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FORMALIZED HANDWRITING ANALYSIS AS A COMPLEMENTARY TOOL IN FORENSIC PSYCHOLOGICAL ASSESSMENT

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Forensic psychological assessment demands a comprehensive, scientifically grounded approach capable of capturing both explicit behavior and implicit psychological dynamics. This article explores the role of formalized handwriting analysis as a structured projective method that complements traditional tools within a multimodal forensic framework. The approach relies on standardized definitions, measurable handwriting parameters, and statistical modeling to translate observable motor patterns into psychologically meaningful indicators.

By focusing on measurable or at least quantitatively assessed handwriting features, such as spatial layout, pressure, speed, form, rhythm, and variability, the method provides access to implicit emotional and cognitive dynamics that are often inaccessible through self-report or structured testing. Its unobtrusive and natural character makes it particularly effective in forensic contexts, where examinees may consciously attempt to regulate or distort self-presentation.

Although empirical validation remains an ongoing process, each application contributes to the refinement and confirmation of model reliability. Case-based analyses demonstrate that handwriting indicators can align meaningfully with expert psychological judgments and behavioral observations, while occasional discrepancies help refine interpretation and promote diagnostic caution. Through methodological triangulation, this approach supports the integration of implicit and explicit data, enhancing both the depth and the objectivity of forensic conclusions.

Formalized handwriting analysis, when applied within a multimethod design, supported by AI-methods and interpreted by qualified professionals,

offers an additional layer of insight into personality structure and behavioral regulation. Its systematic and transparent use reinforces the scientific validity and legal defensibility of expert psychological evaluations, contributing to more comprehensive and credible forensic assessments.

Keywords*: forensic, handwriting analysis, formalization, case-study, projective techniques, artificial intelligence.*

Introduction

Forensic psychological evaluation represents a particularly demanding branch of applied psychology, requiring comprehensive insight into human functioning within judicial contexts [1]. Because human behavior arises from dynamic biological, psychological, and social processes, accurate assessment must integrate these dimensions rather than rely solely on observable conduct.

Contemporary psychology emphasizes the developmental, cognitive, and emotional mechanisms that shape personality and decision-making, reinforcing the need for multifaceted, empirically grounded assessment strategies that satisfy both scientific and legal requirements [2, 3, 4]. No single diagnostic tool can sufficiently capture this complexity. Consequently, modern forensic practice increasingly applies methodological triangulation [5], that is the deliberate combination of structured interviews, behavioral observation, standardized testing, and collaborative expert analysis. This helps to produce balanced and verifiable conclusions.

Theoretical bases, methods and materials

Because forensic situations often involve atypical motivations and deliberate self-presentations, experts must sometimes use nontraditional assessment strategies. One such approach is formalized handwriting analysis. As a projective method, it reveals implicit personality dynamics that are often inaccessible through self-report instruments. This is advantageous in forensic contexts where examinees may distort their responses on purpose. When used alongside conventional psychometric and observational tools, handwriting analysis provides valuable information regarding authenticity, emotional tone, and personality structure. It can also be applied in the absence of a person. For example, it can be used for a postmortem evaluation of cognitive status in legal proceedings regarding a will.

Handwriting encapsulates numerous subtle cues, such as pressure, rhythm, speed, slant, spatial organization and others. They mirror affective states, cognitive style, and deep-seated personality tendencies. As a refractive projective technique [6], handwriting reflects the interaction between conscious control and unconscious expression. This offers a unique window into an individual's psychological functioning. Compared with other projective approaches, formalized handwriting analysis has several advantages:

- Natural and non-intrusive: Draws on routine behavior, reducing test-related anxiety.
- Hard to manipulate: Unlike self-reports, handwriting is difficult to fake consistently.
- Comprehensive: A single sample can inform multiple psychological dimensions.
- Low social desirability bias: It bypasses conscious self-presentation.
- Quantifiable: Features can be systematically coded and compared using normative databases.
- Does not depend on language (for alphabetic languages).

Unlike other projective instruments that require artificial stimuli, handwriting analysis draws on spontaneous behavior, namely ordinary writing. This makes it comfortable for examinees. These properties render it a valuable addition to forensic assessments where authenticity and resistance to distortion are essential. Implementing standardized definitions and quantitative metrics increases the objectivity of formalized handwriting analysis, thereby enhancing the defensibility of expert conclusions.

While graphology and formalized handwriting analysis both focus on handwriting, they differ in their concepts and methods:

Objectivity and scientific grounding: Graphology relies largely on interpretive intuition, while formalized analysis applies statistically verifiable criteria.

Analytic scope: Graphology usually considers a limited set of traits, whereas formalized analysis systematically evaluates extensive feature sets, with the aid of computational modeling.

Reporting standards: Graphological descriptions are typically narrative, whereas formalized analysis produces structured, reproducible results that can be algorithmically transformed into psychological profiles.

While traditional graphology contributed early insights into handwriting–personality relationships, its lack of methodological rigor restricts its relevance in present-day forensic work. In contrast, formalized handwriting analysis bridges empirical measurement with interpretive depth, aligning observational insight with contemporary scientific standards.

The method used in this study achieves formalization in two principal ways. First, each handwriting parameter is precisely defined through standardized, operationalized criteria that permit objective and reproducible quantification. Second, implementation is supported by HSDetect software [7, 8], which encodes roughly 150 handwriting indicators and over 700 distinct microfeatures.

Psychological constructs are modeled statistically, typically as regression functions in which sets of handwriting features serve as predictors. Each construct is associated with dozens of theoretically grounded and empirically validated

indicators. The HSDetect database currently includes models for more than 450 psychological characteristics. However, validation remains challenging [9]. New developments based on AI methods could greatly support this time-consuming and resource-demanding process, for example [10, 11].

Results

Cases from forensic practice [12]. These cases were selected to demonstrate the practical utility of the method in complex forensic evaluations. Traditional assessment tools may be limited in these situations due to examinee defensiveness, intentional distortion, or ambiguous clinical presentation. Both cases involve individuals who were evaluated in legal contexts, which provides a realistic demonstration of the method's relevance and interpretive value. Experts complement handwriting analysis with various standardized psychometric tools. These include the Eysenck Personality Inventory (EPI) [13], the Buss–Perry Aggression Questionnaire (BPAQ) [14], and the Leonhard–Schmieschek Typology (LST) [15]. The selection of instruments depends on the referral question, and the interpretation is performed by experienced practitioners. Across the two cases, handwriting-based indices showed strong convergence with EPI dimensions of extraversion–introversion and neuroticism–stability, which reinforces the construct validity of expert conclusions. Similarly, there was high correspondence between handwriting findings and three of the four BPAQ scales (physical, emotional, and verbal aggression), while only minimal divergence appeared on the cognitive aggression dimension. Greater discrepancies emerged in relation to LST outcomes. Interestingly, these differences were diagnostically useful, prompting a reevaluation of inflated test indicators and supporting a more balanced psychological interpretation. Thus, handwriting analysis functioned as a corrective tool, enhancing the accuracy and nuance of expert judgment.

Validation studies [9, 16]. These studies compare the results of several well-known psychometric tests with formalized handwriting analysis. These tests included the Big Five [17], the 16PF [18], the Portrait Value Questionnaire (PVQ) [19], and the Emotional Quotient Inventory (EQ-i) [20]. In each experiment, a representative number of subjects took the tests and provided freehand writing samples. These samples were evaluated using the tests' scales. All experiments demonstrated a high association between the results. For example, in the Big Five, the association was very high to average for all five scales (Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness). In the 16PF, the agreement was high for eight scales, average for six, and only two showed disagreements, though not statistically significant. In the PVQ, eight out of ten scales demonstrated agreement. In the EQ-i, ten out of fifteen scales showed a high association.

This encourages the use of handwriting analysis in addition to the aforementioned tests. Special attention should be given to the scales that produced contradictory results.

Neurological cognitive degradation [21, 22]. The instrument developed to identify possible dementia (primarily Alzheimer's disease) is based on 42 handwriting characteristics and three linguistic features. The instrument has demonstrated strong discriminative power, allowing it to detect signs of possible cognitive impairment. In a forensic context, the instrument has been applied in several legal proceedings regarding questionable wills of elderly persons.

Discussion & Conclusions

Integrating multiple complementary assessment techniques – particularly the inclusion of formalized handwriting analysis – substantially strengthens the reliability and defensibility of forensic psychological opinions. Concordant findings across diverse instruments increase confidence in conclusions, whereas occasional divergences encourage critical reflection and targeted follow-up analysis. This triangulated approach minimizes diagnostic bias and improves the transparency of expert reasoning.

Implicit and nonverbal techniques, when scientifically grounded and transparently applied, provide indispensable insights into aspects of personality that conventional tests may overlook. Their value in forensic contexts lies in their ability to reveal authentic psychological dynamics that bear directly on legal decision-making. Nonetheless, such methods must be applied prudently and exclusively by trained specialists within a comprehensive, multimethod framework. Used in this way, formalized handwriting analysis contributes both depth and methodological rigor to forensic evaluation, ensuring that expert conclusions remain empirically credible and legally sound.

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