



D85 Differentiating Perpetrator from Witness Using BEOS Profiling

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After attending this presentation, attendees will learn about a new technique for forensic investigation and deception detection.

This presentation will impact the forensic science community by advancing research that is strongly needed in new areas of crime investigation.

Brain Electrical Oscillation Signature (BEOS) Profiling is a technique used to identify individuals with remembrance of specific experiences. The test detects the presence of specific patterns in the electrical signals (EEG) recorded from the brain, while listening to verbal statements used for cueing remembrance of components of a specific experience, acquired while committing a crime or forensically relevant act. Remembrance of autobiographic episodes may have components of motor and visual imageries associated with the actions one has executed and witnessed. If one has only witnessed a scene, he cannot have motor imageries of carrying out the same act, but will have only visual imagery. Remembrance of components of autobiographic episodes contributes to greater neural activation compared to retrieval involved in knowing. Remembrance is found to be often associated with recreation of motor and visual imageries. In BEOS Profiling, short narrative sentences are presented in sequence referring to several of the activities a suspect or accused is considered to have indulged in. The procedure can be used to test an investigator's as well as a suspect's version of the involvement of the latter.

The current study was conducted in the BEOS Laboratory at the Directorate of Forensic Science Laboratory, Mumbai, India. A participant in the experimental group executed an activity according to a pre-designed action plan, when he was accompanied by another participant from the witness group. The latter merely witnessed the actions executed by the former. The activities in the experiment room consisted of playing a numerical game, searching for keys, a doll, tools, boxes, and opening the box, breaking a large flowerpot, collecting coins from it, and finally leaving the room. There were 20 pairs of participants and 13 participants in a control group. Subsequently, the BEOS test was carried out after an interval of 15 days on each participant of the experimental group. A control group of participants who did not take part in the above experiment were also administered the same probes while acquiring their EEG. The probes referred to the activities of the participant who carried out the activities in the experimental room. Several of them required the participant to recreate either both motor and visual imageries or one of them. The participant sat silently listening to the probes with his eyes closed and without giving any response.

The maximum length of a probe was never more than three sec. The EEG was acquired in the range of 0.016 – 100 Hz by Neuro Signature System, using 30 channels of scalp electrodes. Vertical and horizontal eye movements, if present, were recorded in another two channels. Continuous EEG was acquired and it was converted to 10 sec epochs, time locked to the onset of each probe, with three sec pre-probe baseline and seven sec of response segment. Analysis consisted of frequency and time domain analyses followed by statistical comparisons of the patterns in the response segment with the pre-probe baseline values. Frequency analysis was carried out in 10 frequency ranges and the time domain analysis consisted of detection of positive and negative responses of predefined morphology in comparison with the baseline levels. Significant increases in the Coherence values across pairs of fronto-central and fronto-posterior electrodes in the 35 – 85 Hz range in the response segment compared to the baseline indicated the presence of motor and visual imageries respectively.

Specific pattern of significant changes in the power spectrum values in the response segment, presence of significant increase in the phase relationship in gamma range of activities, and presence of significant ERP components indicated the presence of remembrance, which was marked as Experiential Knowledge response. The analysis indicated the presence of motor or visual imageries in response to each probe, if present. The number of probes, which produced such changes, was identified in each participant, and the scores were compared across the three groups. Comparison of results of motor and visual imageries across groups indicated significant increase in motor imageries in the perpetrator group whereas visual imageries were comparable in the perpetrator and witness groups. The control groups had significantly lesser number of EK responses.

Perpetrator, Witness, Motor and Visual Image