Force dynamics in causal meaning and reasoning

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Most theories of causation specify the concept of CAUSE in terms of kinematics, that is, with respect to the observable properties of events. In contrast, the dynamics model, which is based on Talmy's (1988) theory of force dynamics, specifies causation in terms of dynamics: the invisible quantities that produce kinematic patterns. In the dynamics model, causation is characterized as a pattern of forces and a position vector. This model is supported by studies in which participants watched 3D animations generated from a physics simulator. In these experiments, the very same forces used to generate physical scenes were used as inputs into a computer model to predict how those scenes would be described. In a second line of experiments, the model is extended to sequences of events in which configurations of forces are linked together by their resultant vectors. As predicted by the model, people's overall descriptions of causal chains depended on the types of force configurations (e.g., CAUSE, PREVENT, NOT-ALLOW) from which the chains were composed. The model was able to predict when a causal chain could be described in more than one way, and to what degree. Thus, unlike any other model to date, the dynamics model offers an explanation of the relationship between deterministic and probabilistic causation, as well as of the semantics of several complex predicates.