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Understanding as Seen with Emotional Responses

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Key words: understanding; emotion; eye tracking

The topic of this study is to what extent understanding, in particular, aha-experiences, evoke emotions. In the experiment, 40 subjects were asked to look at ambiguous pictures and to solve match-stick and mathematical problems. Their eye movements, pupil dilation and skin conductance was measured, taken as emotional indicators of understanding. Initial behavioural results show that relevant areas are attended more just before subjects clicked to signal understanding.

Introduction

While understanding and solving problems, certain behavioral and physiological correlates are expected. Interest is essential for learning and understanding (Izard, 1991), and it is often claimed that individuals interested in a topic pay more attention, persist for longer and learn more. Interest can be measured both by eye movement behavior such as attention allocation and pupil size, and by skin conductance. Eye movements provide useful information in relation to problem solving (Knoblich, Ohlsson & Raney, 2001). Empirical evidence shows that attending critical areas of a problem is important for solving them (Grant & Spivey, 2003) and to see a certain interpretation of a picture (Pomplun, Ritter & Velichkovsky, 1996).

Hypothesis

The aha-experience is hypothesized to yield responses in eye movement behavior and physiological measures. Attention allocation is predicted to increase on areas of interest referring to relevant parts of the stimulus. For example in one of the stimulus in the experiment (figure 1), the relevant areas are; feet, head, hands and face.

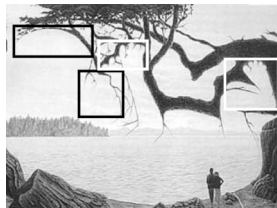


Figure 1: Subjects are asked to find the third person, a baby. Areas of interest are marked with black and white boxes.

Results

All hypothesized understanding-relevant areas of interest gained more attention allocation (% of total time), but it was

significant only for the area of the feet ($p < 0.05$, t-test one-tailed) (table 1). Viewing time on the stimulus was divided in two halves, first and second, where the second half ended with the subject identifying the stimulus.

Table 1: Areas of interest.

| | First half (%) | Second half (%) | p |
|-------|----------------|-----------------|-------|
| Face | 2.89 | 2.22 | .267 |
| Head | 2.34 | 4.33 | .1159 |
| Feet | 7.33 | 16.11 | .043 |
| Hands | 3.11 | 4.33 | .31 |

Results from a previous pilot study indicate a significant increase of pupil dilatation before identifying the stimulus.

Discussion

The initial analysis points in the direction of supporting previous findings reported in the introduction. The order of attended significant features will be examined carefully in an attempt to reveal the predicted process of forming understanding as related to relevant areas and indicated by predicted emotional responses. Fixations are predicted to increase as a result of increased attention on interesting areas. Pupil dilation reflects interest and is hypothesized to increase when identifying a novelty or something interesting. Novel stimuli (Furedy, 1968) or interesting stimuli (Berlyne, 1960) cause skin conductance responses and it is predicted to increase until the moment of identifying the stimulus.

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