Where does the flow go? Humans automatically predict liquid pathing with coarse-grained simulation

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Abstract

Bodies of water manifest rich physical interactions via non-linear dynamics. Yet, humans can successfully perceive and negotiate such systems in everyday life. Here, we hypothesize that liquid bodies play such an integral role in human life that the mind automatically computes their approximate flow-paths, with attention dynamically deployed to efficiently predict flow trajectories using coarse mental simulation. When viewing animations of liquids flowing through maze-like scenes, we asked participants to detect temporary slowdowns embedded in these animations. This task, without any overt prompt of path or prediction, reveals that detection rates vary with the moment-to-moment changes in coarse flow-path predictions. Critically, coarse predictions better explain trial-level detection rates than a finer-grained alternative, independently of bottom-up salience of slowdowns. This work suggests liquid flow-path prediction as an implicit task in the mind, and introduces rich attentional dynamics as a new window into intuitive physics computations.

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