

The Emergence of Interactive Meaning Processes in Autonomous Systems

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ABSTRACT

Cognitive theories explaining how intelligent behaviour and action is produced have been the basis for designing and implementing intelligent artificial systems. Although it is widely accepted that the notion of autonomous intelligent action consists of at least the concepts of intentionality, representation, meaning and information, it seems that their interrelations as well as their functional activation outside or inside the system, result in different theories of representation and information. The problem is usually concentrated on the necessity of the usage of representations in explaining and producing information, or, in the softer and more interesting aspect of the debate, on the objection of a hard, explicit and static notion of representation instead of a more implicit and dynamic one. The different use of the concept of representation results in different frameworks analysing and modeling cognition, where meaning and information adopt a different functional and explanatory role.

The respective dominant frameworks of cognition are all characterized by inherent limitations such as their inability to account for both low and high-level cognition or to scale between them (the symbol-grounding problem and the frame problem) and they all phase a fundamental problem of not being able to account for the emergence of representation in a purely naturalistic manner, as well as their falsification and many other related issues.

This paper proposes a systems-theoretic framework which seems to move towards the accommodation of the aforementioned difficulties, while preserving the basic notions of cognition. The proposed framework utilises elements from the cybersemiotic model and tries to support the reconstruction of the basic cognitive concepts (representation, meaning and information) by incorporating them in an anticipative and interactive context of information dynamics. The 2nd-order cybernetics and self-organisation properties are used in the proposed framework to account for a complex and emergent relational structure of representations, and furthermore, their closure and embodied-based functionality provide the basis for the use of Peircian semiotic processes as the vehicle of these representations and their content formation.

This approach is not a hybrid dynamic/symbolic one, but an interplay between analogue and digital information spaces, in an attempt to model the representational behavior of a system. The focus on the explicitly referential covariation of information between system and environment is shifted towards the interactive modulation of implicit internal content and therefore, the resulting pragmatic adaptation of the system via its interaction with the environment. The basic components of the framework, its nodal points and their dynamic relations are analysed, aiming at providing a functional framework for the complex realm of autonomous information systems.