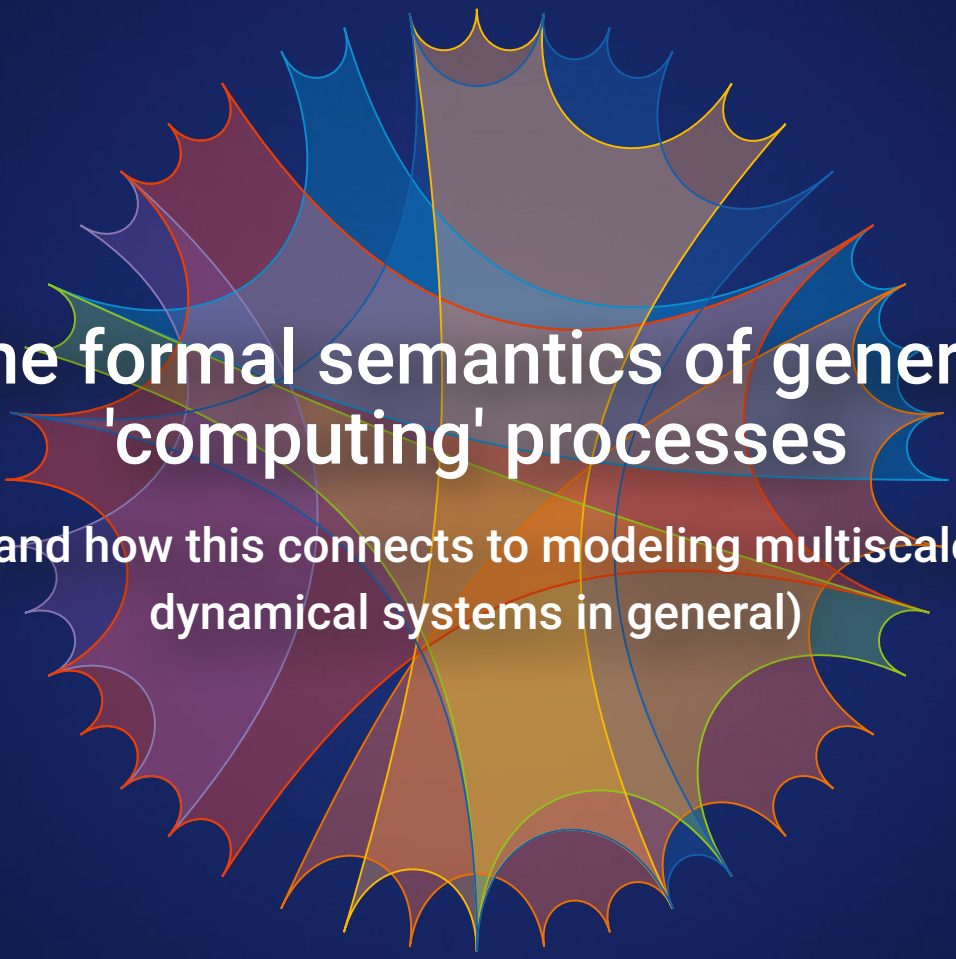
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STRUCTURES JOUR FIXE

Herbert Jaeger

U. Groningen



The formal semantics of general 'computing' processes

(and how this connects to modeling multiscale dynamical systems in general)

NOVEMBER 06, 2026, 1:30 PM, Philosophenweg 12 GHs

COFFEE & SNACKS IN ROOM 106

ZOOM: Meeting ID: 935 6549 3662, Code: 928036

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ABSTRACT

My current research concerns formal theory-building (I am a mathematician) in the field of non-digital, 'neuromorphic' computing (NC). Unlike the situation in digital computing, for which a wonderfully transparent and powerful system of interconnected formal theories has been worked out since Alan Turing set the foundation stone in 1936, for NC we painfully lack a general formal grounding. The challenge lies in the condition that NC hardware systems are not digital but evolve in continuous time in spatially organized nonlinear physical substrates (biological neural tissue or engineered new materials). To become practically useful, neuromorphic computing systems must become analyzable, designable, controllable and interpretable across many temporal and spatial scales. Furthermore, when complex physical dynamics in unconventional hardware should become interpretable as 'computing', it is not enough to describe these multiscale dynamics as a physicist would do – in addition to modeling the physical hardware dynamics, one must at the same time also model what these processes 'mean' (which computational *tasks* they can serve). In the digital computing world, formal theories for capturing the task semantics of computing processes are known, and these formal semantics are key enablers for almost all branches of modern IT technologies. In my talk I explain this problem setting in hopefully understandable ways. While this is all couched in a NC context as far as this talk is concerned, the questions asked are identical to questions that confront other complex systems modelers.

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