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# Interdisciplinarity in ferment: The role of knowledge networks and department affiliation

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ABSTRACT

This paper examines the relation between department affiliation and interdisciplinarity in terms of knowledge creation. While the claims made for the benefits or limitations of interdisciplinarity are diverse, they have been largely related to modes of academic governance or to the bare nature of disciplines. Less is known on the precise role of social networks in fostering or hindering interdisciplinarity within intraorganizational contexts. Thus, to explore the influence of network structure, tie strength and nodal properties in interdisciplinarity within higher education institutions, we study the structure and dynamics of academic's personal knowledge networks. It is used a mixed methods approach combining the delineation of personal networks with the ties' content analysis regarding a conceptual model specifically developed for this study. Personal network data were collected and semi-structured interviews were held with 32 academic staff members of the academic and research system in Catalonia, Spain. Findings suggest that belonging to a department decreases interdisciplinarity and that institutional constraints are more significant than the strength of the ties. Researcher's network centrality and strength of ties are positively related to interdisciplinarity. Structural holes control for certain organizational rewards and individual attributes but are not directly linked to interdisciplinarity.



## 1. Introduction

Despite the fact that research is generally not interdisciplinary (Zürcher, 2007) there is a conventional discourse in favour of interdisciplinary research and, at the same time, much indifference or even disregard for such research (Sperber, 2003). In addition, research shows that constraints to interdisciplinarity are posed both in scientific terms (e.g.: Collinet et al., 2013) but also in institutional terms (e.g.: Su, 2014), especially concerning governance modes (Cooper, 2013). The idea that interdisciplinarity in higher education is related to the framework of institutions, departments and courses is not new (e.g.: Carpenter, 1995; Pirrie et al, 1999; Wall and Shankar, 2008; Dykes et al., 2009). Curiously, for the most part, academic staff are positive about their own experiences of interdisciplinarity research but many are negative about attempts to promote this in ways that force the dominant university logic. For some, interdisciplinary research is seen as privileging over other types of research. For others, it is possible to see themselves as working in an interdisciplinary fashion without necessarily collaborating with anyone (Pisapia, 2012). In turn, Horta and Lacey (2011) showed that factors like international visibility and academic's communication are positively affected by research unit size. As a matter of fact, one of the dominant features of education in universities is that it is usually confined within one subject area and often to one discipline, especially in countries like England, Spain or Portugal. On the other hand, despite technological and economic forces for integration, or convergence, there are equal or perhaps greater forces for fragmentation that hinder truly interdisciplinary research. Literature (e.g. Seeber, 2013) shows that university steering is effective in some disciplines, suggesting that a managerial-like steering may privilege strongest groups and paradigms, while marginalizing minor or emerging streams of research. In this work, as a departure point, the term discipline regards the schema used by Biglan and Becher (1973, 1987) as it has been cited widely in higher education literature and has proven to be a useful tool for viewing disciplinary values, norms, and beliefs as they relate to teaching and research. Becher's typology classifies disciplines according to whether they are hard or soft (according to their level of paradigm development), and whether they are pure or applied (depending on the extent to which they are concerned with practical application).

Considering the institutional embeddedness of researchers, the focus of this paper is on researcher's set of relationships that shape the interdisciplinarity of their research. The purpose is to identify what aspects of the researcher's affiliation influence their personal networks and the interdisciplinarity of research. Looking at the disciplinary diversity of researcher's knowledge networks, the analysis puts forward systemic connexions between the rise of knowledge networks and the characteristics of departments that may promote or hinder interdisciplinarity among researchers. In this paper, departments are seen as a

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cluster to the extent that they are a spatially concentrated group of researchers competing in the same or related fields linked through vertical or horizontal couplings oriented to the transfer and creation of specific knowledge and exchange of ideas. Departments, regardless of the organizational model of their institutions, stem from specialisation, though that is more acute in university research centres than in teaching departments (Su, 2014). In this study, the concept of department will not be restrained to teaching departments as our focus is on research. Given the political context of Catalonia, where the data was collected, three types of institutional departments are surveyed and considered with regard to the respondents (the whole set of relations studied belong to a wider range of institutions): two public universities, the Spanish National Research Council that belongs to the Spanish Ministry of Economy and Competitiveness through the Secretary of State for Research, Development and Innovation (the largest public institution dedicated only to research in Spain and third largest in Europe) and the Catalan Institution for Research and Advanced Studies, which is supported by the Catalan Government and directed by a Board of Trustees.

## 2. Definition of interdisciplinarity

Interdisciplinarity as a concept and a practice is one of the most hotly debated topics among academics and has spun a complex web of development strategies and theorizing. For instance, the emphasis on productivity and competitiveness produces an ideological system that serves the economic regulation at universities, encouraging an overemphasis on research projects and courses (e.g.: the proliferation of summer schools). In the face of this increased turnover on interdisciplinarity, there is a compromise in the efficiency level of the institutions, but the increased emphasis on presenting profits/outputs with minimum transition periods ensures that institutional and group decisions are based on shorter timespans, instead of long-term investments, just like it happens in the corporate world (Mintzberg and Van Der Heyden, 2002). However, its lack of standardization continues to be an issue, namely in universities that have traditionally hermetic departments and a lack of communication embedded in the academic culture.

Usually, interdisciplinarity means the integration of disciplinary perspectives (e.g., Birnbaum; Cotterell; Hanisch and Vollman; Hausman; Klein; Kockelmans; Epton, Hermeren). As a matter of fact, the most known use of the term is when there is a concatenation of different disciplines or their components (e.g.: Rossini and Porter, 1979). Fairbairn and Fulton (2000) define it as a problem-based approach in which knowledge and methods are brought to bear as needed to solve a complex problem or to address an object study. It is a response to a felt need insufficiently addressed by solely disciplinary work; an identification of a gap of the university's mission and its surrounding community. Interdisciplinarity demands constant proactiveness, responsiveness and the ability to adapt to changing situations. As Sperber (2003) notes, often disciplinary boundaries and routines stand in the way of optimal research and that is why the solution is to go ahead with new research programmes, which requires institutional reshaping. A less debated dimension of interdisciplinarity concerns the individual and social epistemology of knowledge and science. In this regard, Lattuca (2003) brought an interesting view on the subject when reporting that rather than disciplinary training, it is the epistemological commitments of informants that result in an affinity for a particular kind of scholarship. Andersen and Wagenknecht (2013) also remind that interdisciplinarity involves: epistemic dependence between researchers with different areas of expertise, the combination of complementary contributions from different researchers through shared mental models and conceptual structures, and shared cooperative activity with interlocking intentions, meshing subplans and mutual responsiveness. Thus, literature has approached interdisciplinarity as a 'trans-epistemic arena' (Knorr-Cetina, 1999), as an emergence of scientific networks (Latour and Woolgar, 1979) and, more recently, through the coordination modes between interacting actors depicted from the analysis of scientific works (Collinet et al., 2013).

This paper contends that interdisciplinarity, although difficult to separate out, is deeply embedded in institutional arrangements and that researchers' networks of relations strongly influence interdisciplinarity. That influence mirrors processes of personal and institutional adaptation, resistance, hindrance or enhancement of interdisciplinary research. For instance, researchers began to apply behaviours they practice in their living rooms or in the elevator: "What do you think about that paper/speech, etc?" This rise of peer production can be assessed by looking at the knowledge networks of researchers. It is possible to empirically understand the way disciplines are organized, the way research relations function and the institutional influences at work towards more or less interdisciplinarity.

In sum, both knowledge creation and interdisciplinarity are social phenomena, thus a social network approach can elucidate the role of the departments and its relation to interdisciplinarity in terms of knowledge creation.

## 3. Social network perspective

Instead of the traditional focus on individual attributes, a social network perspective emphasises the relationship among actors in order to understand the actors' behaviours rather than the actors themselves (Borgatti and Foster, 2003; Brass et al., 2004). The use of social network analysis (SNA) to understand the dynamics of interdisciplinary collaborations is a relatively new field. The SNA approach has been mainly used to characterize interdisciplinary collaboration among researchers in specific fields (e.g.: Aboelela et al., 2007; Haines et al., 2011); to explore collaborative and interdisciplinarity in higher education institutions through the analysis of co-publications (e.g.: Obermeier and Vlegels, 2010; Jung and Horta, 2013); to examine the effect of individual psychological differences on network structures (e.g.: Kalish and Robins, 2006); or to understand how interdisciplinary teams are formed, what makes them work, and what inhibits them (e.g.: Pisapia et al., 2012). Therefore, in most SNA studies interdisciplinarity is considered as co-publication activity (e.g.: Morillo et al., 2003).

More recently, Lazega et al. (2008) analysed the meso-level of interaction in the production of science, studying the duality of social life (Breiger, 1974). Their study showed that the position of an organization in the inter-organizational network is still more important in terms of attaining high levels of performance than the position of individual members in the network of the élite (Lazega et al., 2008).

Some attention has been drawn to understand the optimal network structure for interdisciplinary collaboration, mostly using citation databases, email contact and joint activities such as submitting research grants. Yet, little is known on the network factors linked to interdisciplinarity regarding the content of the knowledge networks where scholars are embedded. On the other hand, it is also important to consider the level of institutional affiliation because the prestige of one's departments is one of the criteria to select research partners (Bellotti, 2010). Knowledge networks are usually defined as a set of actors who are repositories of knowledge and who create, transfer and adopt knowledge (Phelps et al., 2012). The social connections among these nodes are seen as channels and/or conduits of information and knowledge (Owen-Smith & Powell, 2004). These two definitions emphasise node and tie properties for knowledge creation. However, less is known about how knowledge flows in the academy because of inherent difficulties in collecting data on large samples of networks over time and on a changing concept as knowledge is. McFarland and colleagues (Johri, Ramage, McFarland, & Jurafsky, 2011) also found that established authors in certain subfields have more deviation from their previous work than established authors in different subfields or their quantification of the extent to which some authors are more prone to being 'hedgehogs', whereby they heavily focus on certain specific areas,