

Managing Self-Organisation in Socio-Technical Complex Systems by Morphogenetic Engineering

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Abstract

In today's complex interconnected world, where it becomes increasingly unrealistic to establish a company's full picture, perspectives on management tend to shift from construing companies "as machines" toward companies "as living systems". Numerous studies have proposed principles and models of self-organisation with adaptive mechanisms to foster the emergence of resilient socio-technical systems across different domains, from healthcare to automobiles and energy. In these works, however, there is little concern about promoting a specific functional *architecture* as an intrinsic part of the system's development. In the context of software engineering and collaborative project management, we argue here that both a predefined type of structure and its capacity to adapt are necessary. To this aim, we present an agent-based model of reproducible network growth among agents (software engineers and/or software modules) achieving a collective task, specified by external landmarks, without central control. It is derived from Morphogenetic Engineering (ME), a field of research on programmable self-assembly based on the propagation of positional information and genomic rules driving agent differentiation and connections. First, a generic morphogenetic network simulator platform, MorphoNet, is introduced; then, two socio-technical examples of collaborative software development, with a discussion on evolution and the trade-off between prerequisites and dynamic adaptation.