J8   Forensic Handwriting Analysis of Judahite Biblical Period Inscriptions

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Learning Overview: The goal of this presentation is to demonstrate the applicability and usefulness of the modern handwriting expertise methodology for the study of ancient inscriptions.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by informing attendees that, per research, this is the first-of-its-kind handwriting analyses of 2,600-year-old archeological artifacts, which has a strong impact on the history knowledge and the literacy dissemination in the ancient world.

The paleo-Hebrew inscriptions from the Arad fort are one of a few textual corpora from the First Temple period. Dated to ca. 600 Before the Common Era (BCE), the eve of Nebuchadnezzar's destruction of Jerusalem, more than 100 ostraca (texts written in ink on clay potsherds) provide a record of distribution of provisions to military units shortly before the destruction of the Kingdom of Judah by the invading Babylonian army. Due to the site's isolation, small size, and texts that were written in a short time span, the Arad corpus holds important keys to understanding dissemination of literacy in Judah 2,600 years ago. These studies aimed at identifying the number of "hands" (distinct writers) in the Arad corpus. These encompassed 16 ostraca, but since two of them were double-sided, the number of texts analyzed was, in fact, 18. Per research, no such large-scale pair-wise assessments of ancient inscriptions by a forensic expert has previously been published.

The 18 inscriptions were selected because of their relative clarity and potential for character reconstruction. The original ostraca were examined in a number of museums and storage sites. When necessary, high-quality regular and/or multispectral images of the same ostraca were used.

The Paleo-Hebrew alphabet at the First Temple period is different from the modern Hebrew writing but preserves a number of basic similarities: it consists of 22 letters and is written from right to left with mostly separated characters.

The procedure followed the protocol of modern forensic handwriting examination and included a detailed examination of every single inscription according to the following features: general appearance of the sherd, writing style, arrangement and use of space, size and proportions, slant, punctuation, spacing, alignment of words and letters relative to an imaginary baseline, letter shapes and range of their variations within a script, and extraction of distinctive features. Consistent patterns and repetitions, common for different inscriptions, were identified: the same combinations of letters, words, punctuation, relative position of letters vis-à-vis the preceding and following letters, etc. Finally, an evaluation of identicalness or distinctiveness of various writers was made, based on the standard terminology guide for expressing conclusions of forensic document examiners. The grades range from the definite conclusion of identity to the definite elimination of identity. Inconclusive grade was used when there were significant limiting factors.

One encounters many limitations upon examining ancient inscriptions, such as rather poor state of preservation, fading and abrading of some ostraca, as well as flaking-off in places resulting in a partial loss of the ink; the texts are short and may not contain the full range of letters and their natural variations; limited knowledge about the writing instruments and their effect on the writing results; etc. These limitations were taken into account and were reflected in the conclusions. The highest grade of a positive identification was "strong probability that the two ostraca whose numbers 1 and 7 were written by the same writer." Regarding the negative degrees of certainty, it was easier to reach the higher degree of elimination since a sufficient amount of differences was found.

According to the results of the examination, 12 different "hands" were involved in composing 18 examined texts with varying degrees of certainty. That conclusion illuminates the issue of literacy in the Kingdom of Judah at the end of the First Temple period and suggests that many of the inhabitants were able to read and write, and that literacy was not reserved for a handful of royal scribes.

This study is a part of a broader interdisciplinary research carried out in cooperation with a team of the scientists (archaeologists, mathematicians, and artificial intelligence experts) at Tel Aviv University. The forensic handwriting examination was performed in parallel with the advanced machine learning algorithms analysis. Substantial agreement between these two independent methods was found. The findings of the combined study were published on September 9, 2020, in the journal *PLoS ONE*.[1]

Reference(s):

1. Shaus A., Gerber Y., Faigenbaum-Golovin S., Sober B., Piasetzky E., Finkelstein I. (2020) Forensic document examination and algorithmic handwriting analysis of Judahite biblical period inscriptions reveal significant literacy level. *PLoS ONE* 15(9): e0237962. https://doi.org/10.1371/journal.pone.0237962.

Handwriting Analysis, Biblical Inscriptions, Arad Corpus

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