

Graphology: An Empirical Investigation into the Correlation Between Handwriting Features and Personality Traits

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ABSTRACT

Handwriting is the combination of mental and muscular deviation resulting in a nerve-muscular reaction and giving the writing its individuality. Handwriting constitutes the personality traits of an individual which comes under graphology. Graphology is the analysis of handwriting in an attempt to determine the writer's personality traits. Personality can be identified through various handwriting features such as baseline, slant, size, spacing, margin, pressure, etc. This research provides an outline of forensic graphology, to find out the personality of an individual with the help of the characteristics of the handwriting and its related personality traits, overview of the handwriting analysis pattern and a literature survey of the existing papers on handwriting analysis.

Key words: handwriting, graphology, personality traits.

INTRODUCTION

Handwriting is a neuro muscular phenomenon in which there is the combination of muscle with mind connection, the individual imagine the image and imprint it on the writing surface. Our body is controlled by our mind, so in some extent the handwriting exhibits the mindset of an individual. One of the special ways we can communicate with others and express what's on our minds is through

handwriting.(1) Handwriting reveals a person's actual nature in a variety of ways, such as behaviour, emotional expression, self-worth, rage, inventiveness, honesty, phobias, and defences. Graphology is the name of the science. Graphology is a scientific approach that uses the forms and word patterns found in handwriting to identify, evaluate, and comprehend the personality of the writer. Numerous industries, including psychology, medicine, hiring, career guidance, writer identification, forensic investigations, and hiring, use handwriting analysis.(2) Graphologists are qualified handwriting examiners who use handwriting samples to determine a person's personality. The expert at interpreting handwriting to determine character is known as a graphologist. Graphologists analyze multiple handwriting features in order to assess the psychological aspects of the writer, such as the weights of strokes, the trajectory of writing, the way the letters “t” , “y” , “g” are written or how the text is positioned on the page. One expressive approach to reveal a person's nature, psychology, and behavior is through their handwriting. (3)

Graphology is not a brand-new field of study. Handwriting became popular 400 years ago. With good reason, Camillo Baldi is referred to as the father of graphology. He conducted methodical studies on handwriting style and penned the first graphological essay in 1622.

A man's handwriting at fifty might not be the same as it was at eighteen or twenty, and if he lives to be eighty or ninety, it will almost certainly exhibit additional signs of aging. This fact merely highlights the connection between handwriting and personality, as it is consistently observed that when a person's penmanship style changes, so does their personality. Our natures are greatly altered by experience and life's ups and downs, and these changes also have an impact on our handwriting. The difference is highly noticeable in some people, but very modest in others. (4)

Inferring a person's character from their handwriting is known as graphology. Graphology is based on the premise that handwriting is a type of personality expression. As such, personality qualities can be identified via a methodical examination of the formation of words and letters. Graphologists take note of details including letter sizes, ornamentation, angularity, curvature, and the degree and regularity of slanting. The overall style and impression of the writing, the force of the upward and downward strokes, and the writing's smoothness are further fundamental factors.(5)

We can see that every individual writes in a unique way, thus it makes sense to assume that every aspect of his writing indicates a certain quality or inclination about him. There are distinct variances that are connected to the writer's emotional and physical conditions. This identifies the differences between the writings of the two authors. We can notice variations with respect to angularity, slope, speed, pen pressure, letter and word spacing, relative dimensions of letters, connections, pen movement, writing skill, and line quality, etc.(6)

Handwriting being an acquired characteristic is affected by a number of internal and external factors. These are:

Writing Material- Paper, pen, ink, pencil, writing surface, etc. can contribute in the variation in the handwriting.

Physical or Psychological factors- Excitement, fear, illness, anger, nervousness, confusion, age, injury, influence of drugs or alcohol can adversely affect the handwriting of an individual.

Age- Old characteristics are modified or dropped with the passage of time and the new characteristics are acquired. In old age, more tremors may be present or improper letter formation may be there.

Natural Variations- No two writings of the same individual are same. If a person writes the same word or signature a number of times, the variations in all the signatures or words are never alike and they occur naturally. (7)

It is only essential to remark, setting aside all debate or belief, that accurate and scientific research has clearly demonstrated a direct correlation between the numerous attributes of handwriting and the penman's character. It has been extensively shown that a person's chirography may reliably predict his or her temperament and disposition. After we are trained to write, our handwriting changes depending on our personalities. This is due to the fact that our handwriting represents our psychological patterns in symbols on paper that are as distinct as our DNA. You can identify whose handwriting it is, as with a famous artwork or portrait, after you learn to know someone's handwriting well enough. The foundation of graphology is the idea that each person's handwriting has a distinct

personality that is solely attributed to that person's individuality. Therefore, the writer's departures from the copybook are what enable skilled graphologists to most accurately evaluate the writer's abilities and character. (8)

Handwriting Characteristics

There are many features of handwriting like the baseline, slant, pen pressure, alignment, spacing, speed, size, writing movement, line quality, loop formation, etc. that can be used to reveal the personality of a person. Various writing features that can be used to predict personality traits are given as follows:

1. Baseline

Baseline is an imaginary line on which letters are written. If the paper is with no imaginary line, then writer assumes their own baseline according to his/her writing style. Therefore, writing can be straight, ascending, descending, concave, suicidal or erratic.

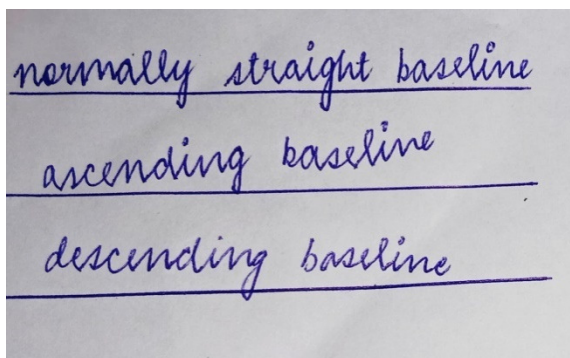


Fig.1

2. Slant

When writer writes assuming imaginary line, each letter in the sentence can be at 90 degree, below 90 degree or above 90 degree. If each letter in the sentence is at 90 degree then writing is considered as vertical slant. If it is below, then

considered as forward slant and if above 90 degree, then considered as backward slant.

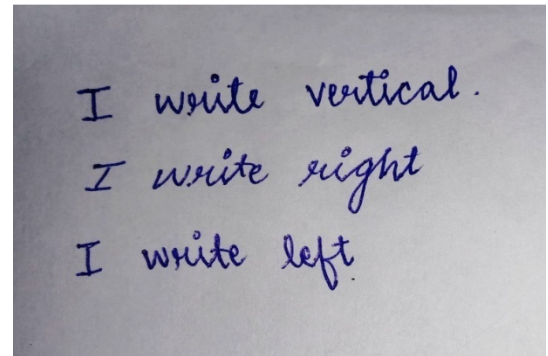


Fig.2

3. Pen Pressure

The amount of the force exerted at the time of writing is considered as pressure of pen. Pen pressure may be heavy/more, light/less or medium/average. It is examined from the width of the strokes, edges of the strokes and deposition of ink on the strokes at the terminals or at the point of turning.

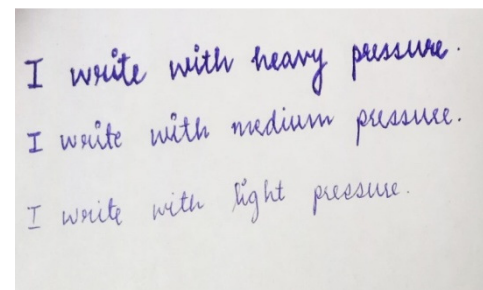


Fig.3

4. Spacing

In handwriting, spacing implies the distance maintained between the lines, words and letters by the writer. Spacing can be categorized into

wide/more or narrow/less or medium/average. The rules of writing dictates one to two letters space between words. Sufficient space must be given between the lines to prevent intermixing of upper and lower loops.

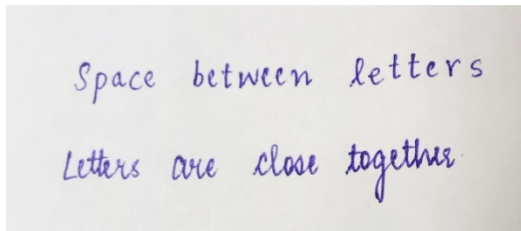


Fig.4

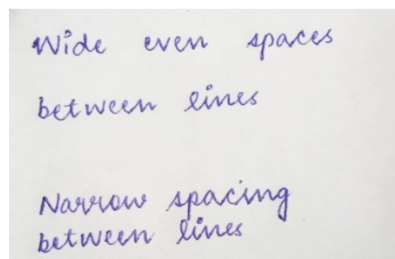


Fig. 5

5. Speed

Amount of time it takes for a writer to execute a writing is called writing speed. The speed is judged from the quality of strokes as it cannot be measured. The writing speed may be good/rapid, medium/average, and slow/less. Higher the movement, higher the speed, higher the skill.

6. Tremors

The tremor in actual is the deviation from the normal direction of the course of writing which may be due to illiteracy, physical weakness, illness, old age, intoxication or due to forgery.

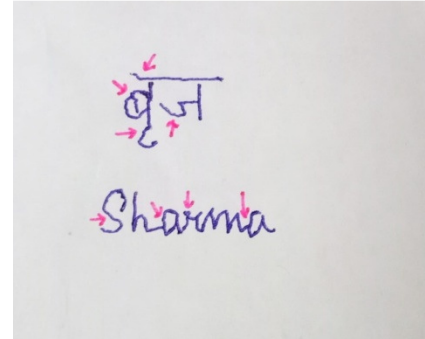


Fig. 6

7. Size

Large writing indicates an individual with initiative, liveliness, enthusiasm, generosity, imagination and the ability to make emotional judgements. Small-sized writing indicates an individual with good concentration, precision, thoroughness, modesty and intensity.

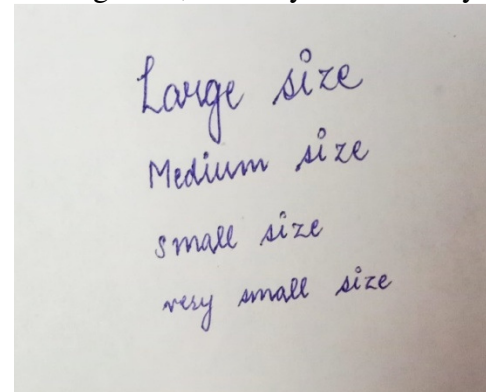


Fig. 7

8. Letter 't' formation

There are various ways of forming letter 't' which reflects a writer's personality. T-bar may be heavy or light in shading. Size of t-bar may be long or short. T-bar may be placed in the upper portion, in the middle portion or in the lower portion.

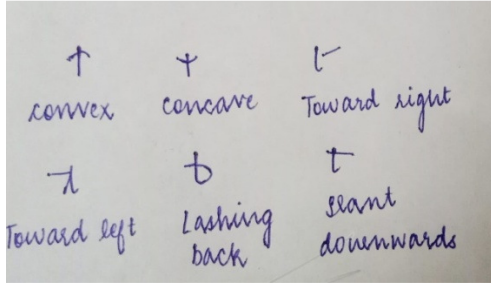


Fig. 8

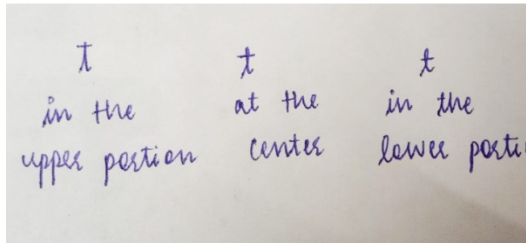


Fig. 9

9. Loop formation

Complete twisting of the stroke at the point of turning in continuous pen operation. Loop may be inked or open in nature.

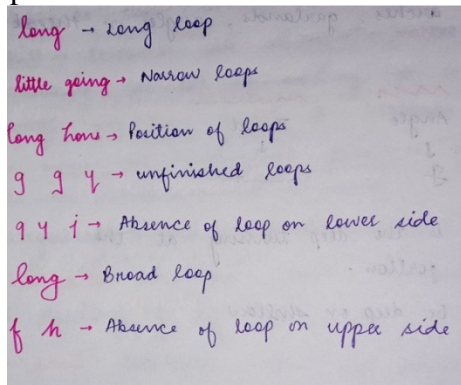


Fig. 10

10. Placement of 'I' dot

I-dot may be heavy or light in shading. I-dot may be in the form of a circle or slash or pointed. I-dot may be to the left of the 'I', high over the 'I' or right over the 'I'.(9)

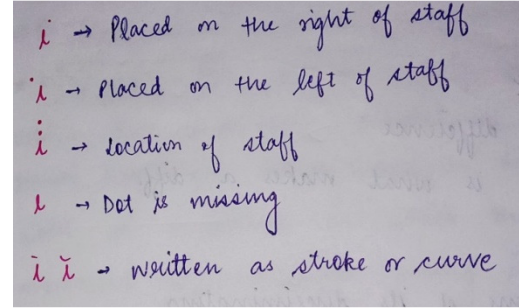


Fig. 11

There are basically two ways in which handwriting analysis can be done to identify personality traits. These two methods are:

- Manual analysis
- Automatic handwriting analysis through computer

Manual analysis

Graphology, also known as handwriting analysis done by hand, is performed simply by the graphologist, who uses a variety of tools, including a magnifying glass, to examine the provided handwriting, note its features, and then use these features to infer the writer's personality. Manual analysis depends on the graphologist's expertise and observation. Following the acquirement of the handwriting sample, the graphologist searches for and attempts to identify the different handwriting features in order to assess the personality of the writer. The features that can be looked for identifying personality traits are – word spacing, letter formation, speed, pen pressure, slant, alignment, baseline, pen pause, line spacing, etc. All these features have their own importance in graphology.

Automatic handwriting analysis through computer

Manually extracting the features from the provided handwriting sample could be laborious and prone to mistakes. It's likely that some aspects were missed during the manual analysis of the sample, and that the script or content of the provided handwriting sample had an impact on the graphologist's findings. Therefore, computers are utilized to help the graphologists and get beyond these constraints. Software is available to assist graphologists in doing analyses more quickly and accurately. The computer-aided graphology (CAG) system is one that allows the graphologist to use the computer to analyze handwriting more quickly and accurately and to get a personality description. The input in the CAG system is the handwriting and the output is the identification of the personality of the writer.

The steps involved in the CAG system are as follows:

- i. Scanning
 - ii. Preprocessing the image
 - iii. Feature extraction
 - iv. Analyzing features
1. **Scanning:** It involves the scanning of the handwriting sample.
 2. **Preprocessing the image:** This step involves cropping of the image so that extra pixels of the image can be removed and image can be converted from RGB image (Red, Blue, Green image) to Gray scale image. After this step, a

binary image of the handwriting sample is obtained which can thus be used for feature extraction.

3. **Feature Extraction:** This step involves segmentation of the image. Each segment is studied to extract the numerous features of handwriting sample such as slant, alignment, spacing, etc.
4. **Analyzing features:** This phase involves interpreting the features that were extracted. In this step, graphology rules are applied using a CAG system with context-free grammar. All that a context-free grammar is a collection of recursive rewriting rules that are used to generate string patterns.

After performing the interpretation step, results are obtained that can be printed and as well as can be stored. (10)

REVIEW OF LITERATURE

Seemant Deshpande (2016) proposed a comprehensive review of graphology, focusing on handwriting analysis as a method of identifying and evaluating personality traits. It emphasizes that handwriting is unique to each individual and is a reflection of their neurological brain patterns, with each stroke or written movement revealing specific personality traits. The study deals into various handwriting measurement criteria, including baseline, slant, size, pressure, spacing, zones, and connecting strokes. The classification phase is highlighted as a crucial step to identify different personality traits, often utilizing Artificial Neural Networks (ANN) for this purpose. The paper also emphasizes the potential applications of automated handwriting analysis systems in

detecting diseases like Parkinson's and cancer, as well as personality recognition. Furthermore, the document outlines the proposed work, which involves providing training time for a neural network to predict human behavior using ANN. It emphasizes the significance of training the system with examples to achieve accuracy and subsequently creating software that can copy tested handwritten words for use in other documents. The references cited in the document offer additional insights into handwriting analysis, including studies on individualistic traits prediction, personality profiling, and the development of automated handwriting analysis systems, providing a comprehensive overview of the topic. The proposed work focuses on training neural networks to predict human behavior and creating software for copying handwritten words, with an overarching goal of reducing human efforts in pen and paper work. (11)

Subhankar Ghosh, Palaiahna kote Shiva kumara, Prasun Roy ,Umapada Pal , Tong Lu (2020) presented a research article titled "Graphology based handwritten character analysis for human behaviour identification" published in CAAI Transactions on Intelligence Technology. The study focuses on the development of an automatic method for analyzing handwritten English lowercase characters from a to z to identify human behaviors. The proposed method extracts structural features such as loops, slants, cursive, straight lines, stroke thickness, contour shapes, aspect ratio, and other geometrical properties to derive hypotheses based on a dictionary of Graphological rules. The derived hypothesis categorizes personal, positive, and negative social aspects of an individual. An automatic system was developed to evaluate the proposed method, which achieved an accuracy of 86.70% based on 5300 responses from users. The

study contributes to the development of an automatic system for identifying human behaviors based on handwriting at the character level, using graphological rules and structural feature extraction. (12)

Siew Hock Ow, Kean Siang Teh and Li Yi Yee (Malaysia) (2005) highlighted the three main elements of modern graphology :research, development, and education; script psychology and interpretation of handwriting; and forensic comparison and identification. It also discusses the role of graphology in career guidance , emphasizing the importance of understanding one's interests, strengths, abilities and personality type. The paper emphasizes the significance of understanding one's personality when making career decisions, citing the "Big Five" model and Dr. John Holland's "Career Personality Theory" as two well-supported classification systems. Additionally, it provides insights into the various computerized handwriting analysis systems available in the market, detailing their features, functionalities, and applications. it provides a detailed comparison of five computerized handwriting analysis systems, including Jerral Sapienza's Self-Analysis, Andy Hunt's Graphonomizer, Handwriting University's Handwriting Wizard, Sheila Lowe's Handwriting Analyzer, and Garth Michaels' Handwriting Analyst, outlining their unique features, applications, and functionalities. (13)

Francesco Galvano, Maria Elena Caporale and Conchita Siliquini (2023)proposed the document "Graphology in Forensic Contexts: Unveiling Personality and Behavior through Handwriting Analysis. The text highlights the significance of graphological analysis in uncovering hidden personality traits and behaviors through meticulous examination of visual aspects

and writing movements. It also emphasizes the role of graphological consultants in interpreting written traces, requiring a combination of graphological analysis with psychological and scientific knowledge. The document provides insights into several case studies involving individuals such as Theodore Kaczynski, also known as the Unabomber, and Luka Rocco Magnotta. It shows the pivotal role of text analysis, particularly forensic linguistics, in unraveling the deceptive online presence and criminal activities of these individuals. (14)

Pierre E Cronje and Hester E Roets (2013) proposed an article in the *Universal Journal of Psychology* in 2013 explores the use of graphology, specifically the holistic approach, as a valuable tool in psychological assessment and diagnosis. The study aims to determine whether graphology can provide insights into a writer's state of mind at the time of writing, shedding light on syndromes and personality disorders. The holistic approach to graphology is emphasized as a powerful expressive projective technique that can be compared to clinical findings, demonstrating strong similarities and confirming its relevance in psychological assessment. The study highlights the importance of understanding the psychodynamics of handwriting and its link to the brain. The study's methodology involves a qualitative approach in research, with five handwriting samples analyzed using a structured holistic approach, involving the assessment of Gestalt, form standard, dominant features, subdominant features, and synthesizing the results to provide valuable information about personality factors, thinking style, and subconscious drives. The findings confirm a positive correlation between holistic graphological findings and clinical and personality assessment, supporting the

viability of graphology as a useful tool in psychological assessment and diagnosis. (15)

Nidhi Pandya, Mohan Bose and Prof. Dr. Himanshu Pandya (2023) published "Exploring Personality Traits in Offenders through Graphological Assessment" which deals into the analysis of personality traits in individuals with criminal backgrounds using graphological methods. The study employs two primary approaches for handwriting analysis: the Trait method, which dissects handwriting into distinct traits, and the Gestalt method, which considers the handwriting as a complete entity. The research aims to determine the personality dimensions of offenders charged under section 302 of IPC by comparing their handwriting with that of a control group. The methodology involves using the Trait-stroke method in graphology and the Maudsley Personality Inventory (MPI) questionnaire to obtain insights into the participants' personality dimensions. The control group exhibits a higher percentage of emotional stability and extroversion. The comparative results between MPI and graphology show no significant difference in the extroversion-introversion percentages, suggesting consistency in the findings. The study acknowledges the potential implications of the findings for forensic psychiatry and the practical applications of handwriting analysis in understanding individual behavior. (16)

Hemlata, Manoj, Sachan and Shailendra Kumar Singh (2018) proposed a document that explores the field of personality detection using handwriting analysis, also known as Graphology. It outlines the features of handwriting that can reveal personality traits, including zones, baseline, slant, size, spacing, margin, and pressure.

The paper discusses the distinction between manual and automated handwriting analysis, emphasizing the advantages of automated analysis in terms of speed, accuracy, and cost-effectiveness. It also mentions the use of machine learning tools, neural networks, and unclear inference systems to improve the efficiency of handwriting analysis for personality detection. The document concludes by presenting the handwriting analysis system (HAS) and discussing the steps involved in personality detection, including scanning, preprocessing, segmentation, feature extraction, and classification. It also addresses the future scope of HAS, suggesting the creation of a language-independent tool, a fully automated system, and a tool to recognize changes in an individual's personality through handwriting. (17)

Amarnath Mishra (Amity University, Noida) (2017) proposed a research paper that discusses the field of forensic graphology, which involves the analysis of handwriting to determine personality traits and behavioural aspects of individuals. Forensic graphology is particularly relevant in cases involving ransom notes, blackmailing letters, and pen poison letters, aiding in criminal profiling by determining the psychological state of the writer and identifying the author. The study involves the integrative and holistic graphology, which focus on strokes and their relation to personality, as well as form, movement during writing, and use of space, respectively. Handwriting analysis is utilized in various applications such as job applications, recruitment, compatibility assessment for marriage, career guidance, and understanding child behaviour and development. This research paper outlines the manual and computerized methods for analyzing handwriting, highlighting the

features such as word spacing, line spacing, page margins, pen pressure, slant, and size and proportion of letters, each of which provides insights into the writer's personality and behavioural traits. This paper also discusses the methodology for handwriting analysis, detailing the manual and computerized approaches. In the manual method, forensic investigators use handwriting patterns to determine personality traits and behavioural aspects of individuals, while computer-aided graphology systems enable more efficient and error-free analysis. Moreover, the importance of features like alignment, position and shape of i-dots, and T-bars in handwriting analysis is discussed, with each revealing specific personality traits. (18)

G. Sheikholeslami, S.N. Srihari and V. Govindaraju (1999) published a paper that discusses the process of feature extraction in the context of computer-aided graphology systems. It begins by introducing the concept of feature extraction in the context of image processing, highlighting the significance of scanning and pre-processing in this process. The document includes a figure depicting the structure of a Computer Aided Graphology system, emphasizing the importance of these features in the overall system. Furthermore, it involves specifics of pre-processing, showcasing the intricate steps involved in this stage. The document then moves on to discuss feature extraction, underscoring its relevance in obtaining meaningful insights from processed images. Additionally, the document outlines the significance of analyzing features; emphasizing the critical role they play in understanding and interpreting the characteristics of the processed images. The paper also underscores the relevance of feature extraction in graphology systems, shedding light on its role in deciphering and

analyzing handwritten text. Overall, it serves as a valuable resource for understanding the complexities and importance of feature extraction in the field of computer-aided graphology. (19)

METHODOLOGY

Sample Collection

Handwriting samples of 30 individuals were taken on an A4 sheet. The individuals taken for handwriting identification belonged to age group 15-50 years in which 10 were males and 20 were females. The maximum amount of samples was from the age group of 19-23 years.

The graphology or handwriting analysis was done in a manual way simply by the researcher who examined the provided handwriting using a magnifying glass and other tools, notes different aspects of the handwriting, and then used these features to infer the writer's personality. The researcher's expertise and observation were essential to manual analysis. Following the acquisition of the handwriting sample, the researcher searched for and attempted to identify the different handwriting characteristics in order to assess the personality of the writer.

The characteristics that can be observed while identifying personality traits are:

Word spacing, Speed, Letter 't' formation, Slant, Baseline, Letter 'm' formation, Looped or retraced 'l', Looped or retraced 't', Placement of dot in letter 'i', Alignment, Initial and ending strokes, Pen pressure, Pen pauses, Position and shape of 't' bars and Line spacing

These features have their crucial meanings and therefore these characteristics should be

observed and studied carefully to identify the individual's personality trait.

Instrumentation

For the examination of the characteristics of the handwriting, the hand magnifying lens was used. The magnification of the hand lens was 10X. All the characteristics such as connection, retouching, pen pause was thoroughly examined with help of magnifying glass. For the examination of intersecting strokes and for the examination of formation of strokes stereo microscope was used.

Hypothesis

- The hypothesis of this research is that handwriting, as a neuromuscular phenomenon, reflects the mindset of the individual, thereby allowing an analysis of psychological states through handwriting characteristics.

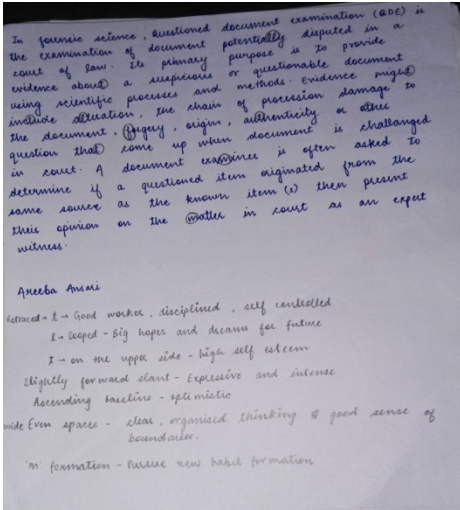


Fig.12 HANDWRITING SAMPLE RESULT

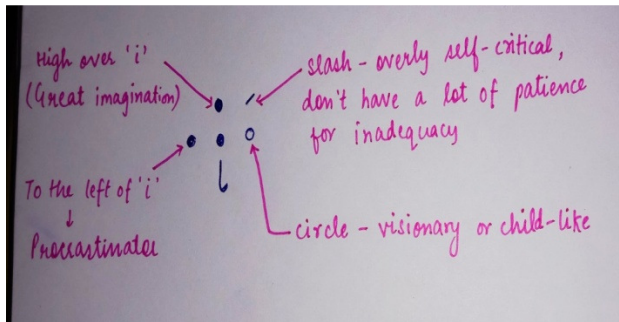


Fig. 13- Personality trait through 'i' dot

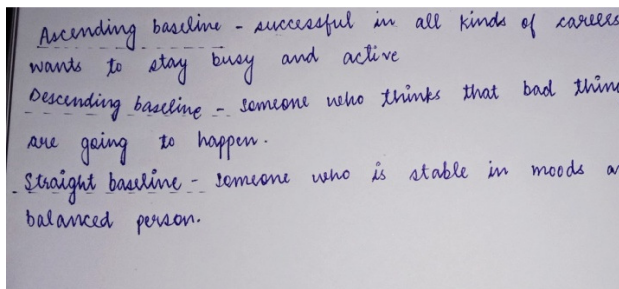


Fig. 14- Personality trait through alignment

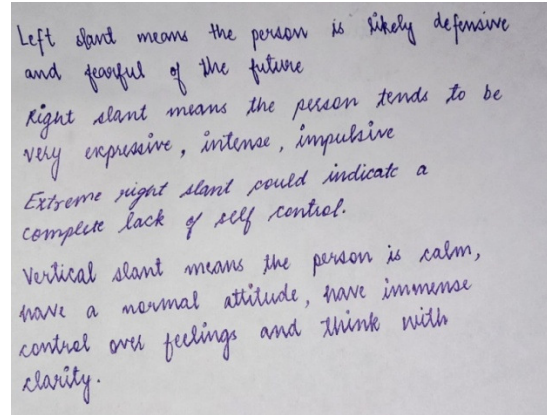


Fig.15- Personality identification through slant

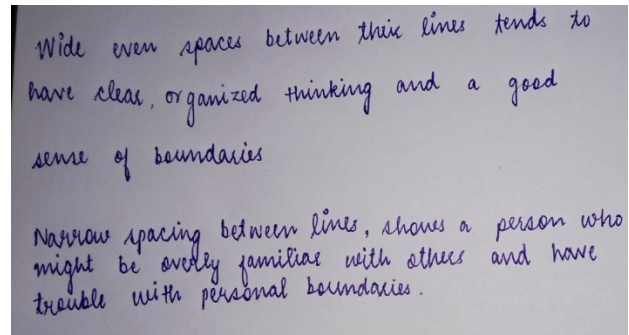


Fig.16- Personality trait through spaces between lines

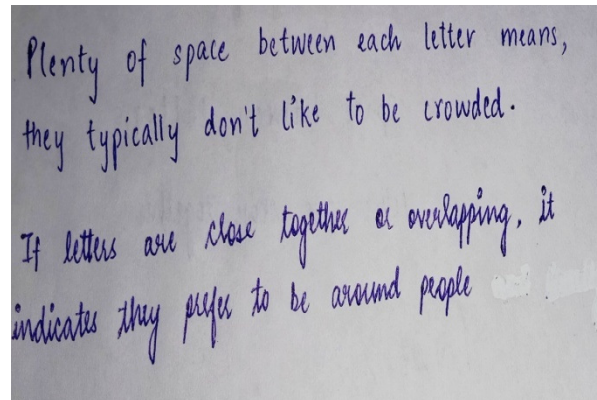


Fig. 17- Personality identification through spaces between letters

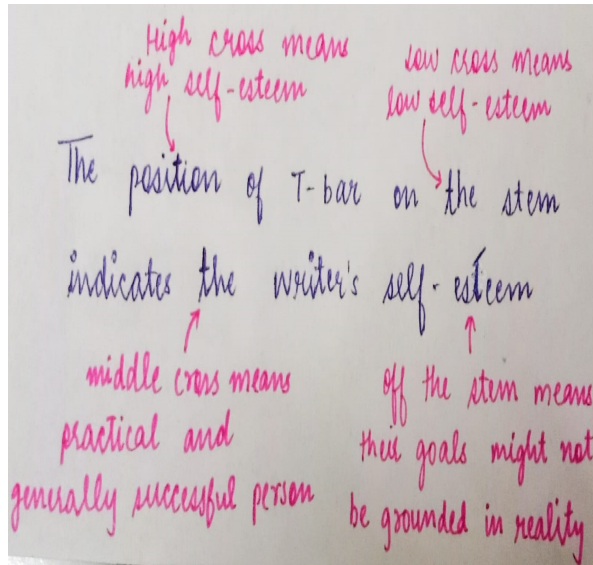
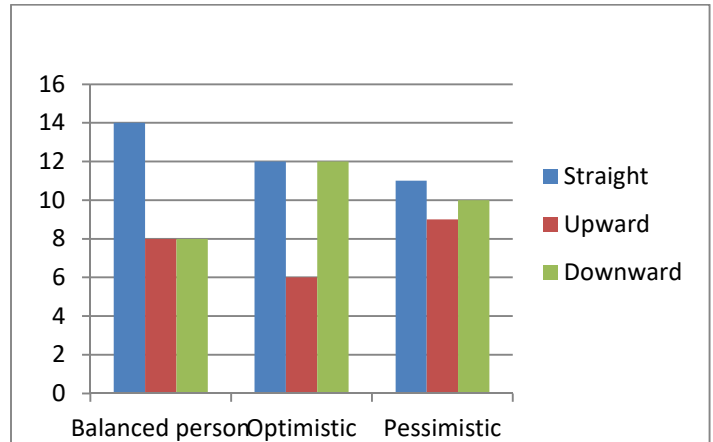
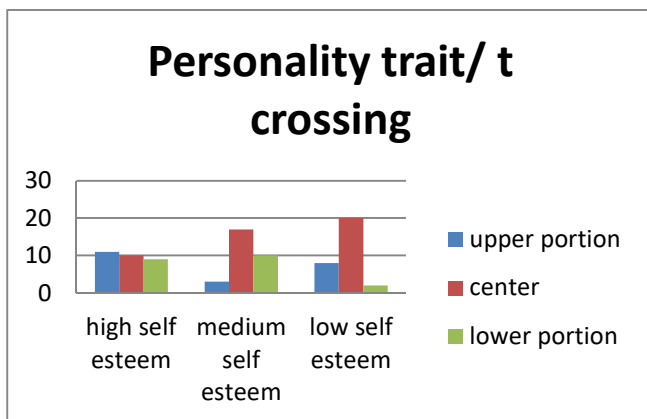


Fig.18- Personality trait through the position of t-cross



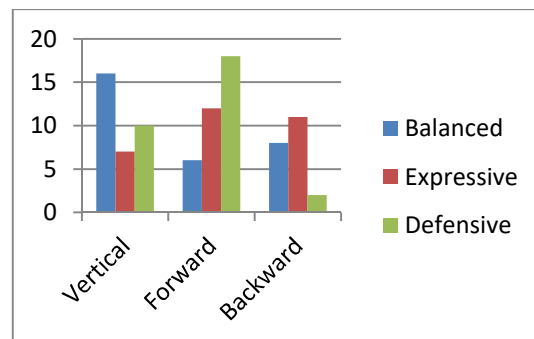
Personality trait with respect to Alignment

This graph shows the comparison between alignment and personality trait. People having straight alignment are generally balanced persons. Individuals having upward alignment are optimistic in nature i.e., positive and confident. On the other hand, persons having downward alignment are pessimistic in nature i.e. negative and defeatist.



Personality trait with respect to t-crossing

This graph shows the comparison of individual's self-esteem with t crossing. Persons having t-crossing in the upper portion have higher self-esteem in comparison to that of t-crossing in the lower portion and at the center. People having centered t-crossing have medium self-esteem whereas people having t-crossing in the lower portion have low self-esteem.



Personality trait with respect to Slant

This graph shows the comparison between personality trait (expressive, defensive and balanced) and handwriting slant. Usually people having forward slant tend to be expressive and intense. Individuals with vertical slant of handwriting are balanced and self-reliant. Persons having backward slant are defensive. They focus more on past

events and may face problems in forgetting bad days.

DISCUSSION

The various handwriting features were observed to identify the personality traits of an individual. Careful study of handwriting samples with the help of magnifying glass was done.

The personality traits that were studied from handwriting are as follows:

1. Relatively large letters might indicate that someone demands attention whereas smaller letters are typically written by someone who is modest and unassuming.
2. Plenty of space between each letter means, they typically don't like to be crowded. If letters are close together or overlapping, it indicates they prefer to be around people and get lonely easily.
3. Left slant means the person is likely defensive, fearful of the future, feels depressed or anxious. Right slant means the person tends to be very expressive, intense and impulsive, confident. Extreme right slant could indicate a complete lack of self-control. People having vertical slant can be calm, have a normal attitude, have immense control over feelings or desires, are mature in terms of conduct and think with clarity.
4. Writing slopes upward from the left means optimistic. Writing slopes downward is considered more pessimistic. Levelled writing means the writer tends to be a pretty balanced person.
5. Wide even spaces between their lines tend to have clear, organised

thinking and a good sense of boundaries. Narrow spacing between lines shows a person who might be overly familiar with others and have trouble with personal boundaries.

6. Balanced loops in letter 'f' indicates that the person is well organised and has managerial ability. Cross form of 'f' indicates concentration. Narrow upper loop in letter 'f' tells that the person is narrow minded. Only upper loop in 'f' means good planners.
7. Looped 'l' indicates that the person has big hopes and dreams for future whereas retraced 'l' tells that the person may have had his hopes and dreams squelched.
8. Looped 't' tells that the person is sensitive to criticism and might be paranoid. Retraced 't' indicates that the person is a good worker, disciplined and self-controlled.
9. Short 't' cross means lack of confidence. Average 't' cross means calmness and self control. Long 't' cross indicates energy, boldness, vigour and resolution.
10. 't' cross : Lighter than the tower tells about extreme sensitiveness.
 - Heavier than the tower indicates great energy
 - Starts thick and ends thin means quick witted and sarcastic
 - Starts thin and ends thick is a sign of cruelty and brutality
 - Connected to the next letter means multi-tasking personality

The following results were obtained through the handwriting analysis of 30 persons:

- The people having t-cross on the upper portion were 11 constituting 36%. The people having t-cross at the centre were 17 constituting 57%. The persons having t-cross on the lower portion were 2 constituting 7% of the total.
- The persons having on the baseline or straight alignment were 14 forming 47% whereas the people having above the baseline alignment or upward alignment were 6 making 20% of the total. The persons having below the baseline alignment or downward alignment were 10 constituting 33%.
- The people having vertical slant in their handwriting were 16 making 53% while the persons having forward slant were 12 forming 40%. The persons having backward slant were 2 constituting 7% of the total.
- Among 30 individuals, 7 individuals face anger issues.
- Among 30 persons, 11 people have big hopes and dreams for their future.

CONCLUSION

From the above research study, we can conclude that the handwriting of an individual reflects his personality traits. Handwriting reveals a person's actual nature in a variety of ways, such as behaviour, emotional expression, self-worth, rage, etc. The identification of personality traits through handwriting analysis is known as graphology. A graphologist is a person who examines the handwriting sample and observes the personality traits of the individual. The handwriting of the individual is identified on the basis of alignment (straight, upward, downward), slant (forward, vertical, backward), spacing (wide, medium or narrow), t-crossing, i-dot, pen pressure, initial and ending strokes, size, etc. Relatively large

letters might indicate that someone demands attention. Smaller letters are written by someone who is shy. Plenty of space between each letter means they typically don't like to be crowded. If letters are closed together or overlapping it indicates they prefer to be around people and lonely easily. Left slant means the person is depressive and fearful of future. Right slant means the person tends to be very expressive, intense and impulsive. Extreme right slant could indicate the complete lack of self-control. The writer who has got a vertical slant is independent and self-reliant. Writing slopes upward from the left means optimistic whereas writing slopes downward is considered more pessimistic. Leveled writing means the writer tends to be a pretty balanced person. t-cross indicates the level of self-esteem. Wide even spaces between lines tend to have clear, organized thinking and a good sense of boundaries. Narrow spacing means the person is familiar with others. These are some of the features that are considered while identifying personality traits of an individual.

Reference

1. Caligiuri, M. P., & Mohammed, L. A. (2012). *The neuroscience of handwriting: Applications for forensic document examination*. CRC Press.
2. DeWitt, D. J. (2017). *BULLYING: Applying Handwriting Analysis to Detect Potential Danger Signs and Effects*. Outskirts Press.
3. Ploog, H. (2013). *Handwriting Psychology: Personality reflected in handwriting*. iUniverse.
4. Marano, G., Traversi, G., Gaetani, E., Sani, G., Mazza, S., & Mazza, M. (2020). Science Repository.
5. West, P. (2012). *Handwriting*. Random House.

6. Storey, A. (2013). *A Manual of Graphology or the Study of Handwriting*. Read Books Ltd.
7. Harris, R. (1995). *Signs of writing*. Psychology Press.
8. Seifer, M. (2008). *The definitive book of handwriting analysis: the complete guide to interpreting personalities, detecting forgeries, and revealing brain activity through the science of graphology*. Red Wheel/Weiser.
9. Srihari, S. N., Cha, S. H., Arora, H., & Lee, S. (2002). Individuality of handwriting. *Journal of forensic sciences*, 47(4), 856-872.
10. Sheikholeslami, G., Srihari, S. N., & Govindaraju, V. (1995). *Computer aided graphology* (Master's thesis, State University of New York at Buffalo).
11. Seemant Deshpande, (2016) " Graphology (To Copy Any Documents In User's Handwriting): A Review " , *International Journal of Advances in Science, Engineering and Technology(IJASEAT)* , pp. 1-3, Volume-4, Issue-3
12. Ghosh, S., Shivakumara, P., Roy, P., Pal, U., & Lu, T. (2020). Graphology based handwritten character analysis for human behaviour identification. *CAAI Transactions on Intelligence Technology*, 5(1), 55-65.
13. Ow, S. H., Teh, K. S., Yee, L. Y., Santiarworn, D., Liawruangrath, S., & Baramée, A. (2005). An overview on the use of graphology as a tool for career guidance. *CMU. Journal*, 4(1), 91.
14. Galvano, Francesco & Caporale, Maria & Siliquini, Conchita. (2023). Graphology in Forensic Contexts Unveiling Personality and Behavior through Handwriting Analysis.
15. Cronje, P. E., & Roets, H. E. (2013). Graphology in psychological assessment: A diagnosis in writing. *Universal Journal of Psychology*, 1(4), 163-168.
16. Pandya, N., Bose, M., & Pandya, H. (2023). Exploring personality traits in offenders through graphological assessment. *International journal of creative research thoughts(IJCRT)*.
17. Hemlata, M. S., & Singh, K. (2018). Personality detection using handwriting analysis. In *The seventh international conference on advances in computing, electronics and communication (ACEC)* (pp. 85-89).
18. Mishra, A. (2017). Forensic graphology: assessment of personality. *Forensic Res. Int. J*, 4(1), 9-12.
19. Sheikholeslami, G., Srihari, S. N., & Govindaraju, V. (1995). *Computer aided graphology* (Master's thesis, State University of New York at Buffalo).