

A STUDY ON THE RELATION OF SPEED, PRESSURE, AND LEGIBILITY IN HANDWRITING USING THREE DISTINCTIVE PENS

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INTRODUCTION

Handwriting is an acquired skill and a neuro-muscular process and it is unique to each individual. Handwriting involves 27 bones and 40 muscles to work. To determine the proper writing speed, the slow speed is indicated by writing with heavy pen pressure, blunt starts, blunt terminals, and pen lifts. Whereas fast speed is indicated by well-defined rhythmic strokes and tapering terminals. Tremors, retouching, and pen pauses in the strokes all indicate slow speed.

Questioned document examination (QDE) is a forensic science discipline that examines documents that may be contested in court. The primary goal of the examination is to provide evidence about suspicious or questioned documents by employing a variety of scientific principles and methods. Document examination may include alterations, by, paper analysis, forgery, origin, determining authenticity, and other issues. Documents related to a criminal or civil case can provide a wealth of critical information.

AIM

This study aims to describe the relation of speed, pressure and legibility as well as the impact of different pens used namely ball point pen, ink pen and gel pen.

METHODOLOGY

One hundred adults between the ages of 18-24 participated in the study. Subjects were told that samples were required of normal handwriting and they were unaware of the purpose of the study. The subjects were given three pens for this study: an ink pen, a ball point pen and a gel pen. To measure the pressure, carbon paper was provided. Writing pad, three distinctive pens and A4 sheets were used as writing instruments. To quantify the pressure, the indent writing must be visible on the next sheet. For all the four speeds, comparable arrangements were produced in collection. The subjects are instructed to pay close attention to the provided audio clip and compose the sentence while listening to the recorded audio because this can be used to determine handwriting speed. The speeds that are taken into account are slow speed, normal speed(which they usually write), speed and high speed. The ball point pen was solely used for the purpose of measuring pressure. The ink pen, ballpoint pen and gel pen were used to determine the legibility. Each pen was given three different sentences and also each of the given sentences had the words mixed or jumbled for each speed, so that the person does not foresee or think of the next word.

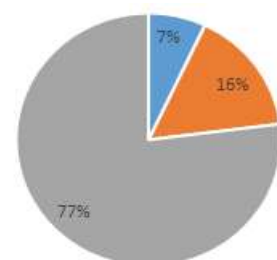
The individuals were given A4 sheets with carbon paper sandwiched between them in order to gather samples containing pressure. The sentence given for each speed to check the pressure was fixed.

Similarly, the sentences given to check the legibility of ink pen and gel pen also were fixed.

FINDINGS

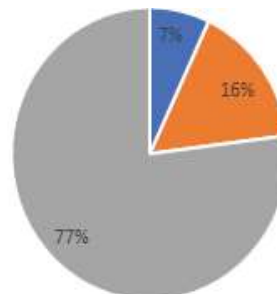
The results of pressure applied by 100 subjects while writing using a ball point at different speed is depicted in the graph provided below in the figure 1.1; figure 1.2; figure 1.3 and 1.4

Figure 1.1: slow speed S1



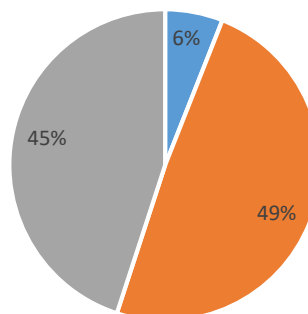
The slow speed S1 writing of 100 individuals is depicted in the figure 1.1. It was shown that 77% of the subjects while writing in slow speed used heavy pressure, 16% used medium or moderate pressure and only 7% used low pressure. So the pressure has increased at slow speed S1.

Figure 1.2: normal speed S2



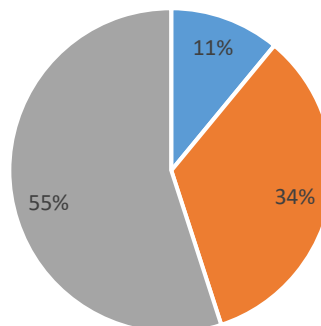
The normal speed S2, writing of 100 individuals, which is the usual way the subject writes is depicted in the figure 1.2. It was shown that only 7% of the subjects used heavy pressure while writing, 54% used medium or moderate pressure and around 39% used low pressure.

Figure 1.3: speed S3



The speed S3, writing of 100 individuals is depicted in the figure 1.3. It was shown that only 6% of the subjects while writing in fast speed used heavy pressure 49% used medium or moderate pressure and only 45% used low pressure.

Figure 1.4: high speed S4

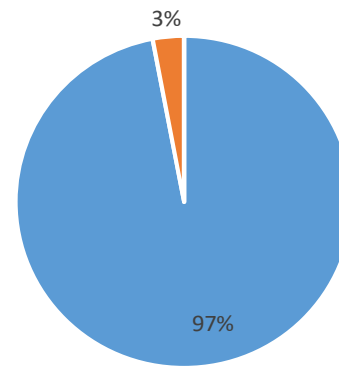


The high speed S4 writing of 100 individuals is depicted in the figure 1.4 . It was shown that only 11% of the subjects while writing in very fast speed used heavy pressure, 34% used medium or moderate pressure and only 55% used low pressure

LEGIBILITY

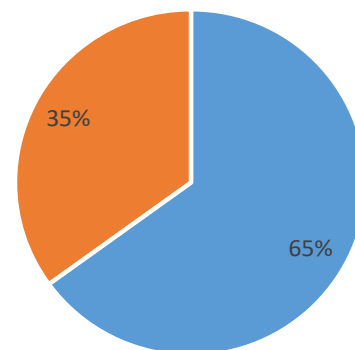
- **Ball pen-** The results of legibility in relation to speed was obtained for 100 subjects when ball pen was used for writing and shown in the figure 2.1; figure 2.2; figure 2.3 and 2.4

Figure 2.1: slow speed S1



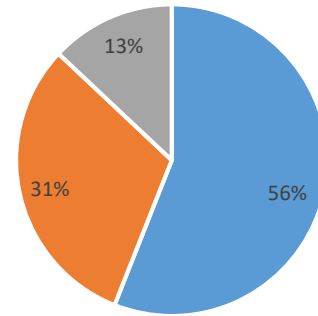
According to figure 2.1, 97% of the subjects' writing samples were clearly visible, indicating that the writing is legible when done in a slow speed S1. Only 3% of the subjects' writing had some words that were unclear, which were subsequently classified as moderately legible.

Figure 2.2: normal speed S2



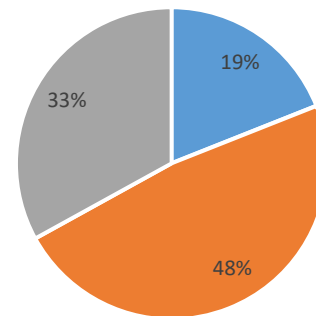
From the figure 2.2 it was depicted that 65% of the subjects' writing was clearly visible indicating that the writing is legible when the samples were written in normal speed S2. And around 35% of the subjects' writing were unclear, which then classified as moderately legible.

Figure 2.3: speed S3



From the figure 2.3 as the speed changed to fast speed S3, 56% of the subjects' writing was clearly visible, indicating that the writing is legible, 31% of the samples had few words unclear while writing in fast speed S3. And around 13% of the subjects' writing none of the words were clear so it is then classified as illegible.

Figure 2.4: high speed S4

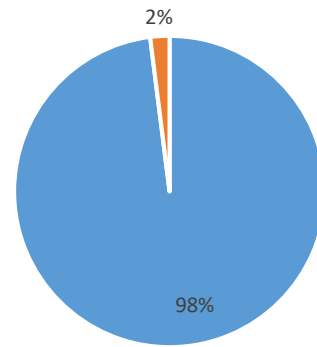


From the figure 2.4 when the samples were written in very fast speed S4, the legibility reduced. That is only 19% of the subjects' writing were clearly visible indicating the samples were legible, 48% of the writing samples had few words that were unclear so it was classified as moderately legible. And also 33% of the subjects' writing none of the words were clear so it was classified as illegible.

Overall, it was discovered that when the subjects wrote the samples with ball point pen, the subject's writing legibility decreased as the speed rose. Only few words were unclear in the majority of the samples, which is moderately legible; few samples were illegible since none of the words were clear.

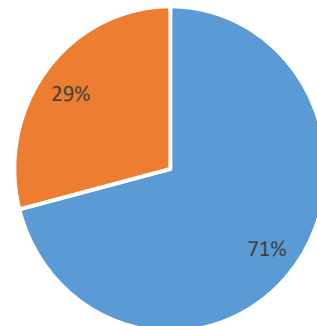
- **Ink pen-** The results of legibility in relation of speed when written using ink pen is depicted in the figure 3.1; figure 3.2; figure 3.3; figure 3.4

Figure 3.1: slow speed S1



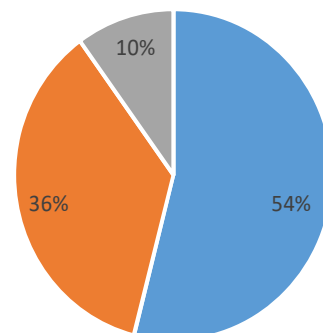
From the figure 3.1, 98% of the subjects' writing samples were clearly visible, indicating that the writing is legible when done in a slow speed S1. Only 2% of the subjects' writing had some words that were unclear, which were subsequently classified as moderately legible.

Figure 3.2: normal speed S2



From the figure 3.2 it was depicted that 71% of the subjects' writing was clearly visible indicating that the writing is legible when the samples were written in normal speed S2. And around 29% of the subjects' writing was unclear, which then classified as moderately legible.

Figure 3.3: speed S3



From the figure 3.3 as the speed changed to fast speed S3,36 % of the subjects' writing was clearly visible, indicating that the writing is legible, 54% of the samples had few words unclear while writing in speed S3. And around 10% of the subjects' writing none of the words were clear so it is then classified as illegible.

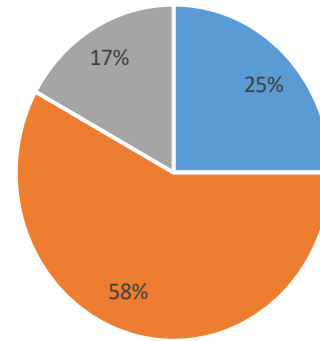


Figure 3.4: high speed S4

When the samples were written in very fast speed S4 Shown in the figure 3.4, the legibility reduced. That is only 17% of the subjects' writing were clearly visible indicating the samples were legible, 58% of the writing samples had few words that were unclear so it was classified as moderately legible. And also 25% of the subjects' writing none of the words were clear so it was classified as illegible.

Overall it was observed that when the subject used an ink pen for writing at different speeds, the writing legibility decreased comparatively. Majority of the samples were moderately legible and few samples were illegible.

- **Gel pen-** The results of legibility in relation to different speeds of 100 subjects, using a gel pen to write are shown in the figure 4.1, 4.2, 4.3 and 4.4

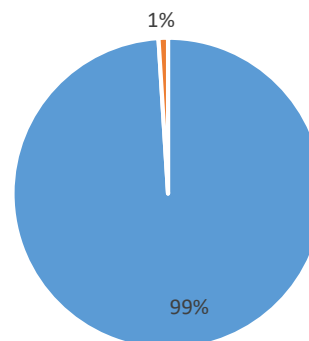
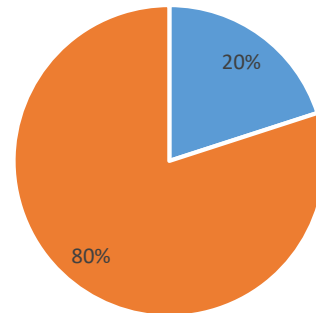


Figure 4.1:slow speed S1

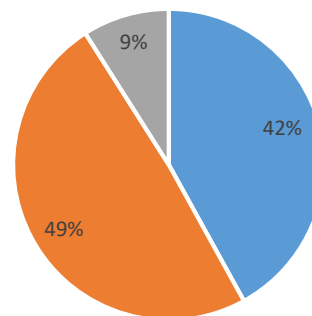
From the figure 4.1, 99% of the subjects' writing samples were clearly visible, indicating that the writing is legible when done in a slow speed S1. Only 1% of the subjects' writing had some words that were unclear, which were subsequently classified as moderately legible.

Figure 4.2: normal speed S2



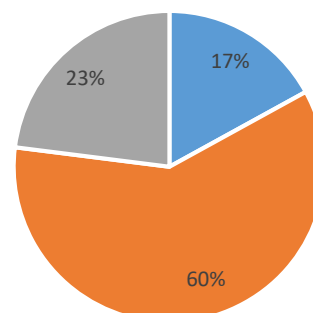
From the graph it was depicted that 80% of the subjects' writing was clearly visible indicating that the writing is legible when the samples were written in normal speed S2. And around 20% of the subjects' writing was unclear, which then classified as moderately legible.

Figure 4.3: speed S3



As the speed changed to increased speed S3, 42 % of the subjects' writing was clearly visible, indicating that the writing is legible, 49% of the samples had few words unclear while writing in fast speed S3. And around 9% of the subjects' writing none of the words were clear so it is then classified as illegible.

Figure 4.4: high speed S4



When the samples were written in high speed S4, the legibility reduced. That is only 17% of the subjects' writing were clearly visible indicating the samples were legible, 60% of the writing samples had few words that were unclear so it was classified as moderately legible. And also 23% of the subjects' writing none of the words was clear so it was classified as illegible.

Overall it was discovered that when the subject wrote samples with gel pen, the subject's writing legibility decreased as the speed increased. Majority of the samples were moderately legible and few illegible but the percentage of the samples with legible reduced comparatively.

CONCLUSION

From this study it was observed that there is an influence of pen on handwriting which is aligned with the expected outcomes, that is as the speed increases the pressure decreases; as the speed increases the writing legibility may decrease and also give a positive effect of pen on different speeds.

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