What is the Object? Co-coordinating Design Work across a Large Construction Project

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Introduction

The literature on innovation and learning is shifting attention away from the firm as the main unit of analysis to explore the interactions between individuals and groups involved in technological change within and across organizational boundaries. This shift brings into view a range of interactions between people and objects, discussed in relation to brokering (Hargadon & Sutton, 1997), play (Dodgson, Gann, & Salter, 2005; Dougherty & Takacs, 2004) and ‘wakes of innovation’ (Boland, Lyytinen, & Yoo, 2007). From a ‘practice-based’ approach, knowledge is described as embedded and emergent, developed through interactions between people and objects (Gherardi & Nicolini, 2000; Orlikowski, 2007). Here too, then, there is an empirical interest in the role that material objects play in knowledge intensive work (Bechky, 2003; Engeström & Blackler, 2005; Oswick & Robertson, 2005).

Within these literatures, objects are variously described as abstract or concrete; stable or influx, and used in dyadic or multiple actor interactions (Ewenstein & Whyte, accepted). Theoretical insight has been developed around the concept of ‘boundary objects’ (Star, 1989) that facilitate (and/or inhibit) collaborative efforts of teams across epistemic and professional boundaries (Carlile, 2002). Objects can also themselves be changed by this process, becoming part of the experimental system and operating as ‘epistemic objects’ (or ‘trans-epistemic objects) that are characterized by lack and incompleteness and partially expressed in multiple instantiations that are continuously evolving (Ewenstein et al., accepted; Knorr Cetina, 1999; Rheinberger,
1997). Drawing on a detailed study of construction, this paper explores the multiple natures of objects in this context by addressing the research question: *What are the roles that objects play in the co-ordination of design and construction work across a large infrastructure development project?*

**Setting and Methods**

The presentation focuses on the case of one of the largest construction projects worldwide (taking place in Europe), and in particular on the role of technologies in co-ordinating design work throughout it. The nature of the organization changes fundamentally through different stages of the project process – with different individuals and firms joining and leaving the overall project team in planning, design and construction phases. Innovation takes place in a number of areas simultaneously, in the contractual arrangements and organization of work and in the technologies used to design and co-ordinate work. As such, it provides a good context for studying the role of objects in co-ordinating knowledge.

Data was collected through two separate empirical studies focused on the technologies and practices within this large construction project. The first study involved ethnographic research by the second author, involving blocks of three or four days observing staff at work, engaging in informal discussions and attending team and project meetings with data collection over several weeks between October 2001 and April 2002. Towards the end of the period the second author conducted 23 semi-structured interviews to clarify observations (Harty, 2005). The second study was largely interview-based and involved the first author and her colleagues, with data collection between October 2005 and November 2006. It is based on 36 semi-structured interviews (taped
and transcribed), 24 informal interviews (notes taken but not taped), on two guided visits onto the construction site, as well on over 1000 pages of related documentation.

This paper builds on our joint work in ongoing analysis of our collective data and theory-building. The separate studies share more than the empirical case; both focus on technologies and other objects in the development of new practices and in the coordination of complex activities. By pooling these data sets together, we gain insight into different phases of the project, from 2001 to 2006, and can make connections between early design and later construction phases. We are especially looking for ways that the broad concept of the single model environment was mobilized across this long time period and how technologies and artifacts are related to the coordination of design across the large construction project. We should stress that this is an ongoing process and our thinking will certainly change and develop before August 2008, when this paper will be presented (if accepted). The examples used here are from the first of these studies, but it is intended that the presentation will draw on both.

**Discussion of Major Findings**

At this stage, our coding and analysis challenges and potentially extends existing theoretical understanding of objects in a number of ways. It suggests that objects that play a role in coordination may not be neutral to the coordinative work, but are themselves implicated in debates around the differentiation and integration of work involved in complex organization. Indeed the debates about knowledge often spill-over into debates about the nature of the artefact that should be used in co-ordination of that knowledge. Within the project there was an effort to introduce a single model environment, with all design work modeled in the same computer system. Firstly, the single model was an attempt to draw clear boundaries around the project, and to coordinate
and integrate it internally through digital technologies. However, on the ground this environment was in fact a loose collection of tools which were interacted with, and themselves transformed, in different ways.

The ethnographic research revealed a number of instances where actors, singly and in collaboration, deviated from or subverted the idea of total coordination. These included the persistence of paper drawings and CAD printouts, despite the positing of the single model as paperless and the sharing of electronic documents outside of the document management system. Others went further, for instance in bringing in unofficial hardware on which to run familiar but unsupported software totally outside the project’s IT system. In these cases, different sorts of objects – computers, software, files, models, paper - were being combined in diverse ways, in isolation from the single model. These are certainly cases of localized practices threatening the integrity of the system at project level.

Such objects were also continually breaking down and reconstituting the boundaries constructed around the single model and around the project. One such instance involved the integration of building services packages. The required level of inter-operability could not be achieved without recourse to the various software developers, who were dragged into negotiations over coordinated working within the project. The requests were rejected, largely because interoperability was considered a threat to the unique functionality of each package within a competitive market. The project could not remain isolated from the wider positioning of software developers.

Boundary drawing through objects worked in other ways. Standards documents, outlining official practice on the project, were the object of much negotiation, and subject to much transformation as they circulated between the project’s managers, engineers, drafters and IT support.
However, the objects’ specificity, coupled with this malleability, focused negotiations on highly particular aspects of practice, and effectively shielded these interactions from disputes over the wider issue of enabling total collaboration through the single model. Such documents therefore were able to maintain a boundary around specific issues, through their circulation and mutability.

Objects certainly play a diverse range of roles. From our on-going analysis, we can say that the idea of the single model wasn’t in fact a reality – it was fluid and uncertain and contested. At the level of practice, its constituent parts did not function as instrumental objects; they could not enforce particular ways of using onto individuals, and were themselves subject to much transformation as they were incorporated into hybrid practices. Objects crossed boundaries, but also constituted and reconfigured them. From this, we are building a tentative argument that, although there are instances and aspects of these objects as epistemic objects and/or as boundary objects, neither completely captures the fluidity seen in practice. Objects are important in coordinating knowledge and practice, but perhaps even more so in their very constitution.

References


Ewenstein, B. & Whyte, J. accepted. Knowledge practices in design: The role of visual representations as 'epistemic objects'. Organization Studies.


