Home
Purpose and vision
People
Workshops
Practicalities
Background readings
Links

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Abstracts for ConChaMo 1

Coherence and Contextualization in the Process of Conceptual Change

Ola Halldén and Åsa Larsson
Stockholm University

In the late 1970th Driver and Easley (1978) requested more focus on understanding the students' ideas and reasoning in its own right rather than focusing on their 'misconceptions' or incorrect ideas. Their main point was that when students' give wrong answers to questions at school these should not always be regarded as misconceptions but as answers from a different point of view, that is, out of an alternative framework. However, within the research field a normative line of research has been dominating. This normative line has focused on how the students' alternative frameworks differ from scientific thinking and are obstacles in the acquisition of science concepts and there has been a search for the crucial event that should make conceptual change to come about in the learner. Another line of research has attempted to describe the students' conceptions in its own right as requested by Driver and Easley. It has been argued that it is of importance to take the applicability of concepts into account as well as the framing of conceptual structures in cultural genres (e.g. Halldén, 1999). For example, how the conventions of drawings influence students' thinking has been investigated (e.g. Ehrlén, 2008). In our presentation we will further explore the complexity of the process of conceptual change. This complexity involves quite different dimensions. First, there is the process of tentative reorganizations within a conceptual structure that have to conform to a new Gestalt in order for conceptual change to occur. These reorganizations involve ideas of quite complexity ranging from knowledge of simple facts to highly theorized concepts and logical relations that have to cohere simultaneously. Second, the student has to find this new Gestalt applicable to adequate explanatory contexts. This also implies that the process of conceptual change is three-tailed. It comprises a conflict among three entities, that is, two or more different facts or conceptions that conflict when related to specific contexts of applicability.

Conceptual change across disciplinary boundaries

Uskali Mäki

Concepts travel or fail to travel across disciplinary boundaries in many kinds of interdisciplinary constellations. The case of the concept of the market is used to illustrate, both when moving from folk views to the discipline of economics, and from the latter to other disciplines such as biology, sociology and political science. Attention will be paid to the role played by analogy and the resolution of counterintuitive paradox. The issue of how to normatively assess conceptual change is raised.

Implicit vs. Explicit Concepts

Gualtiero Piccinini
Department of Philosophy, Center for Neurodynamics
University of Missouri - St. Louis

I argue that there are two kinds of concept. Implicit concepts encode statistical and some causal information about categories; they subsume the implicit aspects of both prototypes and theories. Explicit concepts may encode statistical and causal information, but more importantly, they may encode syntactic information, definitional information, and whatever else is needed for the language faculty to process them. Thus, explicit concepts subsume the explicit aspects of what psychologists call theories (and perhaps prototypes). Explicit concepts are necessary for explicit cognition – the distinctively human ability to use language, represent unobservable, nonexistent, abstract, and ad hoc aspects of the world, and perform linguistic inferences.

Deep Learning – Concept, Findings, and Instructional Implications

Stellan Ohlsson
University of Illinois at Chicago (UIC)
Department of Psychology

In most contexts, “to learn” means “to acquire more knowledge.” But to equate learning with monotonic growth of one’s knowledge base implicitly presupposes that the world remains stable. When the world is turbulent, on the other hand, “to learn” can also mean to abandon, revise, or suppress knowledge previously acquired. I refer to this as “non- monotonic cognitive change”, or, less formally, “deep learning.” A complete theory of learning must explain how knowledge grows, but also what happens to knowledge that is made obsolete by changes in the world. In this presentation, I will contrast two perspectives on deep learning: falsificationist and resubsumption. With support from a simple laboratory model of deep learning that we call re-categorization, I will argue that both perspectives are valid, but

that neither provides a complete picture of deep learning, and that one of the missing pieces might be the interaction between explicit and implicit learning. At the end, I will discuss the complex instructional implications of this situation.

The problem of conceptual change in the learning of science and mathematics concepts

Stella Vosniadou
National and Kapodistrian University of Athens

Conceptual change research investigates learning processes that require the substantial revision of prior knowledge and the acquisition of new concepts. In this presentation I will discuss the major theoretical views on conceptual change and the kinds of instruction required to facilitate it. I will focus on the 'framework theory' approach and argue that learners construct a naïve physics early on in childhood which is based on everyday experience. Naïve physics acts as a framework theory to advance but also constrain learners' knowledge acquisition processes. I will argue that we need to distinguish 'preconceptions' from 'misconceptions' and that many misconceptions are 'synthetic models' produced when constructive mechanisms are used to integrate scientific information with prior knowledge. I will show how the framework theory can be used to predict where students' difficulties in learning science will occur, to understand how explanations in science should be presented to students, and to build a learning progression for science curricula.

Reconstructing Conceptual Change with Conceptual Spaces

Frank Zenker
Lund University

This talk presents a method for reconstructing conceptual change in empirical theories by means of the theory of conceptual spaces. Changes occur in terms of the structure of the dimensions—that is to say, the conceptual spaces—underlying the conceptual framework within which a given theory is formulated. Five types of changes are identified. Given this classification, the conceptual development of empirical theories becomes more gradual and rationalizable. Only the most extreme type—replacement of dimensions—comes close to a Kuhnian revolution. The talk is based on joint work with Peter Gärdenfors.