Conceptual Constraints on the Language of Space and Time

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Language models of qualitative spatial relations and motion tend to focus on cross-linguistic differences and semantic universals of spatial concepts. As equally interesting and important, however, is the question of how the logical interpretations of spatial expressions in language translate into spatial logics for reasoning, inferencing, and planning tasks that are addressed routinely in the qualitative spatiotemporal reasoning community. In this talk, I look at how spatial relations between objects change over time and how this change is characterized by language. I will first focus on change-of-location predicates, and how spatial Aktionsart is both lexically encoded and derived compositionally through adjunct modification. Spatial change predicates fall broadly into two semantic classes: external_move and internal_move. Both classes exhibit the full range of Aktionarten (event classes) through composition. We then illustrate how the meaning of motion (and change-of-state) expressions can be expressed as topological and topometric transformations within an extended Line Region Intersection Calculus. This will be referred to as a spatiotemporal frame. I then provide a linguistic semantics of these spatial predicates using a Dynamic Interval Temporal Logic. I discuss the limitations of this model for handling intentional motion predicates, such as "chase" and "avoid". Next, this language is extended to model change-of-state predicates more generally. Finally, the resulting logic provides a model of interpretation for the behavior of "gating predicates'' as studied in Generative Lexicon Theory, as will be demonstrated.