EYETRACKING IN PSYCHOLOGICAL ASSESSMENT

Yulia V. Bessonova, Alexander A. Oboznov

Russian Academy of Sciences, Moscow, Russia

eolliene@gmail.com

INTRODUCTION

The limitations of test inventories have necessitated objective measure techniques based on psychophysiological correlates to improve the validity of psychological assessment. Improvement of equipment for eye-movements recording and its significant advantages had led the way by using eyetracking in psychodiagnostics. In recent times, eye-tracking is increasingly being used for lie detection for security reasons (EyeDetect, 2014; The Automated Virtual Agent for Truth Assessments

in Real-Time (AVATAR), 2013; Saitama Police detecting system, 2016; The detecting method technique (Luniakova et al., 2015), etc.). Eye-tracking is increasingly being used in lie detection: accuracy is comparable to the polygraph testing (according to various estimates, from 86 to 95%), but technologies are based on a different markers of deception, set of markers and their variability in lying are highly controversial.

Pupil diameter: increase at crime-relation stimulus (Lubou & Fein, 1996), increase at deception (Cook et al., 2012), increase at fright (Ekman, 1992)

Fixation count and duration depend on: *nature of the tasks* (Wang, 2011), *age* (Pereira et al., 2016), *stimulus emotional valence* (Scott, 2009; Cook et al., 2012)

OBJECTIVES & METHODS:

- Identification a complex of eye-movement's markers associated with value driven attention.
- Test of the hypothesis that stimulus configuration, its type, relevance and types of deception have an impact on lie detection's efficiency.

The procedure included series:

1. Presentation of visual neutral, meaningful and composition-enhanced stimuli (varying in size, color, location).
2. Text/image stimuli' presenting in various testing situations.
 - Text and image stimulus (2 or 4 choices to responses). Instruction: 1) true answer, 2) false answer.
 - Projective images of the Social Motivation Test (Almaev, Murasheva, 2012). Instructions: 1) freely viewing, 2) positive vs. negative stimulus, 3) true/false responses.

- Projective images of SMT presented with 3 types of instructions: random choice of picture; false description; false denial
- 3. Control in-blank testing (Motivation-to-work Profile by Martin, Ritchie, 1999).

Presentation time of each stimuli – 10000 ms. The stimuli were counterbalanced and separated by a mask (25% gray, 500 ms).

Hardware: eye-tracker SMI-Red 250Hz. **Participants:** N=108 (51% female, 49% male, aged 20-56 years).

FINDINGS

VALUE DRIVEN ATTENTION TO MEANINGFUL STIMULUS

The complex of oculomotor markers that statistically reliable distinguishes value-driven attention was found. Searching behavior is being replaced by singling out and focusing on meaningful stimulus as reflected in total scanpass length, saccade count and amplitude, blink count and duration reducing. Increased active focus on meaningful stimulus is manifested in longer dwell time, increasing fixation count and duration as well as extended first fixation duration on that stimulus. Attention to composition-enhanced stimulus are traced to a high number of fixation in the first 3000-3500 ms but then the number of fixation has steadily decreased.

DECEPTION MARKERS

Dichotomic or multiple-choice answers?

Stimulus configuration has an impact on the "sensivity" of markers of deception. The information density of the slide hasn't any advantages to increase divergence true/false answers.

- Universal markers of deception have been found, but their discriminating fineness is insufficient.
- Quantitative markers were more revealing for multiple-choice answers.
- The greatest differences were found in case of 2-choices answer

Markers of deception and stimulus emotional valence

- While benchmarks for viewing of neutral stimulus show a ambient attention (searching & orientation), attribution of valence reduced that searching.
- The shift from ambient to focal attention were apparent in the saccade velocity and amplitude as well as fixation indicators.
- The negative stimuli widened the true/false eyemovements gap.

Markers of deception and types of deception

Each type of deception also has a unique set of markers, that distinguishes it from other deception and could identify it. The passive deception (as random choice of answer) were reflected in an orientation viewing and an accelerated motoric response as taking the additional cognitive load off. Any type of active deception has a sharp decrease in the number of eyeblinks and pupil diameter, temporal and speed data is significantly increased, because active deception assumes additional cognitive task – inclusion or exclusion points in context.

GAZE PATTERNS

Centered pattern

Sequential pattern

Chaotic pattern

- "Centered Pattern" (5-7%) is characterized by the stable centred fixation persisted in any stimulus configuration, type or valence.
- "Sequential Pattern" (25%) is a viewing carried out in certain order. The order of viewing changes while false negative stimulus.
- "Chaotic pattern" is the most common strategy of viewing with fixation focus shift at deception.

The special software has been developed to assess background of individual response rate and set flexible criteria for marker-assisted selection of meaningful stimuli and false responses. Eye-tracking testing data has a significantly correlation with in-blank test results but it's more sensitive to hidden needs.