

# Cultural systems

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In this seminar we will present and discuss some recent theoretical work at CEK taking a system approach to cultural evolution. Fredrik will start and present some of our ongoing work on cultural systems, and then Magnus will talk about a new project.

## Modelling cultural systems and their evolution

Cultural traits – whether they are about knowledge, behaviours, preferences, norms, values or artefacts – are results of evolutionary processes. Meanwhile, properties from genetic evolution do not simply carry over to processes in cultural evolution. Cultural traits are not as well-defined, nor is their medium, and there is no clear fitness concept. Also, transmission is not typically vertical, and selection can be targeted and strategic. This has the consequence that biological models that successfully predict genetic variation may not be useful for explaining culturally evolved traits.

A widely accepted view in the cultural evolutionary literature is that culture forms a dynamic system of traits linked together by a variety of relationships. Despite this, large families of models within the cultural evolutionary literature tend to represent only a small number of traits, or traits without interrelationships. Many phenomena, however, cannot be explained unless we consider the interdependence between traits. As such, these models may be unable to capture complex dynamics resulting from multiple interrelated traits. For example, some traits are more or less compatible, and this fact should influence their transmission. The belief in Shiva is harder to spread if the potential recipients already believe in a monotheistic god.

Here we put forward a systems approach to cultural evolutionary research – one that explicitly represents numerous cultural traits and their relationships to one another. Structural dependencies between traits have the consequence that the beliefs or skills that you already have or that exist in society influence the acquisition of new skills or beliefs, and can even provide a mechanistic explanation to the transmission process itself. We examine the implications of the systems approach in four domains: (i) the cultural evolution of decision rules ('filters') and how we determine whether and whom to copy; (ii) the contingency and stochasticity of system trajectories through a structured state space; (iii) how trait interrelationships can modulate rates of cultural change; and (iv) how trait interrelationships can contribute to understandings of inter-group differences in realised traits.

An important tool for reasoning about mechanisms not easily detectable in empirical data, but that underlie emergent phenomena, is formal modelling with mathematics and simulations. In this presentation, we use formal modelling to describe a cultural system and agent-based simulations to illustrate the usefulness of a cultural systems approach.

Some of the consequences are that a wide range of phenomena become available, such as path-dependent and experience-guided cumulation, and that cultural evolution can shape its own learning and transmission mechanisms. We also demonstrate how mathematical models of cultural systems can generate diverse cultural patterns such as polarisation and fashion trends.

See also our paper Buskell, Enquist & Jansson (2019): A systems approach to cultural evolution. *Pelgrave communications* 5:131. <https://www.nature.com/articles/s41599-019-0343-5>

## Symbolic abilities and systems

This second part of the seminar presents new research that we are developing at CEK, exploring the role and importance of symbols and symbolic capacities in human cultural evolution. We have submitted proposals to RJ and VR for this research (see abstract below). We are particularly interested in individual development, and how systems of symbolic abilities and symbolic culture can be socially transmitted between individuals and generations. This part of the seminar will be presented by Magnus.

**Abstract from the RJ application:** The uniquely human ability to create and handle symbols is fundamental for and permeates human culture. It helps us in our understanding of the world, our memory and our thinking. It has also given rise to countless cultural phenomena, such as religion, mathematics and fiction, and a wealth of cultural diversity. Through language, culture can be shared between individuals and generations. Language is also culture and consists of symbolic representations that are created and subject to change. It is still unknown whether human symbolic abilities are mostly inborn or emerge through cultural evolution. This project investigates hypotheses giving cultural evolution a much more decisive role for uniquely human phenomena than the currently dominating explanations. This applies for instance to thinking, language, representations of the world and values. The project will be based on a major interdisciplinary research effort consolidating knowledge from scattered fields that otherwise rarely interact. Theoretical methods, such as mathematical modelling and computer simulations, will be combined with empirical meta-analyses and experiments on children, adults and great apes. The project gathers expertise from linguistics, psychology, artificial intelligence, cultural evolution, biology and mathematics to create a powerful research team with the aim to achieve a new level of synthesis and understanding of the emergence of the symbolic species and her culture.