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Botzer, Galit; Yerushalmy, Michal

Interpreting motion graphs through metaphorical projection of embodied experience.

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Authors' abstract: This paper focuses on the cognitive processes that occur while students are exploring motion graphs. In a classroom experiment, we examine how high-school students (aged 17), with backgrounds in calculus and physics, interpret the graphs they create through drawing the path of the movement of their hand with a computer mouse. Based on recent, and expanding, research on embodied cognition, we analyse both the gestures and the terms that the students use, and probe the cognitive processes that their actions and discourse reflect. In the experimental study, the students faced three main challenges: modelling 2D motion, understanding a rest situation, and dealing with instantaneous rest. We show how the students used the source-path-goal schema to meet these challenges, which we analyze in the context of the philosophical and psychological complexities of the conceptualisation of time. We conclude that the computerised representations that were available to students added to the visible path information that they had about time. This helped the students to conceptualise the physics of motion and to link these concepts to the mathematical properties of the graphs.

Classification: C34 M54 I24

Keywords: motion graphs; cognitive development; concept formation; mathematical modeling; graphical representation; educational research; video data