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Emoji Essence: Detecting User Emotional Response on Visual Centre Field with Emoticons

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ABSTRACT

User experience is understood in so many ways, like a one on one interaction (subjective views), online surveys and questionnaires. This is simply so get the user's implicit response, this paper demonstrates the underlying user emotion on a particular interface such as the webpage visual content based on the context of familiarisation to convey users' emotion on the interface using emoji, we integrated physiological readings and eye movement behaviour to convey user emotion on the visual centre field of a web interface. The physiological reading is synchronised with the eye tracker to obtain correlating user interaction, and emoticons are used as a form of emotion conveyance on the interface. The eye movement prediction is obtained through a control system's loop and is represented by different color display of gaze points (GT) that detects a particular user's emotion on the webpage interface. These are interpreted by the emoticons. Result shows synchronised readings which correlates to area of interests (AOI) of the webpage and user emotion. These are prototypical instances of authentic user response execution for a computer interface and to easily identify user response without user subjective response for better and easy design decisions.

1. Introduction

Users subjective response doesn't allow for authentic response when asked about their user experience. They prefer to give a straight forward answer simply because they don't want to reveal inappropriate views such as expressing their low opinion of an interface. Users' emotional response is the best form of conveying positive or negative authentic response to a computer interface. Computer interface is mostly used as a form of user friendly computer interaction between the user and the system. They are mostly designed to suit the purpose of an underlying assignment. Its design should be configured

to suit 10 the ergonomically characterised requirements of the user. To obtain an astute user response and opinion, physiological response are normally used as a metric for users' authentic response. Authentic responses are required for an enhanced design decision, such as to build an enhanced user interface that is free of stress and a lot more of adaptive physiological ambience of the user. Also for the 15 designers, an astute opinion of the user might not be obtained from direct user communication [1,11,13] but from the interface itself by easily transmitting user emotion on the AOI. One of the most important user attributes is the user behaviour which is communicated

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from the eyes or eye movement behaviour on the interface. The eye tracker is used to measure eye movement behaviour and pupil dilation on an interface. The eyes not only convey a particular information but also an underlying user emotion which is expressed through pupil dilation. Integrating user physiological response (UPR) and user eye movement behaviour (EMB) can give an underlying user response that interprets user opinion of an interface in a high-level instance. Using emoticons is one of the means of expressing user emotion and response in so many ways. It can represent when a person is sad, happy or extremely excited. In this paper, emoticons are used to express user emotion through EMB and UPR. These emoticons are the most voiced language digitally. It is used here to represent users' emotional response to webpage interface based on EMB and UPR integration and prediction through a control system. The user emotional response is represented here as stress, neutral and relaxed mood.

Objectives

Based on the discussion above, the objectives of this paper are to:

- conduct a thorough literature review.
- design a method for predicting users' EMB on visual centre field of a webpage interface.
- illustrate methods of conveying emoticons on visual interface.
- identify correlates of EMB and UPR on webpage interface.

One of the most basic user interface is the web interface used to control basic information that interprets an organisation's hierarchy, activity and research database. Its design must suit the users' profile and user friendly authentication. Conveying user emotion on interface is a novel area which is presently a static state of the art investigation on user interface designed expressed using emoticons. The proceeding section discusses recent work on user behaviour, computer user interface through UPR and EMB and expression of emotion through emoticons on AOI.

2. Literature Review

In user experience, the user behaviour towards a particular interface can be interpreted through the use of eye tracker which stores the users' information for analysis. The EMB is recorded with the pupil dilation. EMB contains fixations points (FP) and saccades connected through scan-path, this represents the trajectories (paths) of the eyes when scanning the visual

field and viewing for analysing visual information. Its predictions interprets emotional response through the pupil dilation^[3,5,7,9]. With the increasing number of human computer interaction technology, the natural interactive products are now more valued by more people. The visual sense is the most important method of channelling information and most research are more focussed on the measurement of the eye movement^[4,3]. The interaction of eyes with machines have a very wide prospect such as including the pluses and minuses of available control systems written by^[4,8,10], that puts forth design principle, system concept and 60 state of change model of eyes interaction from consideration of user-centred design principle. The system simplifies measurement process by focussing on fast tracking and accurate eye movement and calibration using context information to reduce interaction. Physiological measures when used with eye tracking interprets authentic user emotion and despite many challenges. Numerous HCI researches have utilised the use of physiological data to observe user interactions in ways that would have seemed impossible^[20-22]. It demonstrates the common theme of using the technique to collect real-time observations of a particularly task in progress, as opposed to some subjective and post-test response. A study by^[2] used three different traffic control interfaces with three different task complexity levels to investigate the possibility of using a skin conductance response as a metric for cognitive load. The participants used gestured-based and multimodal speech and gesture interfaces to complete tasks. The analysis show that from five participants indications where shown that average response levels were the lowest of the multimodal interface, which is followed by speech and gesture interface whose overall response increased with task complexity. This provides evidence for the utility of using SCR to indicate cognitive loads^[12,14,17]. These SCR peaks were found to be correlated with stressful or frustrating events, with response decreasing overtime. These peaks were also correlated with other major events that were otherwise thought to be cognitively challenging such as reading instructions and completing tasks. While this method proved significant this paper tends to tackle this process by correlating the task performance, eye movement and SCR correlates to convey the user emotion on the task allocated AOI using emoticons. There is not much research conducted in this area of HCI field so far^[15,16,18]. Emoticons express the user expression or language in hidden ways understood by user and examiner. Current studies^[23] examines the influence of social context on the use of emoticons in internet communication. Students responded to short internet chats such as a task-oriented

vs socio-emotional and valence of the context task which either conveys positive or negative emotion which were manipulated in the charts. The results showed that the participants used more of the emoticons in socio-emotional than in the task-oriented social contexts. And also participants are more positive emoticons in positive contexts and negative emoticons in the negative contexts. This is also similar to correlated user interactions with 95 physiological response to interpret user behaviour and emotions. The basic contribution here is conveying user emotions on the interface with these emoticons by conducting a study on user interaction with a webpage interface and predicting user eye movement behaviour synchronised with physiological responses. This is one of the novel method we intend to base our analysis on in this paper as 100 discussed in the proceeding section.

3. Materials and Methods

An experimental study was conducted with six participants, all adults (three females and three males) aged between 32-45 from different work background such as computer and internet oriented environment and a manual and less-internet oriented environment, each asked to interact with a webpage.

An eye movement data generated for a single participant in a given time interval can generate thousands of eye movement behaviour patterns that includes gaze points, saccades, fixation duration, pupil dilation and also hand movement such as the number of clicks per second and the object or area of interest.

Six participants were chosen because this would generate data that would amount to a 100,000 within 10 minutes interval for the purpose of a pilot study. The participants were approached during their free time with the request to fill a participant's agreement form that confirms their consent to the study.

The participants were given 1 to 2 minutes to interact with a Yahoo webpage with four (AOI) containing picture, video and text content dated back to 2014 saved in an eye tracker archive. They sat in-front of the eye tracker and were asked to browse through the webpage interface to locate any content that caught their interest at first glance. Their eye movement and pupil dilation were recorded after calibration. This set the eye positions to the middle and four corners of the webpage cartesian plane. A SCR measure was attached to their wrist to get their physiological readings. The setting was from the start time of interaction with the webpage interface to end of the session. The recorded data from the eye tracker and SCR were collected for analysis.

Emotion Emblem

Three different types of emoticons were used to represent the emotional response of the user, which were classified as "stress", "relaxed" and "neutral" mood. The overall emotion is set to appear at the centre visual field of the webpage. Other emoticons can appear at the upper and lower part of the visual field. The emoticons were novel design constructed from spherical coordinates that uses compact logic in Java to differentiate when the body (face) smiles, slightly stressed, or in a neutral mood. The numbers 1-3 are used as the default value during running time. The 3D emoticon is mapped to the cartesian plane of the webpage using the eye movement predictions of the fixation points generated from the eye tracker.

4. Analysis

The eye movement predictions were generated by a control system loop, using discrete time-variation instance to predict the gaze point with different color shades matching mood fluctuations that indicates user responses corresponding to spikes in the SCR. The correlates of the EMB and UPR to webpage contents is determined by time synchronisation of the measuring sensors (Eye tracker and SCR sensor) used in the study. Error in time synchronisation will be dealt with in length in future prospects.

The stress emotions were correlated with the optimal local maxima of SCR response signal while neutral and relaxed mood were correlated to the average and low local minima of the response. Each emoticon was used to map out these points on the webpage vertical plane with coordinates of a web browser on a desktop view. Using the eye tracker settings, fixations points were set as the coordinates of gaze point on a vertical plane. This process is stretch mapped to each participant's response emotion and the corresponding emojis. The emoticons were set to false for unhappy face when the local maxima is detected and mapped to the fixation points on the webpage.

5. Results

The emotional expression of a user as it happens at a certain point in time in an interaction, is a function of underlying emotions and display rules specifying what kind of expressions are appropriate in a given situation. Here the eye movement and pupil dilation is one of the basic features of interpreting underlying emotions, because there are a lot of cognitive workload and expression during brain activity as the user tries to comprehend the visual field placed in-front of them. The overall emotional expression is summarised to a single

emoticon and conveyed on the visual interface. Lots of fixations are sighted on the AOI for the first visual contact between the eyes and the middle of the main screen. The first participant's gaze point is first located on the picture content in AOI 1 (Figure 1a), the eye movement predictions were displayed around AOI 1 of the webpage. This participant's overall expression was classified as "relaxed" and "Neutral" at the centre of the visual field (Figure 1b) and he also happens to be unfamiliar with the webpage's content. Bother emoticons came out as neutral. The time interval of interest between the SCR and pupil dilation is between 10 to 20 seconds corresponding to the 160 maximum local minima.

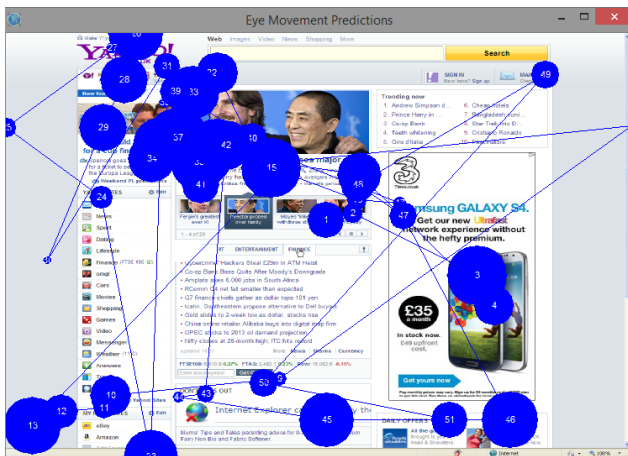


Figure 1a. User 1 original Eye movement behaviour

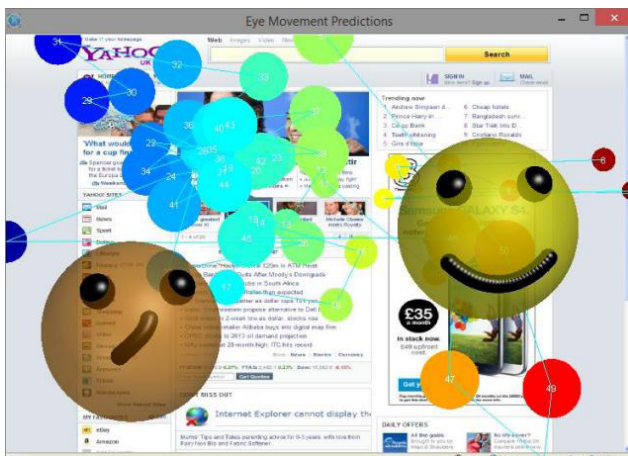


Figure 1b. User 1 Predicted gaze points and overall response.

In most cases, the visual acuity decreases rapidly when the eye movements sway away from the center of the visual field to other locations of the field. The eye movement generates less fixation points if a particular participant is relaxed and comfortable (familiar) with the visual web interface (Figure 2a). The second participant's

overall emotion is summarised as "relaxed", "not happy" and "stressed" at the upper corner and the middle of the visual field during her session with first eye contact on the picture content that contains human features on "AOI-1".



Figure 2a. User 2 original eye movement behaviour.



Figure 2b. User 2 Predicted gaze points and overall emotion expression.

Participant 4 and 6 generated fixations which were summarised as "relaxed", "stressed" and a "neutral" mood, with the centre visual field having stress faced emoticon for participant 4. Few of the predicted fixations also slightly correlates to its original co-ordinate on the webpage cartesian plain. The effects of color on user visual interaction and general arousal indicate that visual attention correlates to physiological effects on human body and influences emotions, feelings and mode. These colors are used to display different eye fixations on the visual webpage (Figure 4).

Figure 3a shows that between 9 to 30 seconds and 30 to 40 seconds into the session, there were changes in emotional response which correlates to eye movement

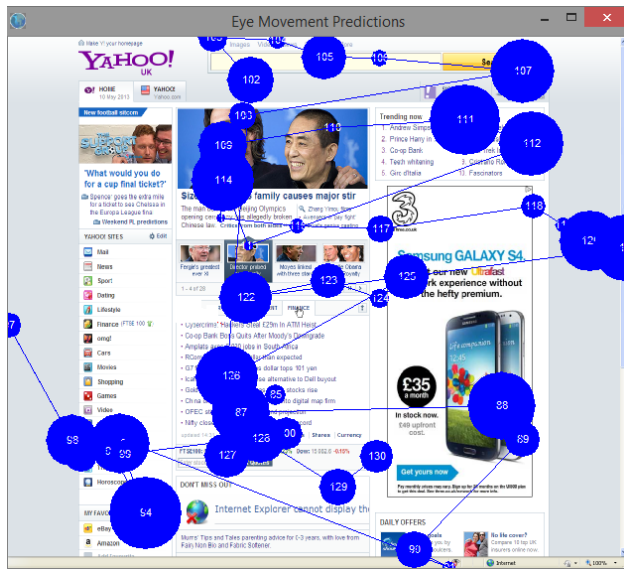


Figure 3a. User 3 original eye movement behaviour.

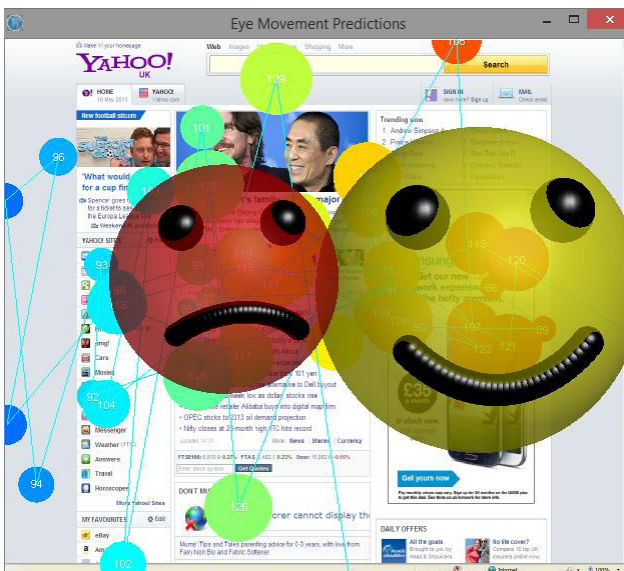


Figure 3b. User 3 Predicted gaze point and overall emotion expression.

behaviour running between picture contents and text contents. The predicted fixation points lie below the lower section of the webpage which is represented by AOI 3 and 4. The participant general response is termed as “relaxed” and “stressed” and also familiar with the webpage’s contents. In the real sense, changes or consecutive spikes in pupil dilation don’t necessarily mean the participant is stressed but could also mean excitement or happy mood. Visual attention is also known to correlate with divided attention in a complex visual field.

The fifth participant’s original eye movement behaviour (Figure 5a) reveals that attention can be subjected to the middle of a visual field at first gaze, as demonstration by

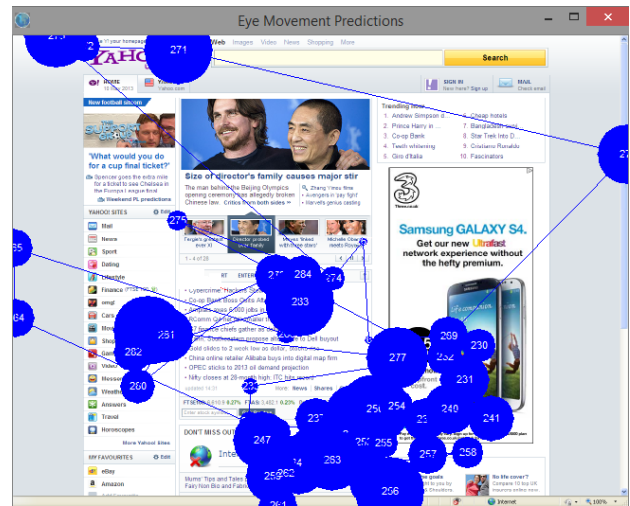


Figure 4a. User 4 original eye movement behaviour



Figure 4b. User 4 Predicted gaze point and overall emotion expression.

the amount of eye fixation between AOI-3 and AOI-4 of the webpage interface, just like that of participant 4, the fixation points were mostly in AOI-4 (left lower corner of the webpage). The predicted eye movement conveyed a neutral mood at the centre of the visual field between these AOIs and a relaxed face with not happy expression (Figure 5b). The number of interval of interest was two (0-20 and 40-50) seconds into the interaction section. Though the participant could not tell between which web content to start with but settled for the middle of the page.

The size of the emojis depends on the extent of the emotional expression e.g. if a particular user expressed intense unfamiliarity to the webpage layout and content the size of the emoji is increased (Figure 6b), just like when a user gazed for a long moment on a particular point in the visual field, the gaze point becomes enlarged,

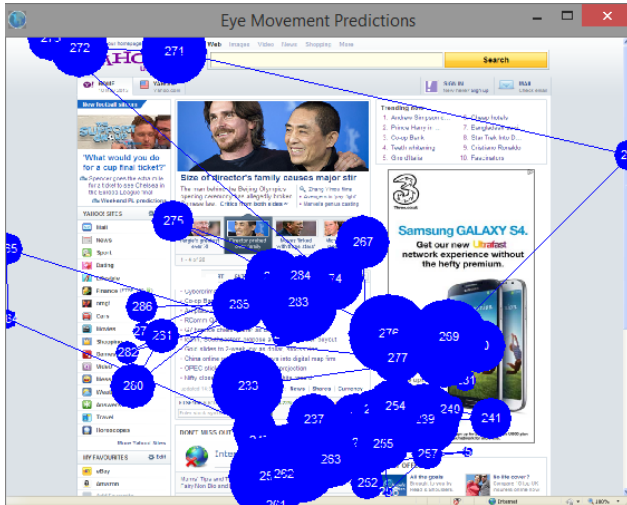


Figure 5a. User 5 original eye movement behaviour.

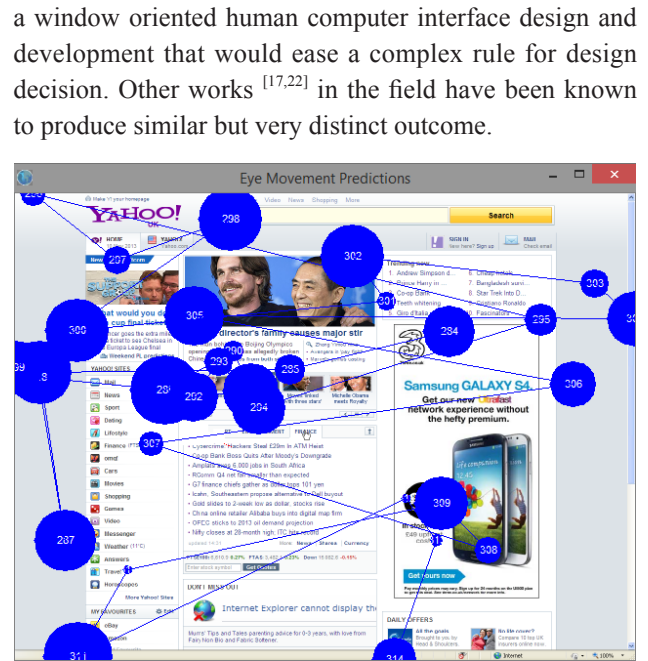


Figure 6a. User 6 original eye movement behaviour.

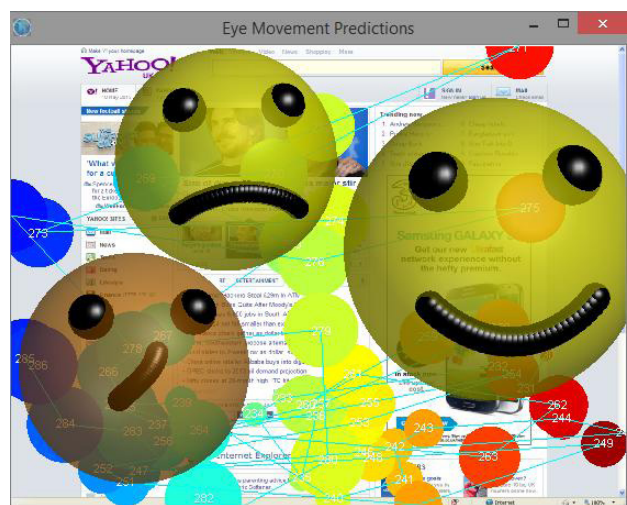


Figure 5b. User 5 Predicted gaze point and overall emotion expression.

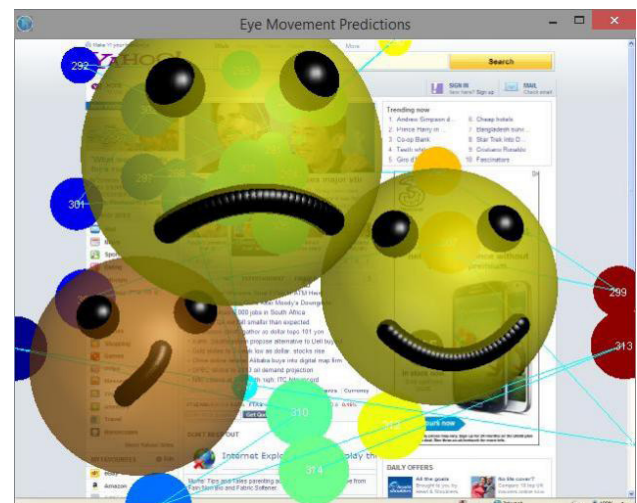


Figure 6b. User 6 Predicted gaze point and overall emotion expression.

the larger the gaze point the intense the look. EMB are mostly seem to correlate with predicted gaze points (Figure 6a). In this session the fixations are mostly located at the AOI-1 section (picture content) of the page, this AOI also contained the predicted eye movement response. The interval of interest in the pupil dilation lies between 10, 30 to 50 seconds into the session. This matches the eye movement. As noted, emotions are often instantaneous and may be unconscious, so investigations should not be limited to self-report gaze points [17] and single physiological measurement but must measure affective responses with a variety of tools. The combination of generated and self-report provides richer insight into emotions. The result of the analysis above is just a conceptualize framework demonstrated for the purpose of developing a high-level prototypical model of

a window oriented human computer interface design and development that would ease a complex rule for design decision. Other works [17,22] in the field have been known to produce similar but very distinct outcome.

6. Conclusions

This paper demonstrates emotion essence that replaces user subjective response, by conveying user emotion expression to the centre visual field of a webpage interface, the conveying of emoticons that represents user expression on a webpage interface is a relatively new topic in the field of user interaction. This particular study contributes to a new line of analysis on the expression of emotions and the use of emoticons to convey user emotion. The effects of color on user visual interaction and general arousal indicates that visual attention

correlates to physiological effects on human body and influences emotions, feelings and mood. These colors are used to display different eye fixations on the visual webpage. The paper also puts forward the eye movement interaction design with an eye control system that predicts the gaze points used to summarise the overall user emotion during interaction. These possibilities influence other novel approaches such as using emoticons to locate a particular coordinate on an interface that triggered the elicited emotion and also the use of emoticons to unveil underlying visual expression. This could also be embedded in an eye tracker by using emoticons to represent user response during interaction.

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