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Catching eureka on the fly

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Eureka and its pedagogical potential

There is a growing interest within the domain of intelligent tutoring systems (ITS) to develop systems that are capable of detecting affective responses and states in students and to adapt teaching strategies and processes accordingly.

Our work focuses on the affective state of eureka – or insight experienced as “*Ah, now I get it!*” – and on the pedagogical potentials of an ITS that can identify this state.

It can easily be seen how the recognition of *confusion* or *frustration*, can be useful in guiding the pedagogical interventions of an intelligent tutoring system – or a teacher. But how could identification of the relatively brief and clearly positive emotion of eureka be useful? How could an ITS make use of such information?

First, the experience characterized by “*Alright, I’ve got it now*” or “*Oh now I really understand it*” can be useful in signaling that the student is now ready to proceed in the learning process. Such a functional communicative characteristic is a crucial point that might seem quite obvious but refers to the delicate balance between providing well-timed support and well-timed challenges to a student.

Second, and importantly, pedagogical adaptivity in a powerful ITS (as well as in a human teacher) involves *learnability* on the part of the teaching system. In order to *improve* ones teaching, an ability to analyze and identify the kinds of learning situations or activities that *precede* students’ eureka experiences can be highly relevant. Not the least so with respect to material that is well known to be hard for students really to understand. Here an identification of eureka experiences can help to pinpoint the teaching strategies, the set of examples and tasks etc. that seem to work well in guiding students’ towards an understanding of such material that is often difficult to get a grip of.

Attempting to study the eureka experience

Our study was set up in line with a suggestion by Craig et al. (2004) to aim at *more precise identifications* of when emotions occur during the learning process: in a sense, to try to catch emotions on the fly. In the study, 40 participants were asked to identify 26 stimuli consisting of pictures, which were pre-validated to yield an eureka-experience when identified: ambiguous pictures, incomplete pictures and mathematical logical problems; each picture accompanied by a written sentence to provide subjects with a context to interpret the stimulus within. Participants were asked to click the mouse button as soon as they identified the stimuli. The measurements consisted of a combination

of a behavioral measure – eye movements – with two physiological measures: skin conductance and pupil dilation. It was predicted that participants identifying a stimulus would look more on critical areas of the stimulus picture, have larger pupil dilation and higher skin conductance compared to participants not identifying the stimulus.

Results and discussion

The result was in line with the predictions, and clearly so for the eye movement data (with a distinct peak occurring around 6 seconds before reporting identification of the stimulus by clicking the button.) The overall pattern on the physiological measures was, though, *less dramatic* than expected. This result though, points towards the important issue about *the span of eureka*. An eureka experience in the sense of *Newtonian insight* may be prototypical in our conceptions of eureka. Such intense moments or states are, however, probably quite rare. Our working hypothesis is that there are *less intense*, but still very similar experiences when something falls into place and is finally or suddenly clear or solved, that occur much more frequently in learning contexts.

The tasks and situation in the actual study are more likely to produce such affective states than Newtonian eureka.

Our aim is to continue to explore the eureka phenomenon in its entire manifestation. In this quest the next step is to focus on more typical learning contexts and tasks and to continue to work on refinements of the measuring methods.

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References

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Craig, S. D., Graesser, A. C., Sullins, J., & Gholson, B. (2004). Affect and learning: an exploratory look into the role of affect in learning with AutoTutor. *Journal of Educational Media*, 29(3), 241-250.