

Designing Effective Visualizations of Molecular Structure and Dynamics

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Abstract:

Successfully conveying complex scientific phenomena depends on understanding how the mind takes in, interprets, and understands the phenomena. Animations, for example, are rarely more effective than static diagrams in any field because they are too complex and fast or because they merely show without explaining. An effective animation must present information at a rate the mind can take in, highlight the relevant information, and segment it the way people do. Scientists, educators, graphic designers, computer scientists are among those involved creating molecular visualizations. Some have expertise in scientific fields, others in tools, and many of the visualizations they create don't do their job as well as they could.

This project has been developing research-based principles for designing effective molecular visualizations. The research studies have confirmed literature findings that many students, regardless of prior chemistry background and academic ability, have misconceptions about molecular-level structures and processes. These misconceptions interfere with learning many scientific concepts that assume an accurate mental model of the molecular world. The research findings show that many students are able to correct their misconceptions after viewing either still molecular visualizations or animations. However, they also show that visualizations can actually reinforce or create misconceptions.