
A Frame Representation of Distributed Cognition in Science

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In our monograph *The Cognitive Structure of Scientific Revolutions*, Peter Barker, Xiang Chen and I have argued that the dynamic frame representation of concepts developed by Barsalou can serve to extend and refine Kuhn's account of scientific concepts and the role they play in his phase-model of the development of science. In this paper I shall extend this work in showing how the dynamic frame representation can be extended to capture the social aspects of cognition in science. Particularly, I shall focus on how scientists collaborating in interdisciplinary research *combine* their conceptual resources, and how they adopt *structures* and *constraints* provided by collaborators from other areas of expertise.

This will provide an important extension of our account of scientific concepts. In the ABC group we have so far focused only on one social aspect of cognition in science and how it could be captured by the dynamic frame representation, namely how differences in graded structures between scientists employing the same set of concepts could cause them to judge anomalies differently and therefore play different roles in the process of conceptual change within a discipline. This analysis only applies to monodisciplinary research within a community whose members have gone through similar training in the same area of expertise. However, much science, not least much contemporary science, is developed by groups of scientists with different backgrounds and whose different areas of expertise complement each other.

Focusing here on scientists participating in interdisciplinary collaborations, new aspects in the social process of conceptual change by groups of scientists are brought to the front. Two important issues need to be addressed in order to understand conceptual developments in the intersection between different disciplines, namely first, how in a group of collaborating scientists concepts that are distributed among the collaborators get combined, second, how scientists arrive at a joint consent to accept conceptual changes in the overlap between distributed concepts.

First, I shall extend the dynamic frame account of concepts developed by the ABC group to include frames that are interconnected in complicated crisscrossing patterns where features or attributes are related across frames, for example through regularities or laws. Second, I shall extend our account by showing how the frame representation can capture concepts and knowledge that is distributed among the members of the scientific community in the sense that different members draw on different parts of closely related frames.

Second, I shall argue that the situation in which an overall conceptual structure is jointly accepted by a group of scientists while individual parts of the structure are distributed among group members with different areas of expertise can be described the notion of a conceptual heterogeneous consensus, and I shall describe how this situation can be captured in the dynamic frame representation.

Finally, drawing on work from social epistemology I shall analyse when such a conceptual heterogeneous consensus can work as a constraint against scientific change.