Opening the Black Box: Cognitive and Interpersonal Mechanics of Knowledge Interactions in Interdisciplinary Collaborative Teams. Dissertation, submitted by Lianghao Dai. Published as Open Access Publication (eDiss) at Göttingen State and University Library (SUB) 2020.

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## Abstract

This doctoral dissertation teases out how scientific knowledge in interdisciplinary collaborative teams is learned, shared and integrated in scientists' minds and in their daily interpersonal communications. This work is based on thirty months of ethnographic fieldwork conducted at a German university between the years of 2012 and 2016. In total, seven interdisciplinary collaborative projects with thirty-seven scientific researchers have been investigated. Deploying methods of participant observation, semi-structured interview and cognitive mapping, this research visualises and analyses personalised and structural understandings on knowledge among members of interdisciplinary collaboration and their division of labour, a cognitive and interpersonal process which for a long time scholars in the sociology of science and in the Science of Technology Studies were unable to clearly capture and illustrate. This doctoral dissertation thus makes a critical contribution to these fields by innovatively combining methods of cognitive mapping and social network analysis to help understand the cognitive and interpersonal mechanism of knowledge production and innovation.


To be more specific, it claims the following main findings:

(a) Shared knowledge between scientists is established via processes of contextualisation and integration. The necessary extents and structures of shared knowledge for building up an interdisciplinary research team differ depending on two collaborative patterns: theory-method pattern and technical pattern.

(b) In an interdisciplinary collaborative team, the discipline a scientist belongs to merely influences the strength of cognitive connections. But the hierarchical position one is located

affects not only that but also the rhythm that a pair of scientists work interdependently. There is a clear division of labour between the junior and senior researchers in a team. Junior researchers conduct practical and technical works asynchronously in a 'zip process'; seniors take care of general ideas and work on the same pace during the networking process. Groups of a senior and a junior from the same disciplines interact in the knowledge plantation mode.

(c) A quadruple-people team with one senior and one junior researcher from each of the two disciplines have been found with higher work efficiency than a team with four seniors from the same two disciplines, if the junior is well-trained and experienced in operations related to the project. As well, the effectiveness of an interdisciplinary research, that leads to knowledge innovation, is achieved by two modes of division of labour.

(d) A sharing of knowledge has to be achieved in order to build up an interdisciplinary collaborative team, but it cannot guarantee the maintenance of the team. Thus this dissertation argues that the interpersonal networks of scientists are based on the network of scientific notions baring in scientists' minds, namely the former is embedded into (Granovetter, 1985) the latter.

Based on these findings, this dissertation provides a number of policy recommendations for better enhancing the performance of interdisciplinary collaboration projects and for evaluating the quality of the collaborative endeavour in the scientific academia.