

Obtaining Self-Reports for Affective System Design

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ABSTRACT

Constructing affect-sensitive intelligent tutoring systems often requires training data in which the learner's true affective or mental states are known. We use students' self reports as ground truth data. We record students during learning then obtain self reports about their mental states during post-recording interviews. We have found a surprising level of consistency in the relationship across different students from different cultures between affective or mental states and unintentional hand gestures during learning. However, in collecting these data, we face some challenges that we outline in this paper.

Author Keywords

Emotions, mental states, hand gestures, self-reported mental state.

ACM Classification Keywords

Human-Computer Interaction, Gesture Interpretation.

INTRODUCTION

Affect-sensitive intelligent tutoring systems are among the promising applications of technology related to interaction between humans and computers. Recently, there has been an increasing trend to account for learners' emotional states when designing intelligent tutoring systems [6]. The rationale for this trend is based on evidence that positive emotions increase students' achievement and learning [5].

Speech, visual gestures and interactive questionnaires are some of the modalities commonly used to measure affective information. In our work, we focus on inferring affective information from visual gestures in context [1]. The correlations we have observed between gestures and affective states may be useful in affect-sensitive intelligent tutoring environments.

To establish correlations between affective states and gestures, we need reliable ground truth data. Self-reporting, either alone or in combination with other sensory measurements, is one way to establish ground truth. In this

paper, we briefly describe an experiment we performed to establish ground truth on student affect in classroom situations. We then outline some important issues related to gathering information from students' self reports in context.

HUMAN STUDY DESCRIPTION

In our human study, we set up five recording sessions with 11 human subjects. The subjects were students from various cultures and both genders. We installed video cameras in a classroom to record the activities of these students while they attended Japanese language lessons at NII. A snapshot of one of such recording session is shown in Figure 1.



Figure 1. Students attending a classroom lecture.

In every session, we recorded students for 25 minutes as they listened to the lecture. In the post-recording interviews, we asked each student what they were feeling during the lecture while showing them their own video recordings.

We attempted to obtain ground truth data for the whole video by segmenting the video recordings into 20-second intervals. Interestingly, we found that the students could not recall what they were thinking at the time except during those intervals in which they performed a body gesture. As a result, we changed the protocol very early on to request

self reports for each body gesture we observed. We converted the free-format responses to unique representative categories using the Geneva Affect Label Coding (GALC) system [4]. For example, a student's report that she was "feeling anxiety" was categorized as "stressed."

During the experiment, we observed a total of 16 distinct gestures, eight of which were common across multiple subjects. These were: Head Scratch, Chin Rest, Eye Rub, Lip Touch, Ear Scratch, Nose Itch, Locked Fingers, and Yawn. Two such gestures are shown in Figure 2.



Figure 2. A "Head Scratch" (left) and an "Ear Scratch" (right). This student reported corresponding mental states of "Thinking" and "Concentrating," respectively.

In the post-recording interviews, these eight gestures were associated with six different mental states: Stressed, Tired, Thinking, Satisfied, Recalling, and Concentrating. However, in many cases, the student could not identify any particular mental state. We coded the mental states for these gestures as "None."

ISSUES

Here we make four informal observations based on our experience collecting ground truth mental states and discuss their possible implications.

Observation 1: Early on in our experiment, we found, surprisingly, that students could not recall any particular mental state unless they had hints provided by their own gestures. During idle conditions, when students were not moving much, they found it difficult to interpret their feelings. They would typically say things like "I am looking at the white board" or "I am reading the note book" unless they saw themselves make a gesture.

Implication: There are at least two possible explanations for this observation, 1) that seeing ourselves make gestures triggers genuine memories of our mental states, or 2) that when we see ourselves making a gesture we use reasoning based on past experience to infer that if we made that particular gesture, we must have been in a particular mental state.

If the first explanation is correct, it would be further evidence for a deep neurological relationship between motor control, feelings, and memory. Damasio writes that

"to feel an emotion it is necessary but not sufficient that neural signals from viscera, from muscles and joints, and from neurotransmitter nuclei – all of which are activated during the process of emotion – reach certain subcortical nuclei and the cerebral cortex" [2, p.145]. Further understanding the underlying causes of this effect would help us to design effective experimental protocols for obtaining self reports of mental states.

Observation 2: Students were more consistent in describing their mental state during long-lasting unintentional gestures. For example, when they observed themselves making a long "Chin Rest" gesture, our subjects always reported the "Thinking" state. On the other hand, when faced with a quick "Eye-Rub" gesture, they often could not report any particular mental state. We also noticed that whereas short-term gestures might not trigger recall of a particular mental state, if that same gesture was repeated frequently during some period of time, the subject would more confidently report a specific mental state rather than "I don't know," "none," or "not sure."

Implication: One explanation for this effect is that lasting mental states lead to consistent repeated gestures over time, and that fleeting gestures are more likely due to noise. This would have important implications for affective system design: systems that try to infer mental state from gestures or other objective measurements should take into account not only the static characteristics of a gesture or expression but also the time course of that gesture or expression. The importance of dynamics is well known for facial expressions [3], but our work provides some informal preliminary evidence that the same is true for other indicators of mental state.

Observation 3: If we only get ground truth when gestures are present, there are long gaps in the data for which we can obtain a ground truth. As illustrated in Figure 3, students only made gestures during a small part of the total recording time.

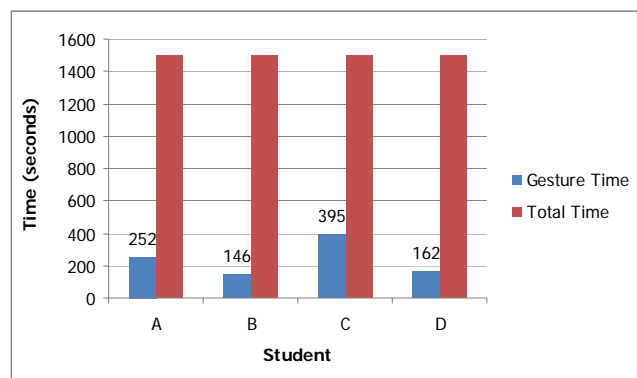


Figure 3. Presence of gestures as a fraction of total time of 25 minutes (1500 seconds) for four of the sample students in our data during the first two recording sessions.

Implication: Although it is probably the case that students were more likely to be in the “None” state when they were not making gestures, it is also unlikely that the students were never in an identifiable mental state when they were not making gestures. Ideally, we would like to identify those points in time, but it is unclear how to obtain reliable self reports in the absence of visible gestures or other context.

A possible remedy in above scenario may be to serve forced-choice questionnaires and get targeted information that may give a complete track of possible mental states. But this could be misleading as at one hand it may limit or bias the responses, however, in our study, we found surprising results that the interpretations remain consistent. Secondly, the subject may be forced to provide non-existing information. Still we need to explore which method is best suited for the situation.

Observation 4: To encourage spontaneous self reports, we avoided describing the exact nature of the study to subjects before the experiment begins. However, we found that this led to the students having a very difficult time recalling their mental states.

Implication: Knowing the nature of experiment may affect/bias the experimental results. However, some level of pre-experiment briefing is necessary, as for some experiments it is necessary for users’ to retain their memories about the proceedings like in our case. So what is that optimum level is yet to explore.

CONCLUSION

In this paper, we report on a study to establish correlations between mental states and unintentional gestures towards construction of affect-sensitive intelligent tutoring systems.

In the process of establishing the ground truth mental states during student learning in a classroom situation, we have made four informal observations: 1) students could not recall any particular mental state unless they had hints provided by their own gestures, 2) relationship of long-lasting gestures to the certainty in mental state

interpretations, 3) ways to develop questionnaires to retrieve complete information and 4) level of pre-experiment briefing to the participants under study.

After mentioning these observations, we point out possible implications they may have on obtaining reliable ground truth for affective system design. We expect that it would be useful to address these issues.

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