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Title

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Journal

Proceedings of the Annual Meeting of the Cognitive Science Society, 42(0)

Authors

Colantonio II, Joseph

Bascandziev, Igor

Theobald, Maria

et al.

Publication Date

2020

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Peer reviewed

Modeling pupillary surprise response in elementary school children with theory-based Bayesian models

Joseph Colantonio II

Rutgers University - Newark, Newark, New Jersey, United States

Igor Bascandziew

Rutgers University, Newark, New Jersey, United States

Maria Theobald

Leibniz Institute for Research and Information in Education (DIPF), Frankfurt, Germany

Garvin Brod

Leibniz Institute for Research and Information in Education (DIPF), Frankfurt, Germany

Elizabeth Bonawitz

Rutgers University - Newark, Newark, New Jersey, United States

Abstract

Affective components are frequently overlooked in computational modelling, despite the notable role of emotions in learning. Towards the goal of measuring affect in learning, we developed a theory-based Bayesian model that predicts surprise based on a learner's prior beliefs and the evidence observed, and then compared the model to a physiological measure commonly suggested to capture surprise: pupil dilation. Critically, we also investigate whether this correlation is strong when participants predict the events. Comparing our model predictions to the first four test trial responses from 93 participants (mean age: 8.00 years) revealed a significant, positive correlation when making predictions ($r(9)=.55$, $p=0.04$), a negative correlation when only evaluating ($r(9)=-.50$, $p=0.07$), and significant difference between groups ($z=2.34$, $p<0.01$). Next steps will allow us to build on this result by developing a modified Bayesian model, that takes physiological surprise as a component in predicting the participants' learning.