

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

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## **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.