



J6 Cognitive Human Factors and Forensic Document Examiner Methods and Procedures: Key Results From an International Study of Handwriting Experts

Mara L. Merlino, PhD*, Kentucky State University, Frankfort, KY 40601; Veronica B. Dahir, PhD*, University of Nevada, Reno, Reno, NV 89557; Derek L. Hammond, BA*, U.S. Army Criminal Investigation Laboratory, Forest Park, GA 30297-5205; La'Quida Smith, MA*, Kentucky State University, Frankfort, KY 40601; Chandler D. Al Namer, BA, Kentucky State University, Frankfort, KY 40601; Taleb A. Al Namer, BA, Kentucky State University, Frankfort, KY 40601; Mauricio Alvarez, PhD, University of Nevada, Reno, Reno, NV 89557; J. Guillermo Villalobos, MA, University of Nevada, Reno, Reno, NV 89557; Charles Edwards, MA, University of Nevada, Reno, Reno, NV 89557

Learning Overview: After attending this presentation, attendees will understand some of the principles of cognitive human factors, cognitive psychology, and the use of eye-tracking technology to study attention and feature-matching processes as they relate to decision-making processes in forensic document examination.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by addressing the relationship between cognitive human factors such as context effects, information about the measurement characteristics of the currently used nine-position authorship opinion scale, and findings about sufficiency in the number and complexity of handwriting samples available in signature comparison tasks.

The International Ergonomics Association defines human factors as “the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimize human well-being and overall system performance.”¹ Cognitive ergonomics is a subfield of human factors in which cognitive processes, such as memory, perception, reasoning, decision making, skilled performance, and human reliability, are examined in the context of work and operational settings. The goal of cognitive ergonomics is to improve task performance by the systematic study of the interaction between human cognitive functioning and the systems or environments in which tasks are performed.

Forensic science is produced and consumed in the context of various systems developed by human actors. At the “Examiner Action” level, error may be based on examiner decision (e.g., failure to recognize exemplars or standards as inadequate, or insufficient data to support conclusions); examiner perception (e.g., not all data are perceived, or data are inadequately compared); examiner skill (e.g., data are misinterpreted or misunderstood); or examiner violations (e.g., disregarding procedures, or misrepresenting information).²

“Conditions that Affect Performance” are adverse mental states of the examiner (e.g., anger, haste, mental fatigue, stress, or other cognitive factors); adverse physiological states (e.g., illness, lack of sleep, eyestrain); physical or mental limitations of the examiner (e.g., inadequate training, limited experience, color vision deficiency); communications (e.g., confusing or conflicting directions or demands, inadequate communication among examiners, inadequate report-writing skills); physical environment (e.g., clutter, inadequate lighting, poor workplace design); or the technical environment (e.g., defective, inadequate, or outdated software, tools, or equipment).

Interdisciplinary research encompassing expertise from forensic practice, social and cognitive psychology, vision science, and other areas is needed to establish the basis and extent of expertise, to develop rigorous protocols and measures, and to establish education and training programs that consistently and comprehensively address the knowledge and skills required to establish expertise in forensic fields. A human factor approach to understanding issues of reliability, validity, proficiency, expertise, and sources of bias involves an examination of multiple sources of information, and it is important to address the production of forensic science from multiple perspectives. This international multidisciplinary research program (National Institute of Justice Award No. 2015-90606-KY-DN) extended previous research exploring the reliability, measurement validity, and accuracy of established Forensic Document Examiner (FDE) procedures. The three experiments in this research investigated the following questions: (1) What is the relationship between the context established by presentation order of questioned and known writing and the examination process?; (2) How do examiners apply the currently used bipolar continuum of certainty (Elimination through Identification with a center position of Inconclusive) when expressing their opinions about the authorship of questioned writings?; and (3) How much writing constitutes “sufficient” information upon which to base an opinion?

This series of four papers will report on the results of: (1) a telephone survey about the training, education, and background of project participants, as well as their opinions about the strengths and weaknesses of professional training; (2) an eye-tracking experiment investigating the relationship between position of the questioned and known writings and the visual inspection of available writing features; (3) examiners’ use of the nine-position “authorship” scale; and (4) an eye-tracking experiment investigating examiner call accuracy given varying numbers of writings and writing complexity.

Reference(s):

1. <http://www.iea.cc/whats/>.
2. Working Group for Human Factors in Handwriting Examination. *Forensic Handwriting Examination and Human Factors: Improving the Practice Through a Systems Approach*. U.S. Department of Commerce, National Institute of Standards and Technology. 2018.

Cognitive Human Factors, Empirical Measurement, Sufficiency and Complexity