Scientists analyze handwriting with lasers to evaluate mental states

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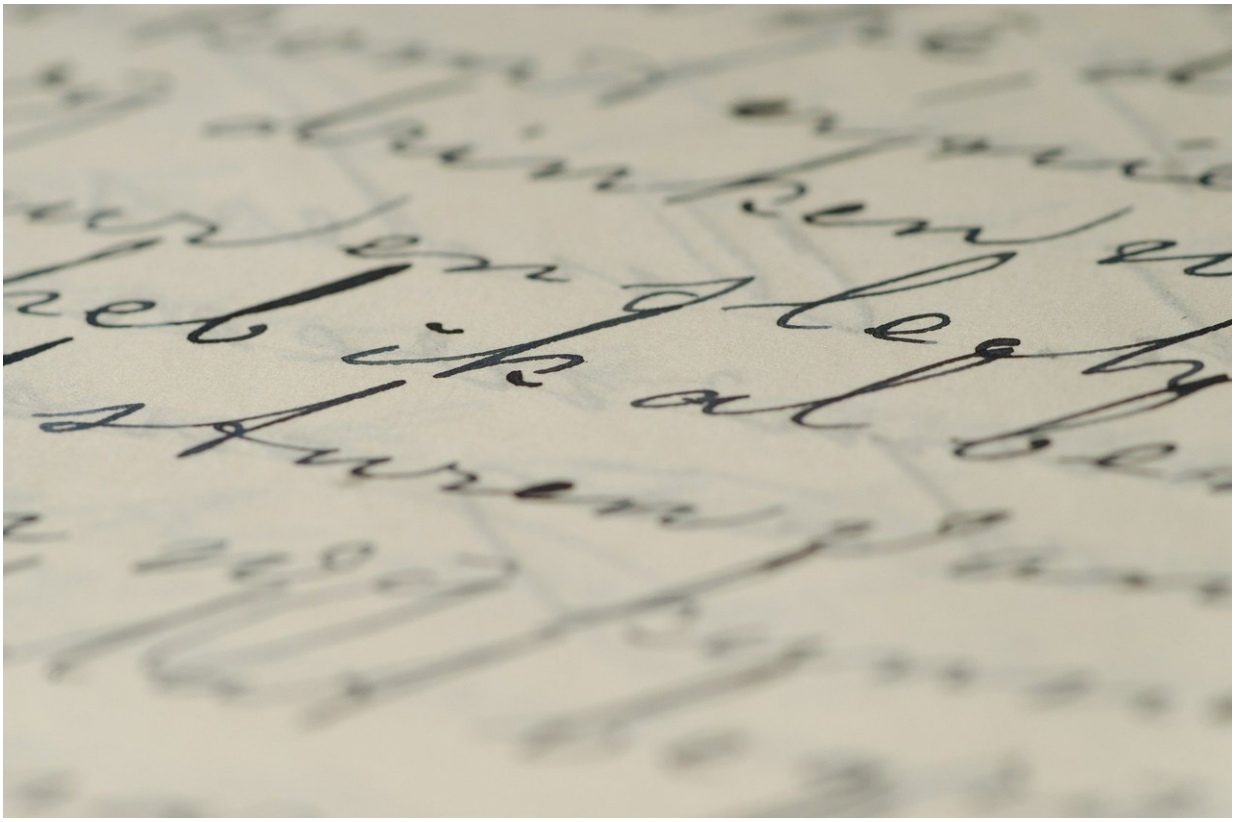

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Scientists at the National Research Nuclear University MEPhI (Russia) along with international colleagues have studied the biomechanics of hand movements when writing and drawing and developed a unique

method to evaluate the individual properties of writing speed and pencil pressure. The research results were published in the journal *Laser Physics Letters*.

The researchers used a dynamic light-scattering method. Passing through dense, opaque matter like biotissues or paper, laser radiation scatters on their internal structural elements and decays into subtle composite light rays. The scattered parts interfere, resulting in the formation of zones of positive and negative interference called laser speckles.

If there is any movement in the medium, a tremor in the interference speckle pattern is observed. Analysing speckle tremors allows for a quantitative assessment of the structural properties of a light-scattering medium.

"The method of laser speckle analysis is sensitive to any mechanical influence, even if these changes occur at the micro- and nano-level. All changes in structural and physical properties are recorded by a high-speed digital camera, then a special computer algorithm calculates and restores accurate information about the nature of both the hand and pencil movement in three dimensions over time. We suggest that this method can be used by forensics for system analysis and the study of handwriting properties of criminals, their victims and witnesses," said Igor Meglinskiy, the author of the study and a professor at MEPhI and the University of Aston.

According to Meglinskiy, the research team's main task was to introduce the study results into practical medicine and forensics. Currently, with the help of the group of Professor Vyacheslav Kalchenko and Dr. Yuri Kuznetsov, a certified expert in the field of forensic psychiatry and handwriting (both from Weizmann Institute, Israel), materials are being collected and evaluated in order to modify the method for use in forensics. It's expected that the method can also be used to establish the

effects of psychotropics on people.

According to the scientists, the method can be quite effective in the non-contact diagnosis of a wide variety of nervous and mental conditions such as autism, Alzheimer's and Parkinson's disease, epilepsy and schizophrenia. In particular, the method can be useful when working with children; analysing the way a child draws or writes could reveal disease progression or the effectiveness of a selected treatment or rehabilitation plan.

More information: Yuri Kuznetsov et al. Evaluation of handwriting peculiarities utilizing laser speckle contrast imaging, *Laser Physics Letters* (2019). DOI: 10.1088/1612-202X/ab43d7

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