Measuring emotions using eye tracking

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This abstract introduces a new automated method of measuring human emotions by analyzing eye properties via an eye tracking platform. The method utilizes eye tracking data in a new way that makes it possible to measure the immediate unconscious and uncontrollable emotional responses before they are cognitively perceived, interpreted, and biased by our mind.

Introduction

The eye property based method for quantifying emotions is implemented in Emotion Tool™ a software to measure immediate human emotional responses to visual stimuli. The non-intrusive, non-verbal, psychophysiology measurement instrument uses an eye tracking hardware and a statistical system to determine the level of excitement to an image and if the emotion is of a pleasant or unpleasant character. Each emotional response is extracted from subtle dynamical psycho-physiological changes within the respondents' eye via the eye tracking monitor. The results are hereafter classified and delivered directly as a fully quantified reading of the emotional response. Via the eye tracker the software collects and analyzes several subtle changes within the respondent's eye gaze characteristics, blink characteristics, and pupil change characteristics in order to determine the emotional response.

Accessing emotions through analysis of eye properties

The emotion measurement system (iET) can measure pleasantness and emotional reactions from humans looking at images, using a method that is nonintrusive, reliable and valid. Using specially designed algorithms and eye-tracking, we have invented a method and encapsulated it in a software which now enables researchers to quantify the basic low-level emotions, in an easy-to-use and time efficient way.

Psychophysiological measures

The iET system is an automation of the methods similar to the ones used by e.g. psychologists, witness experts and others, who have been trained to spot the subtle changes in facial expressions, to detect emotional signals from subjects. More specifically, the emotional signals are primarily based on the eye region. Pupil size, blink properties and gaze are analyzed and used to calculate an index of emotional reaction, using modern eye tracking equipment and specially developed software. Pupil size is known to be related to emotional reactions. For example, pupil dilation has been coupled with activation of the sympathetic nervous system [1-3]. However, the relationship is complex because pupil size is also related to cognitive processing load [4, 5] and the amount of light or hue in visual stimuli [1]. Blink has also been related to emotional reactions, for example with defensive reactions like emotion-modulated eye blink startle [6-8]. Finally, gaze patterns have been linked to emotional reactions [9].As an expert gains experience, his method becomes more accurate. One of these somatic markers mentioned above is not alone sufficient to spot an emotion in the subject. However several of these clues put together enable the experts to spot emotions correctly more than 80% of the time. In other words, the human brain is able to put this subtle information together in a way that can reveal the subjects' emotions. A similar technique as the one used by the experts has been formalized and is used within the iET emotion measurement system. This intuition that the expert has developed over a long time has now been formalized mathematically in an algorithm and software as a new easier way to gain access to the emotional reactions.

Conclusion

We propose an application area of eye tracking as nonintrusive, reliable, cost effective measurement of emotional response. This type of measurement is becoming increasingly more valuable for psychologists and emotion researchers to evaluate human behavior, memory and decision making – there is an obvious double benefit of both having respondents' visual attention combined with emotional response in one measurement. We demonstrate that this can in fact be done when stimuli are still images displayed on a monitor, in a controlled test environment.

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