

Application of Infrared Thermal Imaging, Eye Tracking and Behavioral Analysis for Deception Detection

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Abstract : One of the challenges of forensic psychology is to detect deception during a face-to-face interview. In addition to the classical approaches of monitoring the utterance and its components, detection is also sought by observing behavioral and physiological changes that occur as a result of the increased emotional and cognitive load caused by the production of distorted information. Typical are changes in facial temperature, eye movements and their fixation, pupil dilation, emotional micro-expression, heart rate and its variability. Expanding technological capabilities have opened the space to detect these psychophysiological changes and behavioral manifestations through non-contact technologies that do not interfere with face-to-face interaction. Non-contact deception detection methodology is still in development, and there is a lack of studies that combine multiple non-contact technologies to investigate their accuracy, as well as studies that show how different types of lies produced by different interviewers affect physiological and behavioral changes. The main objective of this study is to apply a specific non-contact technology for deception detection. The next objective is to investigate scenarios in which non-contact deception detection is possible. A series of psychophysiological experiments using infrared thermal imaging, eye tracking and behavioral analysis with FaceReader 9.0 software was used to achieve our goals. In the laboratory experiment, 16 adults (12 women, 4 men) between 18 and 35 years of age (SD = 4.42) were instructed to produce alternating prepared and spontaneous truths and lies. The baseline of each proband was also measured, and its results were compared to the experimental conditions. Because the personality of the examiner (particularly gender and facial appearance) to whom the subject is lying can influence physiological and behavioral changes, the experiment included four different interviewers. The interviewer was represented by a photograph of a face that met the required parameters in terms of gender and facial appearance (i.e., interviewer likability/antipathy) to follow standardized procedures. The subject provided all information to the simulated interviewer. During follow-up analyzes, facial temperature (main ROIs: forehead, cheeks, the tip of the nose, chin, and corners of the eyes), heart rate, emotional expression, intensity and fixation of eye movements and pupil dilation were observed. The results showed that the variables studied varied with respect to the production of prepared truths and lies versus the production of spontaneous truths and lies, as well as the variability of the simulated interviewer. The results also supported the assumption of variability in physiological and behavioural values during the subject's resting state, the so-called baseline, and the production of prepared and spontaneous truths and lies. A series of psychophysiological experiments provided evidence of variability in the areas of interest in the production of truths and lies to different interviewers. The combination of technologies used also led to a comprehensive assessment of the physiological and behavioral changes associated with false and true statements. The study presented here opens the space for further research in the field of lie detection with non-contact technologies.

Keywords : emotional expression decoding, eye-tracking, functional infrared thermal imaging, non-contact deception detection, psychophysiological experiment

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