

## Chapter 2.33

# Modeling Sociotechnical Change in IS with a Quantitative Longitudinal Approach: The PPR Method

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### ABSTRACT

The following article suggests a critical realistic framework, which aims at modeling sociotechnical change linked to end-users' IT appropriation: the "archetypal approach." The basic situations it includes (the "sociotechnical archetypes"), and the possible appropriative trajectories that combine them, together with three propositions linked to the model, are developed. They are illustrated by means of a case study describing the implementation of an e-learning system within a French university. Then, the article presents an instrumentation of the theoretical framework, based on a quantitative longitudinal approach: the Process Patterns Recognition (PPR) method.

This one draws mainly on Doty, Glick and Huber (1993, 1994), who propose to evaluate the distance between organizational archetypes and empirical configurations by means of Euclidean distance calculus. The adaptation consists of evaluating the distance between appropriative trajectories (embodied by series of theoretically specified vectors) and empirical processes linked to the implementation of computerized tools in organizations. The PPR method is then applied to the same organizational setting as the one related to the case study. It validates the relevance of this type of a research strategy, which makes it possible to model sociotechnical dynamics related to end-users' IT appropriations.

## **INTRODUCTION: TOWARDS QUANTITATIVE PROCESSUAL APPROACHES?**

The study of the organization-technology relationship is hardly a new topic in the social sciences. From the first research forays into the sociotechnical school by Trist and Bamforth (1951) to Orlikowski's structurational model (1992, 2000), Lin and Conford's contribution (2000), Callon and Latour's Actor Network Theory (1990, 1992), and Alter's (1985, 1995) innovation sociology in the French-speaking community, many theoretical frameworks have been developed in this perspective. With regard to information system research, they draw either on static quantitative approaches, or on more longitudinal qualitative techniques (Choudrie & Dwivedi, 2005; Pinsonneault & Kraemer, 1993). But in spite of Giddens' (1984) invitation not to "wield a methodological scalpel" towards quantitative approaches, Archer's (1995) open view on methodology or a broader discourse in most methodological research about the use of innovative quantitative techniques (assumed to be compatible with a more emergentist perspective, see for instance Thietart, 2001) and quantitative processual research is extremely rare in IS (Kaplan & Duchon, 1988; Choudrie & Dwivedi, 2005). "Process measures" (Kaplan and Duchon, 1988) are thus lacking in most IS research. This has led us to a very challenging research question:

### **How Could One Make Sense Quantitatively of Sociotechnical Dynamics from a Processual Perspective?**

The current IS literature is not very helpful on this. Among the few longitudinal strategies<sup>1</sup> in IS, techniques based on surveys have been used for more than fifteen years. Most common implemented techniques with a longitudinal orientation are multivariate techniques such as log-linear

models, probit and logit models, Markovian approaches, along with other linear formulations (Venkatesh and Vitalari, 1991, p. 126) or other simpler descriptive techniques. Numerous works have taken an interest in a technology acceptance evolution (like Hu, Clark, & Ma, 2003) or in the evolution of computer tools' diffusion (like Mustonen-Ollila & Lyytinen, 2003, 2004), by means of more or less complex statistical models. Beyond a classic paradigm that could be labeled "assimilationnist" (based on Roger's (1995) theory of the diffusion of innovation), several frameworks have been applied quantitatively to specific forms of organization-technology interactions. If some of these works used the same kind of techniques as those previously mentioned (like Chaomei & Roy, 1996), others, less frequently, opened the way to other longitudinal techniques linked to recurrent cross-sectional studies (often focused on a single variable, e.g., beliefs, adoption, acceptance, and so forth) or structural analysis. From a structural perspective, Burkhardt and Brass (1990) or Barley (1986, 1990) can be mentioned. Barley, notably in his study of CAT scanners as "occasions for structuring," (p. 79) used longitudinal data collection centered on direct observation of interaction scripts between technicians and radiologists. Nonetheless, the complete set seems to put aside the interpretive aspects of a critical realistic approach and of many other processual approaches (structuration, Actor-Network theory, innovation sociology, and so forth). Moreover, it is hard to see how to apply this research strategy to the case of network technologies (for which direct observation of interactions is somewhat difficult). Adopting a recurrent cross-sectional perspective, some researchers have also tried to develop specific quantitative approaches (see Karahanna, Straub, & Chervany, 1999 or Hu, Clark, and Ma, 2003). Nonetheless, most research in this case focuses on single variables (adoption, beliefs, acceptance, and so forth) and do not instrument a broader processual framework.

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