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Handwriting Characteristics as Indicators of Psychological States in Forensic Document Examination

[1]Mr. Kartik Dinesh Bhai Bhatt,[2] Ms. Arpita Sharma, [3]Mr. Karan J. Mehta

(M.Sc Pursuing)
Student - Department of Forensic Science, Parul University, NAAC A++
P.O. Limda, Tal. Waghodia, Dist. Vadodara – 391760, Gujarat State, India
(M.Sc , Ph.D pursuing)
Assistant Professor - Department of Forensic Science, Parul University (NAAC A++),
P.O. Limda, Tal. Waghodia, Dist. Vadodara – 391760, Gujarat State, India.
(M.Sc , Ph.D pursuing)
Assistant Professor - Department of Forensic Science, Parul University (NAAC A++),
P.O. Limda, Tal. Waghodia, Dist. Vadodara – 391760, Gujarat State, India.

Abstract

Handwriting serves as a highly distinctive and personal mode of human expression, subtly revealing aspects of an individual's personality, emotional state, cognitive patterns, and even subconscious movement such as confidence, creativity, honesty, fears, and behavioural mechanisms. Graphology, the systematic study of handwriting's visual features including zones like upper, middle, lower, baseline direction and consistency which are reflecting emotional stability or mood fluctuations, slant indicating introversion extroversion or emotional expressiveness, letter size suggesting self-perception and attention to detail, spacing between letters/words/lines revealing social attitudes and mental organization, margin usage showing boundaries and openness, pen pressure are denoting emotional intensity or energy levels, and specific letter formations enables trained analysts to construct nuanced psychological profiles. This practice extends beyond mere communication to offer insights into deeper traits and has found applications in diverse fields: in psychology, it helps identify emotional states or potential disorders; in medicine, deviations in handwriting can signal neurological conditions like Parkinson's or stress-related issues for early detection; in recruitment and career counselling, it evaluates suitability traits such as leadership, adaptability, or emotional resilience to guide hiring or vocational alignment for greater job satisfaction; and in forensic contexts, it authenticates documents or aids in suspect profiling. While each person's handwriting remains uniquely shaped by lifelong experiences, habits, and innate characteristics, graphology's interpretive power lies in these interconnected features, despite persistent scientific controversies major reviews and meta-analyses consistently classify it as a fraud with weak empirical validity or reliability for correctly forecasting behaviour, job performance, or traits in people, with graphologists often performing no better than non-experts in controlled studies. Nevertheless, graphology endures as a fascinating, interdisciplinary tool for exploring human behaviour, combining psychological understanding with artistic observation, even as discussions about its evidence-based foundation continue to draw attention to the conflict between thorough scientific examination and experiential success.

.**Key words** Handwriting, Handwriting Analysis, Feature Extraction, Psychological Analysis, Personality Trait.

Introduction

handwriting analysis has been conducted and used as a distinct, specialised, and developing scientific method. However, its efficacy and dependability as a technique for evaluating behaviour and personality are still up for debate. [1] A neurological brain pattern can be used to represent the personality trait; such patterns build neuromuscular movements [2] Hand writing analysis has been widely explored in forensic psychology, clinical psychology, and neurology to assess personality traits, emotional disturbances, and neurological disorders.

Professional handwriting examiners who identify the personality through the handwriting samples are called graphologist. [3] Emotional states play a crucial role in shaping handwriting patterns. For instance, stress and anxiety often lead to erratic, pressured, or inconsistent handwriting, whereas depression may manifest in smaller, more compressed letters with reduced writing pressure. Similarly, individuals experiencing excitement or confidence tend to produce larger, more fluid handwriting.

This review paper aims to examine the psychological effects on handwriting by reviewing empirical studies and theoretical frameworks in psychology and neuroscience. It will explore how various psychological states influence handwriting characteristics, the role of handwriting analysis in mental health assessment, and the potential applications of handwriting studies in forensic and clinical settings. By understanding the connection between handwriting and psychological states, the study aims to avoid the drawbacks of the conventional approach while utilising the benefits of handwriting analysis as a nonverbal, supplementary test system within the framework of personality assessments. [4]

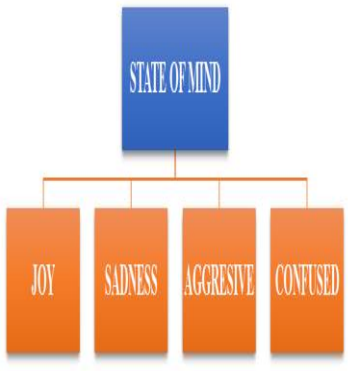

Chart 1: showing the state of mind

Joy State:

Handwriting in a joy mood is generally more expressive, free-flowing, and aesthetically pleasing processing. When a person feels joyful, the brain releases dopamine and serotonin, this neurological shift results in handwriting which enhance writing skills, reduce tension, A confident, gregarious and expressive personality is usually reflected in handwriting with a greater slant, smooth flow, even spacing and large letter size. An elevated slant frequently denotes an emotionally receptive and communicative individual. Handwriting that flows well conveys emotional stability, mental clarity and ease of thought expression. A balanced and well-organized mindset is demonstrated by the writer's ability to maintain appropriate boundaries in social situations, as evidenced by the even spacing between words and letters. Furthermore, extroverted people who are enthusiastic, attention-seeking and at ease in social situations are typically linked to large letter sizes. All of these characteristics suggest a dynamic, confident and talkative personality.

Sadness State:

When a person feels sadness, the brain releases lower levels of dopamine and serotonin, this neurological shift results in handwriting that appears weak, inconsistent, or restrained. The motor system, which is influenced by emotional states, slows down, causing hesitation and irregularities in handwriting. Smaller letter sizes, erratic pen pressure, close spacing, and a slow writing motion are all signs of a reserved, reflective and potentially emotionally troubled person. A smaller letter size is usually linked to an introverted, focused, and detail-oriented person. Unusual pen pressure could be a sign of stress, emotional instability, or erratic energy levels. A propensity for overanalysing, anxiety, or a need for security and intimacy can be indicated by a lack of space between words and letters. Low energy, exhaustion, or depressive tendencies may be associated with slow writing movement, which frequently reflects a cautious, deliberate thought process. When combined, these handwriting characteristics could indicate a highly reflective personality or psychological distress.

Aggressive State

When someone is angry, their body releases more cortisol and adrenaline, which triggers the fight-or-flight reaction. Handwriting is affected by this physiological state, which causes tense muscle movements, the author's psychological and emotional instability is reflected in the aggressive

handwriting, Handwriting that exhibits angular shapes, slant variation, heavy pen pressure, and irregular spacing is frequently a sign of psychological conflict, emotional intensity, and internal tension. Strong feelings, resolve, and occasionally hostility or stress are indicated by heavy pen pressure. Inconsistent thought patterns, impulsivity, or trouble regulating emotions can all be indicated by irregular letter and word spacing. Slant variation frequently illustrates mood swings or emotional instability, demonstrating how the writer's emotions can change quickly. In handwriting, angular shapes usually indicate a critical, analytical, or even confrontational mindset from the writer, who may be expressing impatience or a strong will. When combined, these characteristics may show a complex personality coping with high emotional arousal or internal conflict.

Confused State

Handwriting in confused person's handwriting exhibits erratic, inconsistent, and uncoordinated characteristics. These irregularities help experts determine whether the confusion was due to psychological distress, cognitive impairment, intoxication, or intentional deception. Pen pressure variations, shaky strokes, rewritten letters, and irregular spacing in handwriting are frequently signs of emotional distress, anxiety, or insecurity. Regular variations in pen pressure may be a sign of mental instability or shifting emotional states. Handwriting that is shaky could indicate anxiety, physical weakness, or mental stress. Rewriting letters frequently reveals a lack of confidence and may be a sign of self-doubt, hesitation, or a desire for perfection. Unusual letter and word spacing can be a sign of mental disarray, confusion, or internal conflict. When taken together, these characteristics suggest that the writer may be dealing with stress, psychological discomfort, or cognitive overload. [5]

Literature Reviews

Detecting Honest People's Lies in Handwriting: The Power of the Ten Commandments and Internalized Ethical Values [6], Thomas Li-Ping Tang's article examines how handwriting analysis can detect deception, even in honest individuals, by focusing on the style of writing rather than its content. The study introduces eight principles for identifying lies through handwriting features like inconsistent pressure or irregular letter forms, which may reflect internal conflicts influenced by ethical values or moral frameworks, such as the Ten Commandments. This approach is significant because it shifts the focus from what is written to how it is written, offering a novel perspective on graphology's role in communication and deception detection. The paper suggests that handwriting analysis can provide subtle cues about truthfulness, making it a valuable tool in psychological and forensic investigations.

Handwriting Differences in Individuals with Presence and Absence of Antisocial Behaviour [7] This 2021 study by Puja Singh and Dr. Kamini Tanwar investigates whether handwriting can reveal criminal tendencies by comparing samples from individuals with high and low levels of antisocial behaviour. The findings indicate that those with high antisocial tendencies often produce monotonous, stiff, and abnormal handwriting, reflecting hidden psychological characteristics and internal conflicts. These distinct writing patterns provide insights that could inform prevention and intervention strategies for criminal behaviour. The study highlights graphology's potential as a diagnostic tool in criminology, suggesting that specific handwriting traits can serve as early indicators of antisocial tendencies, thus contributing to proactive measures in behavioural management.

Do Differences in Sex Hormones Affect Handwriting stylea? Evidence from Digit Ratio and Sex Role Identity as Determinants of the Sex of Handwriting [8] Published in 2005, this study by John R. Beech and Isla C. Mackintosh explores the influence of biological factors, specifically prenatal sex hormones, on handwriting style and its perceived gender. The authors focus on the 2D:4D digit ratio (index-to-ring finger length ratio) as an indicator of fetal hormone exposure. In a study of 120 participants, raters correctly identified the writer's gender in two-thirds of handwriting samples. The results showed that women with lower digit ratios (indicating higher prenatal testosterone) exhibited more masculine handwriting traits, while no significant hormonal effect was found in men. This

suggests that prenatal hormones shape handwriting characteristics, particularly in women, offering a biological perspective on how gender differences manifest in script and their implications for personality analysis.

Survey on Handwriting-based Personality Trait Identification [9] This paper, published in a 2015 conference proceeding, explores the connection between handwriting features and personality traits through the lens of graphology, also known as grasphoanalysis. The authors, Mahesh Ramanna Gowda and colleagues, emphasize that personality is shaped by values, attributes, and habits, which can be reflected in handwriting characteristics such as slant, size, and pressure. The study reviews how graphology links handwriting to personality psychology, focusing on feature extraction techniques to identify traits like extroversion or emotional stability. It advocates for computer-based graphology systems to enhance the accuracy and objectivity of personality predictions. By highlighting the potential of automated analysis, the paper underscores the need for technological advancements to make graphology a reliable tool in psychological assessments, offering a foundation for further research in digital handwriting analysis.

Handprints of the Mind: Decoding Personality Traits and Handwriting [10](Chaudhari & Thakkar, 2019) Published in 2019 after revisions, this study by Kinjal Chaudhari and Ankit Thakkar investigates the relationship between handwriting analysis and clinical personality assessments, specifically in children. The authors compare handwriting characteristics with results from the Children's Personality Questionnaire to determine if graphology can reliably identify personality traits. Their findings show no significant differences between the traits identified through handwriting and those from the questionnaire, supporting the null hypothesis that both methods are comparably reliable. This suggests that handwriting analysis can serve as a complementary tool in clinical settings, offering a non-invasive way to assess personality without contradicting standardized psychological tests. The study highlights the potential of graphology in child psychology, encouraging further exploration of its diagnostic applications.

Personality Detection using Handwriting Analysis: Review [11] In this 2018 conference paper, Hemlata, Manoj Sachan, and Shailendra Kumar Singh provide a comprehensive overview of handwriting analysis, or graphology, as a method to reveal personality traits. The authors explain that handwriting is a unique characteristic that reflects traits through features like zones (upper, middle, lower parts of letters), baseline, slant, size, spacing, margin, and pressure. The paper discusses graphology's applications in psychology for therapy, medical diagnosis for mental health, career counselling to match personalities with jobs, and forensic studies for document authentication. By reviewing existing literature, the study highlights the versatility of handwriting analysis but notes the need for more empirical validation to address criticisms of graphology as a pseudoscience, paving the way for its integration into scientific fields.

Formalized Computer-Aided Handwriting Psychology: Validation and Integration into Psychological Assessment [12] Published in 2020, this study by Yury Chernov and Claudia Caspers validates the integration of computer-aided handwriting analysis with the 16PF-R personality test to enhance psychological assessments. Participants completed the 16PF-R test and provided handwriting samples, which were digitized and analyzed using the HSDetect software. The results showed strong correlations between handwriting features and the 16PF-R scales, demonstrating that computer-based analysis improves the objectivity of personality evaluations by reducing human bias. This study is significant for its empirical approach, as it provides evidence that automated handwriting analysis can be a reliable supplement to traditional psychological tests, offering a more standardized and data-driven method for trait identification in clinical and research settings.

General Characteristics of Handwriting and its Psychological Importance [13] Puja Singh's 2022 paper, published as a student work from Amity University Haryana, explores the psychological significance of handwriting characteristics in educated individuals. The study argues that handwriting can reveal inner struggles and provide insights into personality and behaviour. It highlights

graphology's potential in criminal profiling, where specific writing patterns may indicate psychological tendencies or motivations behind actions. By connecting penmanship to brain science, the paper suggests that handwriting analysis can contribute to understanding human behaviour and interpersonal connections. This work emphasizes the practical applications of graphology in fields like criminology and psychology, advocating for its use as a tool to uncover hidden psychological traits.

Identifying Personality Traits, and Especially Traits Resulting in Violent Behavior through Automatic Handwriting Analysis [14] The study by Janet Fisher, Anish Maredia, Anita Nixon, Nerissa Williams, and Jonathan Leet (2012) critically reviews the potential of handwriting analysis for identifying personality traits, particularly those associated with deviant or violent behavior. The authors examine the longstanding practice of handwriting interpretation while acknowledging the ongoing debate regarding its scientific reliability. The review distinguishes between two primary approaches: graphology, which attempts to infer psychological and behavioral characteristics from handwriting patterns, and forensic handwriting examination, which focuses on identifying authorship and verifying document authenticity. The paper further explores several computational and analytical systems used in modern handwriting analysis, including the Lewinson–Zubin system, NEUROSCRIPT, WANDA, CEDAR-FOX, and statistical approaches such as Gaussian Mixture Models. Through evaluating these techniques, the authors highlight both their potential applications and their methodological limitations in predicting behavioral tendencies, demographic attributes (such as gender and handedness), and writer identity. Overall, the review concludes that while automated handwriting analysis and computational models have improved the objectivity of handwriting-based assessments, significant challenges remain in establishing reliable and scientifically validated links between handwriting characteristics and complex psychological traits, particularly violent behavior.

WANDA: A Generic Framework applied in Forensic Handwriting Analysis and Writer Identification [15] Proposed in 2003 by researchers including Katrin Franke and Lambert Schomaker, the framework provides an extensible platform for electronic processing and analysis of handwriting data. It uses a plug-in architecture that enables the integration of client graphical interfaces and server modules without modifying the core system. WANDA also utilizes an XML-based data representation called WANDAXML for document modeling, annotation, journaling, and storage of digitized handwriting samples. By incorporating image processing and pattern recognition techniques, the framework supports objective and reproducible feature extraction for handwriting comparison. The system was originally developed at the Fraunhofer Institute for Production Systems and Design Technology (Fraunhofer IPK) with the goal of modernizing traditional forensic handwriting analysis through a flexible and standardized research environment.

Methodology

Digital Analysis Technique

The subject of modern technology is growing. A lot of examiners are searching for new software to improve the accuracy of handwriting examination readings. Organisations Both the public and corporate sectors are willing to invest large sums of money in any program that can carry out analysis and produce accurate readings. In the domains of information technology and forensics, identifying and analysing written language has become commonplace.

The numbers will unavoidably increase as technology develops, and interest will rise along with the necessity of identification verification. within the forensic science field to create particular automated systems that will aid in the identification process, such as identifying personality features and figuring out authorship, gender, age, and handedness.

WANDA

WANDA is a one of the computer programs which is used to compare handwriting based on specific attributes as well as the knowledge and skills of a forensic specialist

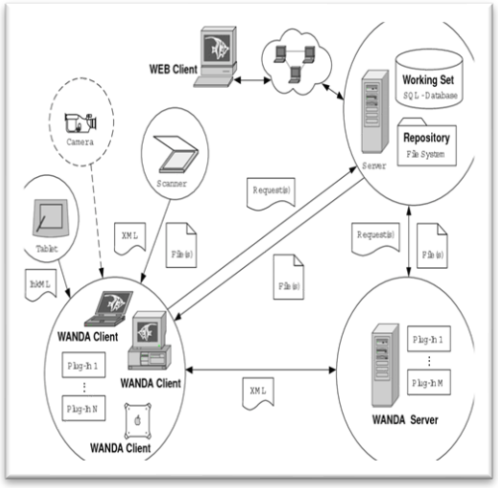

Figure: *WANDA INSTRUMENT [16]*

file:///G:/thesis/WANDA.png.

In specific forensic and investigative situations when dynamic handwriting evidence rather than only visual comparison is needed, the WANDA (Writing Analysis Digitiser and Analyser) tool is employed. When there is significant dispute regarding the validity of writing and objective measurement is required, its use becomes even more crucial. Particularly in financial and legal documents like wills, checks, contracts, property transfers, and banking instruments, WANDA is frequently utilised in situations involving contested signatures. The instrument assists in determining whether the writing was created naturally or artificially when a party claims that a signature has been faked or obtained fraudulently. It is particularly helpful when there is a suspicion of sluggish, drawn imitation but the questioned signature looks visually identical to authentic examples. Investigations into counterfeiting, such as those involving traced signatures, guided-hand writing, or freehand imitation, also employ this tool. In such situations, WANDA records hesitation marks, tremors, abnormal pressure variation, and irregular stroke sequencing that are characteristic of non-genuine writing. This is especially important when it comes to inheritance disputes, insurance fraud, and white, collar crimes. Examining handwriting that has been hidden is another crucial scenario. When a suspect intentionally alters their writing style to avoid identification such as in ransom notes, threatening letters, or anonymous communications WANDA helps analyze underlying motor patterns that remain consistent despite superficial changes in letter formation. When the writer's physical or mental health is questioned, WANDA is further used. In medico-legal investigations, for instance, it can be important to ascertain whether a document was written while intoxicated, unwell, suffering from a neurological condition (such Parkinsonian tremor), or physically weak. Such judgements are aided by the instrument's capacity to measure coordination, tremor frequency, and pressure stability. WANDA is also utilised in forensic science labs for research, academic instruction, and validation studies. It enhances the scientific validity of forensic document analysis and aids in the creation of objective criteria for handwriting recognition. [17]

MovAlyzeR

MovAlyzeR is used by forensic document examiners to compare questioned handwriting samples to known handwriting samples. Images of handwriting are processed using MovAlyzeR. It can capture various writing passages, word segments, pen lifts, pauses, and up and down strokes. Every stroke is characterised by dynamic and spatial elements.

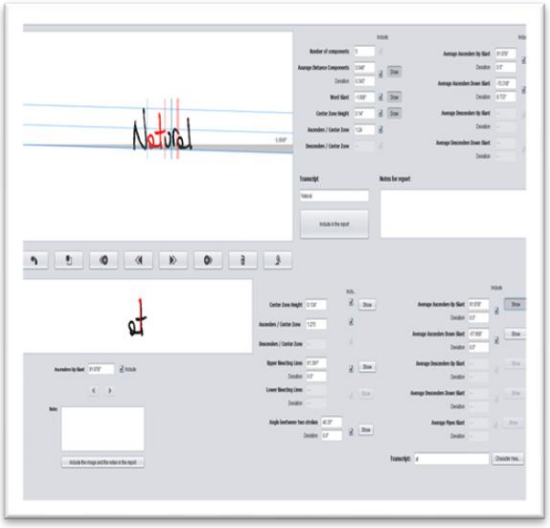

Figure: MovAlyzeR SOFTWARE [18]

file:///G:/thesis/MovAlyzeR.png.

A computerised handwriting analysis system called MovAlyzeR is used to capture and examine the dynamic (movement-based) aspects of writing. Using a digitising tablet, it records real-time kinematic data, including pen pressure, speed, acceleration, timing, stroke sequence, and pen lifts.

MovAlyzeR transforms handwriting into quantifiable and statistically analyzeable data by concentrating on the neuromuscular processes involved in writing, in contrast to conventional visual comparison techniques. This improves forensic document analysis's objectivity and scientific dependability. MovAlyzeR is utilised in forensic settings for disputed signature cases, authorship identification, forgery detection (freehand or tracked simulations), and disguised writing analysis. Additionally, it is used in research and validation studies to bolster the scientific foundation of handwriting analysis, as well as in medico-legal investigations to evaluate writing impacted by illness, intoxication, or neurological diseases.

GMM and SVM Methods

Sequential information about the handwriting is accessible when it is done online. For the classification of gender and orientation, two classifiers can be used. issue. While the second method is based on Support Vector Machines (SVMs), the first classifier models the classes using Gaussian Mixture Models (GMMs). The identical set of handwriting-extracted features is used to train both classifiers.

By using handwriting assessment systems to identify subcategories, analysts may be able to compare and analyse samples from various languages or geographical areas. For such purposes, handwriting analysis could be applied seamlessly to determine handedness and gender.

Foster and Freeman VSC 6000

Examiner's methods for reviewing and contrasting documents can vary widely and include any of the following superior vision or the application of a loupe or hand lens: This is employed to examine written documents more closely.

Stereomicroscope is a device for electrostatic detection: A specialised piece of equipment called an electrostatic detection device, or EDD, is frequently used in the examination of questioned documents to find impressions or indentations in paper that might otherwise go undetected, because it is a non-destructive approach, more testing can be done. The method is highly sensitive and can identify changes on pages that are several layers below the page's top.

A complete digital imaging system, the NEW VSC 6000/HS desktop video spectral comparator provides the questioned document examiner with a variety of tools for spotting anomalies on forged and altered documents. Some other handwriting analysis tools and software are like CEDAR-FOX, Forensic XP, VSC, ESDA,

Figure: FOSTER AND FREEMAN VSC 6000 INSTRUMENT [19]

file:///G:/thesis/deo-Spectral-Comparator-VSC-6000.png .

Physical analysis technique

This technique is a quit lengthy and time consuming but still it is a very help full technique, in this technique we are a analysis a handwriting under a microscopy and a magnifying glass in this method we are analysis physically Examination of a, Examination of letter shapes, sizes, and connections, Assessment of ink pressure variations, Evaluation of spacing between letters, words, and lines, Analysis of the slant of handwriting, Observation of the rhythm and flow of handwriting. [20]

Future Expectations for Graphology

- Integration with AI and Machine Learning:

Future handwriting analysis may be performed by advanced algorithms trained on massive datasets

linking writing patterns to validated psychological profiles. This could make analysis faster, more consistent, and potentially more reliable than traditional subjective approaches.

- Fusion with Neurological and Biometric Data:

Combining handwriting metrics with EEG brain activity, heart rate variability, and motor control studies could deepen the connection between neurological states and handwriting features. This could allow for real-time monitoring of stress, fatigue, or emotional shifts via handwriting on digital tablets.

- Expanded Applications in Forensics and Security:

In legal and law enforcement fields, AI-based handwriting authentication could become standard for verifying signatures, detecting forgeries, or profiling suspects in criminal investigations.

- Personal Development & Career Guidance:

Graphology may be integrated into career counselling software, where handwriting input could supplement personality and aptitude tests for a more holistic evaluation.

- Medical Diagnostics Support:

Subtle changes in handwriting such as tremor patterns or letter formation could be early markers for neurological diseases like Parkinson's or Alzheimer's. AI could detect these long before clinical symptoms become obvious.

Implications & Challenges

Scientific Validation will be crucial: The field must address criticisms of subjectivity and inconsistent reliability through peer-reviewed research and standardized protocols.

Ethical Use: Misinterpretation could lead to unfair hiring or legal decisions, so strong ethical guidelines will be needed.

Digital Handwriting Shift: As society types more and writes less, handwriting data might decline, pushing research toward stylus-based or hybrid handwriting recognition.

Conclusion

Handwriting is a crucial aspect of human expression, revealing an individual's personality traits and cognitive and emotional states. Graphology, a scientific method, helps understand a Shapes and word patterns in handwriting reveal a writer's personality. Numerous characteristics, including zone, baseline, slant, size, spacing, margin, and pressure, can be used to identify personality. Applications for handwriting analysis can be found in a variety of fields, including forensics studies, psychology, medical diagnosis, hiring, career counselling, and writer identification. Emotional states play a crucial role in shaping handwriting patterns, with stress and anxiety leading to erratic, pressured, or inconsistent handwriting, while depression may manifest in smaller, more compressed letters with reduced writing pressure. This research paper aims to examine the psychological effects on handwriting by reviewing empirical studies and theoretical frameworks in psychology and neuroscience. It will explore how various psychological states influence handwriting characteristics, the role of handwriting analysis in mental health assessment, and the potential applications of handwriting studies in forensic and clinical settings.

References

[1] N. H. A. A. M. P. R. M. Mahesh Ramanna Gowda, "Handprints of the Mind: Decoding Personality Traits".

[2] A. T. Kinjal Chaudhari, "Survey on handwriting-based personality trait identification," 2019.

[3] M. S. S. K. S. Hemlata, "Personality Detection using Handwriting Analysis," 2018.

[4] C. C. Yury Chernov, "Formalized Computer-Aided Handwriting Psychology: Validation and Integration into Psychological Assessment," 2020.

[5] P. Singh, "General Characteristics of Handwriting and its Psychological Importance," pp. 1-4, 2022.

[6] T. L.-P. Tang, "Detecting Honest People's Lies in Handwriting: The Power of the Ten Commandments and Internalized Ethical Values," *Journal of Business Ethics.*

[7] K. T. Puja Singh, "Handwriting Differences in Individuals with Presence and Absence of Antisocial Behaviour of the Creative Commons Attribution License (CC BY 4.0)".

[8] I. C. M. John Beech, "Do differences in sex hormones affect handwriting style? Evidence from digit ratio and sex role identity as determinants of the sex of handwriting Do differences in sex hormones affect handwriting style? Evidence from digit ratio and sex role identity as," *Personality and Individual Differences 39(2).*

[9] N. H. A. A. M. P. R. M. Mahesh Ramanna Gowda, "Handprints of the Mind: Decoding Personality Traits and Handwritings," *Indian Journal of Psychological Medicine 37(4):409.*

[10] A. T. Kinjal Chaudhari, "Survey on Handwriting-based Personality Trait Identification".

[11] M. S. S. K. S. Hemlata, "Personality Detection using Handwriting".

[12] C. C. Yury Chernov, "Formalized Computer-Aided Handwriting Psychology: Validation and Integration into Psychological Assessment," 2020.

[13] P. Singh, "General Characteristics of Handwriting and its Psychological Importance".

[14] A. M. A. N. N. W. a. J. L. Janet Fisher, "Identifying Personality Traits, and Especially Traits Resulting in Violent Behavior through Automatic Handwriting Analysis," 2012.

[15] L. S. C. V. C. T. I. G. L. V. M. v. E. G. Z. Katrin Franke, "WANDA: A Generic Framework applied in Forensic Handwriting Analysis and Writer Identification," 2003.

[16] "INSTRUMENT, WANDA," [Online]. Available: file:///G:/thesis/WANDA.png.

[17] L. S. C. V. C. T. I. G. L. V. M. v. E. G. Z. Katrin Franke, "WANDA: A generic Framework applied in Forensic Handwriting Analysis and Writer Identification.," 2003.

[18] "MovAlyzeR SOFTWARE," [Online]. Available: file:///G:/thesis/MovAlyzeR.png.

[19] "FOSTER AND FREEMAN VSC 6000 INSTRUMENT," [Online]. Available: file:///G:/thesis/deo-Spectral-Comparator-VSC-6000.png .

[20] A. M. A. N. N. W. J. L. Janet Fisher, "Identifying Personality Traits, and Especially Traits Resulting in Violent Behavior through Automatic Handwriting Analysis".