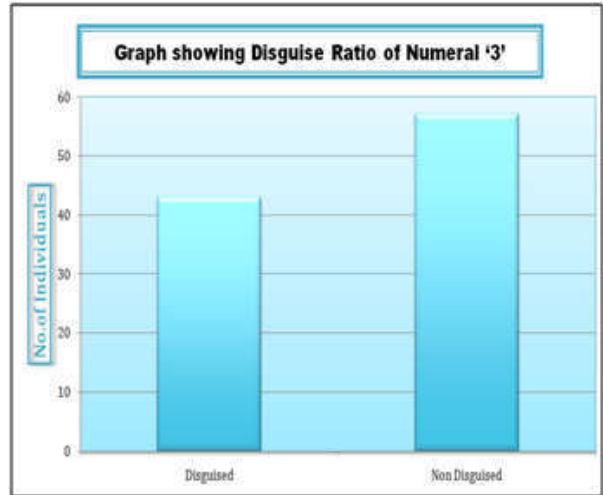


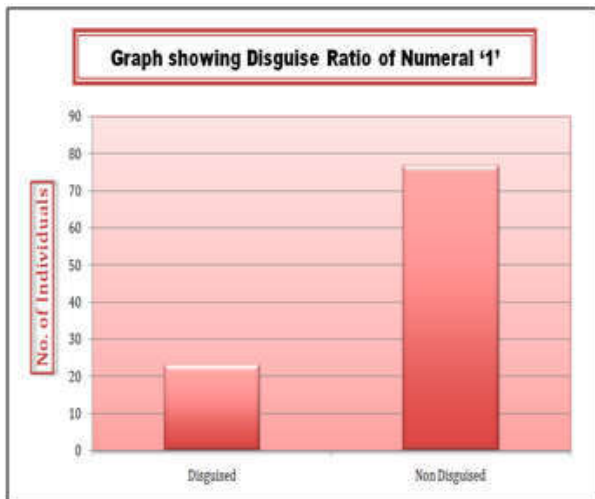
Fig. 5: The Graph and Pie Chart shows that 30% is the highest Disguised Percentage within the population and 80% and 90% are the lowest



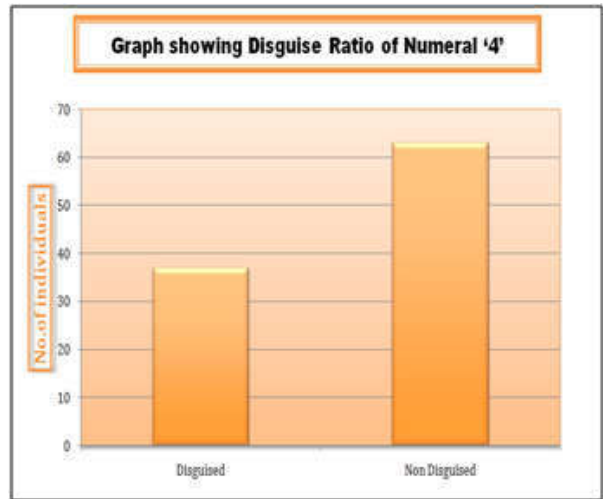
Graph 1: Showing that 5% of the population disguised numeral '0'



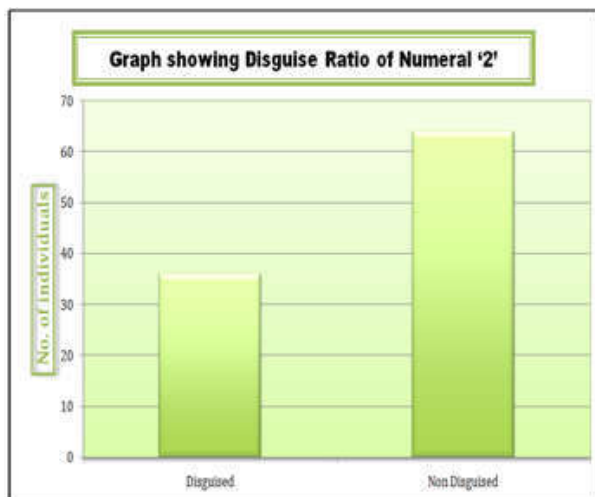
Graph 4: Showing that 43% of the population disguised numeral '3'



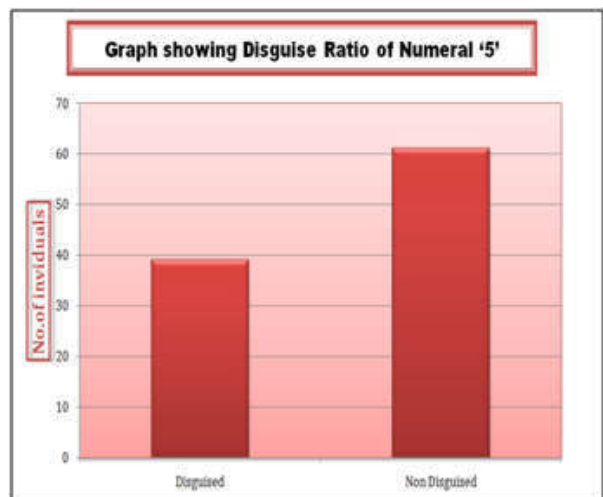
Graph 2: Showing that 23% of the population disguised numeral '1'



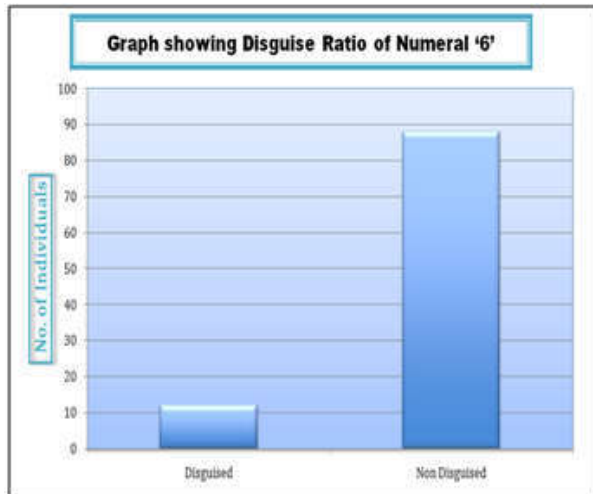
Graph 5: Showing that 37% of the population disguised numeral '4'



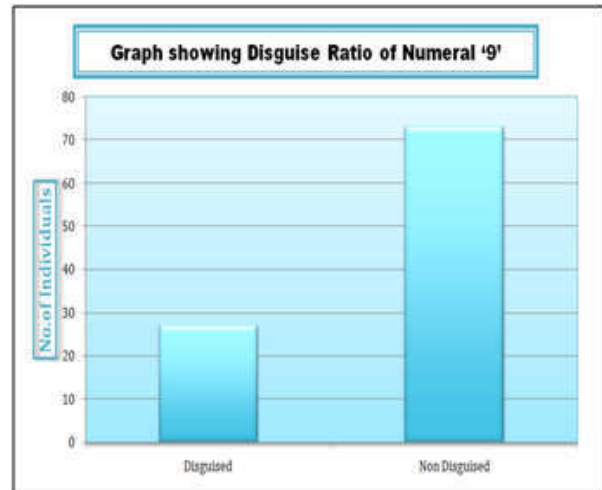
Graph 3: Showing that 36% of the population disguised numeral '2'



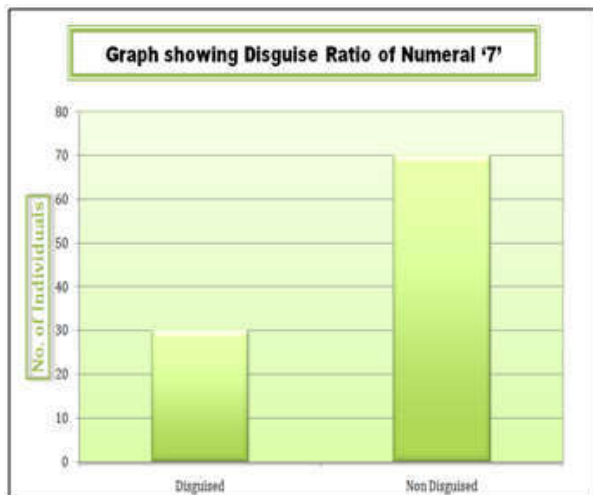
Graph 6: Showing that 39% of the population disguised numeral '5'



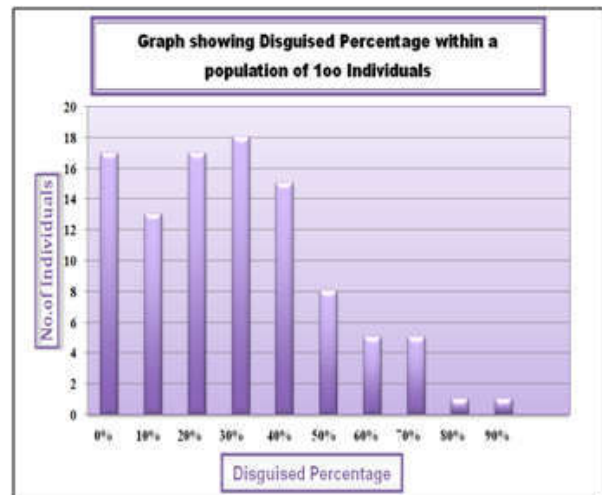
Graph 7: Showing that 12% of the population disguised numeral '6'



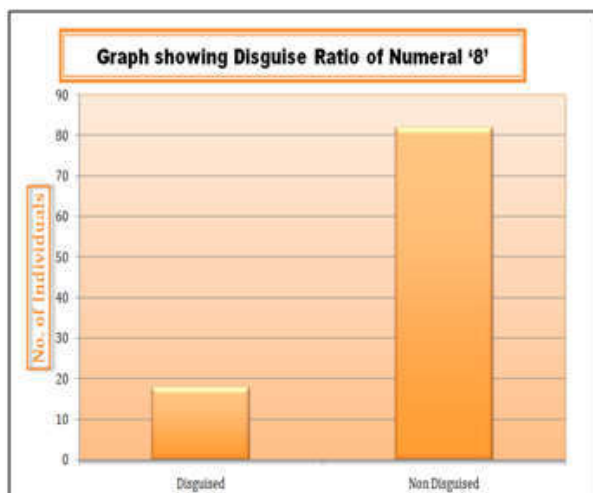
Graph 10: Showing that 27% of the population disguised numeral '9'



Graph 8: Showing that 30% of the population disguised numeral '7'



Graph 11: Showing Disguised percentage within population



Graph 9: Showing that 18% of the population disguised numeral '8'

The Pie Chart showing the sector area of different numerals out of which the area of numeral '3' is maximum which indicates that it is the most disguised numeral among the population whereas area of numeral '0' is minimum that means it is least disguised.

We had also checked for the Disguised Percentage in different handwriting samples which indicates that how many numerals had been disguised out of ten. It had been found that the Disguised Percentage of 100 handwriting samples were as follows:

Conclusion

Disguised writing is a deliberate attempt to alter one's handwriting to prevent recognition. When

a person tries to disguise its handwriting after a certain period of time the person tends to come back to its natural handwriting characteristics as the subconscious brain commands the muscles to return to its normal handwriting. The same was also found during analysis of the collected samples. In case of numerals, it was found that most of the individuals tried to disguise the numerals by altering the size of numeral or by addition or elimination of additional stroke. But they were not able to maintain it along the entire content as the formation and pen movement of the numerals in disguised handwriting were somewhat similar as that in the normal handwriting.

Approximately 17% of the population was not able to disguise even one numeral out of ten, i.e. their calculated disguised percentage was 0%. As we knew from our previous knowledge that 100% disguise by an individual is not possible and it was also found in our analysis that there was no individual who could disguise all of his/her ten numerals which means that no individual had 100% disguise percentage.

Our finding showed that 43% of the population, that is the highest, had disguised numeral '3' which concluded that it was the most disguised numeral. Whereas only 5% of the population, that is the lowest, had disguised numeral '0'. Only 2% of the population that disguised their handwritings skillfully was able to disguise 80-90% of their numerals. On the other hand, the number of numerals that were usually disguised out of ten were 3 i.e., the highest disguised percentage was 30%.

As we had also studied the different formations of each numeral it was found that numeral '5' had maximum number of variation in its formation that people generally do while disguising. There were a total of 11 different formations that were found in the collected samples. Whereas, only 5 different formations of numeral '6' were found that is the minimum number of variations found among the numerals.

From this study we have concluded that if numerals are also found on a questioned document like in cases of forgery, anonymous letters, cheque frauds, disputed wills, etc. their analysis should not be neglected. When numerals are closely examined, they can act as a significant aspect in Questioned Document Examination.

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