Distributed Cognition in Human-Machine Systems
(Distributed Epistemic Systems)
Trustworthy Autonomous Systems (TAS) – Security

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Empirical Research

Empirical analysis is conducted by using methods of participant observation, data collection and data analysis in ethnographic fieldwork. The research field is a scientific organization called Multi-Agent Programming Contest (MAPC) that has organized annual competitions between multi-agent systems since 2005.

Agents Assemble (contest environment 2020/2021)

Defining System Boundaries: According to Cilliers (1998), the *framing* of complex systems is influenced by the position of the observer, who defines the scope of the system according to purpose. The MAPC organization is framed here as a higher-level sociotechnical system composed by lower-level human, technological, and semantic subsystems. Rather than ontological classes, these terms are applied to facilitate the mapping of communication dynamics and information flows between different elements of the overarching system (i.e., agents, subsystems, and environment).
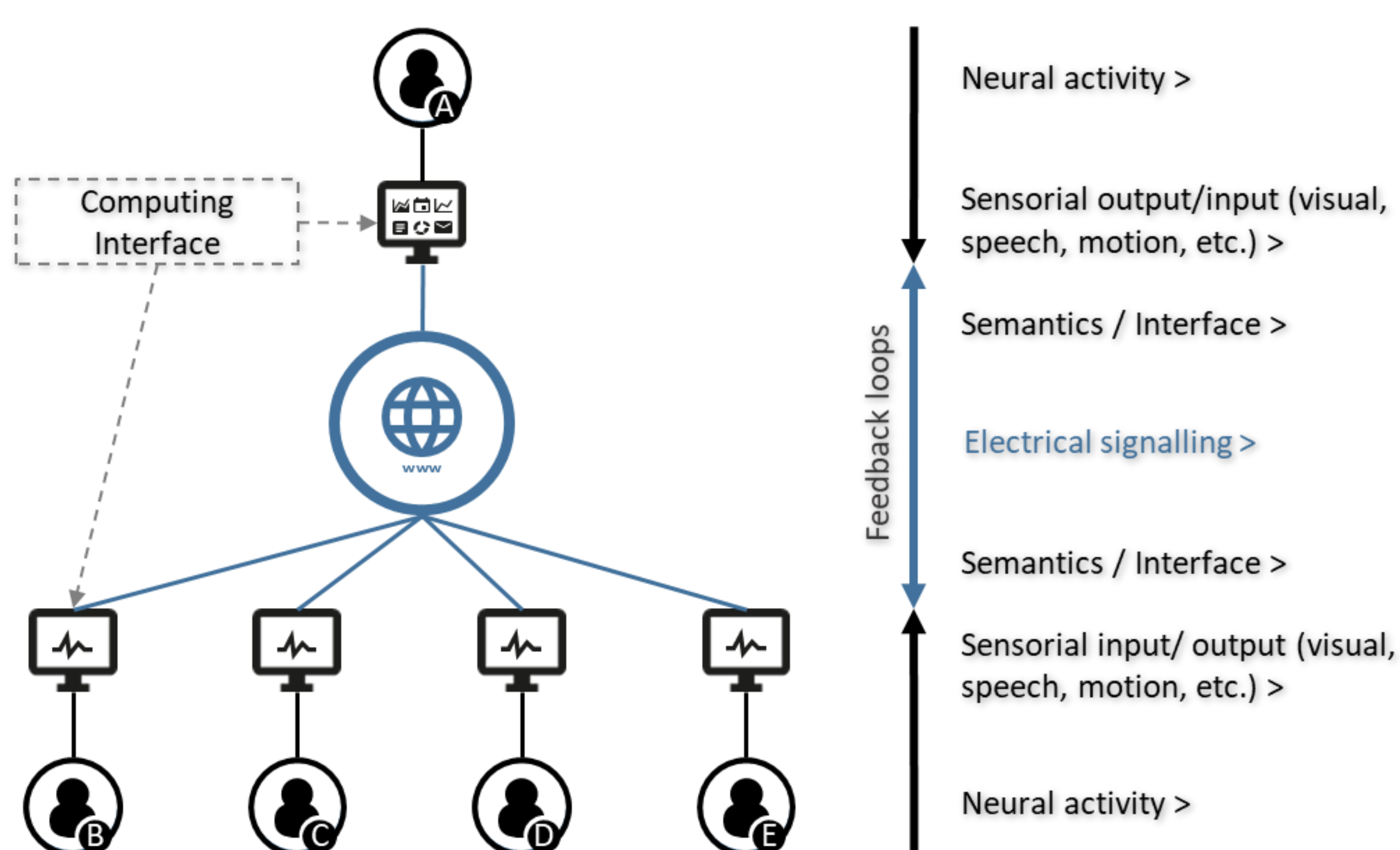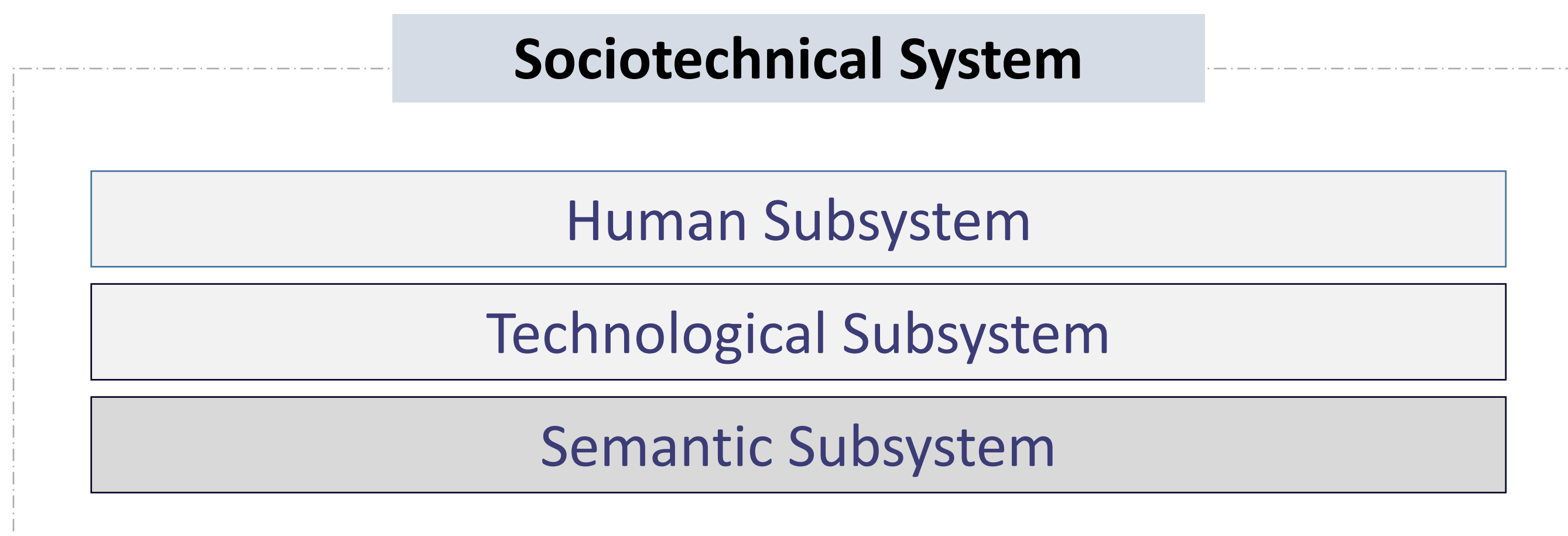
Research Question

How does human-machine cognitive interaction constitute and regulate the making of distributed autonomous technology?

Theoretical Framework

This research is grounded on posthumanism and modern systems theory to decenter the human from the discourse, argue for the breakdown of human-machine boundaries, and explain sociotechnical phenomena as a complex network of human and nonhuman agents whose cognitive interactions establish feedback loops. Systems thinking allows the study of sociotechnical phenomena through the lens of complexity by framing material-semiotic assemblages as a non-linear composition of systems and subsystems. This approach informs the observation of interactive dynamics between agents, systems, subsystems, and environment, and provides insights into aspects of self-organization, self-regulation and emergent collective behaviour in human-machine systems.

Bridging the Gap Between Human and Artifact

In human-machine systems, information flows through hybrid organic and artificial communication networks, where cognitive feedback loops are mediators connecting material bodies and virtual simulation (Hayles, 1999). In these sociotechnical assemblages, information travels across different material substrates by going through a transduction process.

Sociotechnical System

Human Subsystem
Technological Subsystem
Semantic Subsystem

Communication dynamics and information flows between human and nonhuman agents within the sociotechnical system (but more specifically within its semantic subsystem) are enacted as distributed cognitive interactions that establish feedback loops. Observing these interactions leads to insights into systemic features such as self-organization, self-regulation, and emergent collective behaviour.

Semantic Subsystem

Communication Platforms	
Contest Environments	
Multi-Agent Systems	Artificial Agents
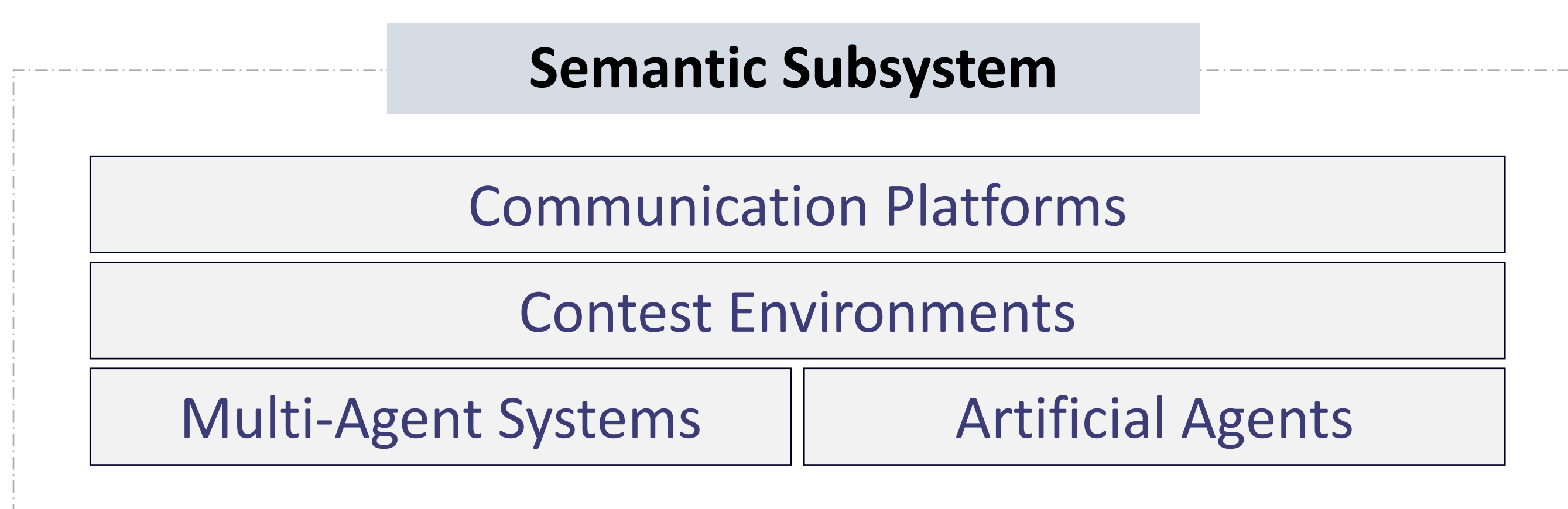
REFERENCES
Cilliers, P. (1998) Complexity and Postmodernism: Understanding complex systems. London: Routledge.
Hayles, K. (1999) How We Became Posthuman: Virtual bodies in cybernetics, literature, and informatics. Chicago: University of Chicago Press.