The Role of Events in Actor Network Analysis of IT-Based Change

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ABSTRACT

While Actor Network Theory (ANT) has been successfully adopted to study organizational changes enabled by information technology (IT), Walsham suggests that, in such studies, data easily become highly complex and that it can be difficult for the researcher to make sense of data and structure them into a coherent presentation. This paper reviews the role played by events in structuring and presenting successfully published cases of ANT analyses. We identify a gap between the role played by events in the general literature on organizational change and the specific roles that events play in published cases of ANT analyses of IT-based change. We discuss, in consequence, how events can be used to help researchers adopt ANT to study IT-based change.

Keywords

Actor network theory, Event-based analysis, IT-based change

INTRODUCTION

Actor Network Theory (ANT) has been successfully adopted to study changes enabled by Information Technology (IT). Several ANT studies provide valuable insights into IT-based organizational change including: responsibility accounting and the constitutive role of accounting systems in hospitals (Bloomfield, Coombs, Cooper and Rea 1992); boundary disputes between the technical and non-technical in healthcare and financial services (Bloomfield and Vurdubakis 1994); transformation of work (Boland and Schultze 1996); infrastructure and classification (Bowker, Timmermans and Star, 1996); network building (Doolin 1999); information infrastructure and inscriptions (Monteiro and Hanseth 1996; Hanseth and Monteiro 1997); the nature and social construction of time related to IT-based change of control systems in a pharmaceutical plant (Kavanagh and Arajou 1995); temporal zones (Scott and Wagner 2003); stakeholder maps in order to take into account multiple interests (Vidgen and McMaster 1996); reliability of lay health information on the Internet (Adams and Berg 2004) and embedded Trojan actor networks to explain escalation (Mähring, Holmström, Keil and Montealegre, 2004). ANT has also been applied to IT-based change within public institutions and society at large; for example, concerning cash-cards in Sweden and recognizing the need for multi-purpose networks (Holmström and Stalder 2001); the link between enrolment strategies and inclusion in the personal digital assistant industry (Allen 2004); the shaping of the web browser (Faraj, Kwon and Watts, 2004), and concerning implementation and use of geographical information systems (GIS) in a district-level administration in India (Walsham and Sahay 1999).

While these studies demonstrate the feasibility of ANT as a framework for understanding IT-based change, they also raise a number of issues related to structuring and reporting such studies: what is the unit of analysis, where do networks begin and end, what is the extension of an actor, on what level do you conduct the analysis, and how do you practically manage the veritable mass of details that the approach easily leads to because of its flexibility and the generic nature of its vocabulary? Based on such concerns, Walsham (1997) suggests that we need further experimentation to improve the way we structure and report ANT analyses of IT-based change.

* All three authors have equal contribution to the paper and the names are listed in an alphabetical order.
In response to this challenge, our paper reviews published ANT analyses to contribute to the methodological literature on IT-based organizational change within the information systems (IS) discipline. We distinguish between use of ANT for data collection by ‘following the network’, the structuring of ANT analysis of the data, and the subsequent reporting of the data and findings. Our emphasis is on structuring and reporting ANT studies. Data from process studies of organizational change are generally complex and making sense of them is a constant challenge (Langley 1999). The notion of ‘events’ has, however, been used with success to structure and report process studies of organizational change in general (c.f. Peterson 1995) and IT-based changes in particular (c.f. Newman and Robey 1992). We therefore use events as the lens through which we review published ANT analyses and discuss alternative ways to structure and report ANT studies.

In the following, we briefly review key ANT concepts and consider the different roles played by events in organizational change studies. We then review the roles played by events in structuring and reporting ANT analyses of IT-based change. This analysis shows that events have so far not been fully exploited as a mechanism to overcome the problems researchers face when adopting ANT as a framework for studying IT-based change. We discuss in consequence how researchers can use critical events - or as Robey and Newman (1992) calls them ‘encounters’ - to structure and report ANT studies. We argue that such an approach represents one important way to overcome some of the experienced problems.

**CORE CONCEPTS OF ANT AND ITS PROBLEMS FOR STUDYING IT-BASED CHANGE**

ANT has its roots in sociology science (Latour 1987; Callon 1986) and aims to understand processes that lead to construction and transformation of socio-technical networks (Callon and Law 1989). The focus is on how people and objects are brought together in stable, heterogeneous networks of aligned interests (Law 1991) through processes of translations and negotiations (Callon 1986; Callon and Law 1989). ANT has frequently been revised and extended, and there is, therefore, no unified body of knowledge. There are, however, some relatively stable key elements of the theory (Walsham 1997) and a subset of those key elements are introduced in the following.

A core assumption in ANT is that no actor is different in kind from another. The inclusion of non-human actors in networks is explicitly an analytical stance. When people interact with other people, they are mediated through various objects, and such interactions are, in turn, mediated through additional networks of objects and people. Networks both participate in and shape the social, and, therefore, if the material in these networks would disappear, the so-called social order(s) would too (Law 1992). A particular order is as a consequence an effect generated by heterogeneous means. An actor is produced from or as an effect of heterogeneous relations between people and objects, and an actor is also, always, itself a network (Law 1992). An actor-network can, conversely, be assimilated into a black box. Such a punctualisation is a temporary simplification by which the network is viewed as one actor (Callon 1987; 1991; Law 1992).

Translation (Callon 1986) implies transformation through which actors engage with other actors to generate ordering effects (Law 1992). Callon (1991) emphasizes that translation goes beyond the traditional definition of action as it deals with mutual definition and inscription. Actors negotiate or maneuver others’ interest to one’s own to enroll actors into the network. Hence, enrollment refers to processes for actors to mobilize support by creating a body of allies through translations. When such translations get embodied into a medium or material they are referred to as inscriptions. Inscriptions prescribe a program of action for other actors, although they can vary in strength and flexibility (Hanseth and Monteiro 1997).

In a review of the use of ANT, Walsham (1997) recognizes four main areas of critique in the literature: ANT’s disregard for social structures; its disregard for moral and political analysis; its symmetric treatment of humans and non-humans; its power to describe as opposed to explain; and the problem of managing veritable masses of detail in data. Walsham concludes that, although the criticism caution researchers against using the theory, ANT could be supplemented without difficulty by other social theories to deal with social structures, moral or power when needed. He also points out that researchers can use ANT without accepting complete symmetry between humans and non-humans. To manage the complexity of details that emerge from adopting ANT, Walsham suggests experimenting to improve our ways of structuring and reporting ANT studies.

**EVENTS IN PROCESS STUDIES**

There are two widely accepted approaches to studying and explaining social phenomena: process studies and variance studies (Mohr 1982; Newman and Robey 1992; Van De Ven and Huber 1990). According to Mohr (1982), process studies deal with discrete states and events, and time ordering of events generally play a major role; variance studies deal with relationships between variables, and time ordering among variables is considered immaterial to the outcome. Process studies are hence concerned with appreciation of dynamic organizational life, and with developing and testing theories of organizational adaptation, change, innovation, and redesign by addressing “how” question (Van De Ven and Huber 1990). Since ANT is a process theory whose focus is on how people and objects are brought together in stable, heterogeneous networks of aligned interests (Law 1991) through processes of translations and negotiations, we focus on process studies, which describe how
sequences of events over time can explain how and why particular outcomes are reached (Van De Ven and Huber 1990). In process studies, events are generally considered as an important unit of analysis (Peterson 1995).

It is by no means straightforward to define events. Peterson (1995) has identified five different ways to conceptualize events in the literature (particle, wave, field, multiple perspective, and potential). Such classifications can help researchers choose appropriate concepts to analyze organizational processes, and they can also help address granularity issues by suggesting ways to distinguish between different levels of events. Different events do not have the same magnitude of importance to social actors due to embeddedness of particle events into higher order concepts. For example, in describing processes as waves, Peterson points out that “focal point crests of high energy” separates waves whereas it is difficult to identify separate events within the process as a wave. (Peterson 1995).

While one can argue that you can interpret any event as being “critical” by considering it as something that has impact and leads to responses, only a limited set of events can in each study be considered the focal point crests with high energy that play a key role in shaping the process. Newman and Robey (1992) suggest a model for studying information system development that structures development processes into encounters and episodes. Encounters are critical events that change the trajectory of processes and mark the beginnings an ends of episodes. Episodes are higher order concepts, or sets of events that stand apart by encounters (Newman and Robey 1992). Isabella (1990) adds that events are often different in terms of their cognitive magnitude and consequential process influence. Quoting Schein (1985), Isabella states that events become critical when actors perceive them as such and they therefore unbalance established routines and evoke conscious thought. Events that are critical in the eyes of organizational actors make a difference in people’s thought and action.

Events play, in summary, a key role in organizational process studies. There are important challenges related to defining and focusing on those events that make a difference, and researchers have consequently suggested using critical events or encounters as a means of separating changes in process trajectory in between more stable episodes of process fluctuation. In the same vein, critical events can play a role in change process studies framed with ANT, by looking at critical events that challenge current configuration of networks or initiate negotiation and translation processes among actors.

THE ROLE OF EVENTS IN ANT STUDIES

Out of the many papers that use ANT in relation to IT, we focus on those that present case studies of IT-based organizational change over time. Other papers, where the main theme is conceptual, where the focus is not on organizational change have been excluded. For example, Kavanagh and Araujo’s paper (1995) suggesting five concepts of time as well as (Bloomfield and Vurdubakis 1994) and (Hine 1995) is excluded because the main thrust of the paper is conceptual. Our review therefore focuses on five case studies that use ANT to structure and analyze IT-based change. As summarized in Table 2, we ask for each case: How is it structured? What is the role of events? Which key events are included?

<table>
<thead>
<tr>
<th>Paper</th>
<th>Case presentation</th>
<th>Case analysis</th>
<th>Key events/Encounters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mähring et al. 2004</td>
<td>Case presented in four phases with clear timeline: Conceptualization, Emergence, Turmoil, and Mounting problems. Events used to describe case.</td>
<td>ANT analysis structured into four network formation stages: Problematization, Interessement, Enrollment, and Mobilization. Address the efforts to create sufficiently powerful actor-networks. Events play a minor role in the network formation stages Stages not demarcated by distinct events.</td>
<td>- The City of Denver completed a master plan for a new airport.</td>
</tr>
<tr>
<td>Baggage system at Denver airport</td>
<td></td>
<td></td>
<td>- BAE was awarded the $175.6 million contract to build the airport system.</td>
</tr>
<tr>
<td>Scott &amp; Wagner 2003</td>
<td>Case presented as a chronological narrative. Events used to describe case.</td>
<td>ANT analysis structured into three temporal zones: Crafting ERP vision, Creating project, and Collective attempts to create order.</td>
<td>- The chief airport engineer Walter Slinger died.</td>
</tr>
<tr>
<td>ERP system at IVY league</td>
<td></td>
<td></td>
<td>- Delayed opening of airport.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Failed test of CBHS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Implementation of manual system replaced CBHS.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Opening of airport and abandoned CBHS.</td>
</tr>
</tbody>
</table>
Address the achievement of order. Events play a role in some temporal zones, but not all.

- Oracle missed original deadline.
- Ivy received ‘bare bones’ technology from Oracle.
- Phase-one system implemented.

**Holmström & Stalder 2001**

**Cash-card system in Sweden**

- Case presented in two phases with clear timeline: Trial introduction, Nationwide rollout. Events used to describe case.
- ANT analysis structured around networks and actors. Address the complexity of emerging actor-networks. Events play minor role.

- Cash-card introduced.
- Cash-card launched nationwide.
- Conventional credit card containing a cash-chip offered to customers.
- Merchants resisted new technology.

**Walsham & Sahay 1999**

**GIS in India**

- Case presented in three phases with clear timeline: Initiation, Phase I, Phase II. Events used to describe case.
- ANT analysis structured into three network configuration stages: Creating network, Maintaining network, and Extending network. Address the processes of enrollment. Events play minor role.

- Ten GIS projects initiated.
- Eight projects successfully completed.
- Proposals for continuation submitted.
- Key stakeholder dropped out of Phase I.
- Five institutions agreed to terms for Phase II.
- Project director left.
- Disagreement between center and institutions on roles and purpose.

**Vidgen & McMaster 1996**

**Car park system at UK institution**

- Case presented through technology and four accidents, events, in chronological order.
- ANT analysis structured on interests of stakeholders, human and non-human actors. Address stakeholders’ interests. Events play little role.

- Implementation decision.
- Accident 1 and 2, vehicle collision during testing period.
- Accident 3 and 4, vehicle collisions during operational system.
- Decision to shut down system.

### Table 2. The Role of Events in ANT Case Studies

First, we look at how the cases are presented. In two cases, Holmström and Stalder’s study (2001) on the Swedish Cashcard and Walsham and Sahay’s study (1999) on geographic information systems in India, the main structuring mechanism is chronological phases that represent key activities and milestones in the way the projects were organized and executed. The presentations of the other cases are not based on similar straightforward project phases. Instead, the authors have identified particular events of interest and these play a major role in structuring the presentation. Mähring et al.’s study (2004) on the Denver International Airport baggage claim system describes the case using conceptual phases: conceptualizing the system, emergence of a solution and a supplier, turmoil in project governance, and mounting problems and repeated delays. Scott and Wagner’s study (2003) on ERP system implementation at an Ivy league school in the U. S. describe the change process in a chronological order focusing on the following events: VP for finance and administration arrived at Ivy, alliance with Oracle, project structure formed and a leader with ERP implementation experience hired, Oracle missed the original deadline, Ivy received ‘bare bones’ technology from Oracle, phase-one system implemented. Vidgen and McMaster’s study (1996) on implementation of an innovative car park system in the U. K characterizes the technology and identify four accidents that occurred within the first four weeks of implementing the system.

While the review shows that events play a role in the *description* of all cases to some degree, their relative importance differs. In two of the cases, the main structuring mechanism is planned project phases (Holmström and Stalder and Walsham and Sahay). The other three papers offer a description that is structured along major encounters (Mähring et al., Scott and Wagner, and Vidgen and McMaster). These two options are noted by Gersick (1991), who points out that there are two modes to trigger revolutionary periods. One is the system’s arrival at key temporal milestones and the other is the attraction of newcomers to crisis situations (encounters).
The review also shows that encounters are identified and mentioned in the ANT analysis of all five cases. However, the mode of analysis varies significantly among the papers. Mähring et al. structure the analysis along four network formation stages: problematization, interessement, enrollment, mobilization and some encounters are identified and mentioned. However, it is not clear whether the network formation stages were linear and aligned with description structure, or whether there were specific events that triggered transition of those states. Scott and Wagner’s analysis focuses on three temporal zones: crafting an ERP vision, creating the project collective, and attempting to create order. The analysis of each temporal zone builds on critical events. For example, arrival of a new VP seems to be the key event contributing to the crafting of temporal zones. Still, these key events are not utilized to explain shifting mechanism between time zones, but to characterize each time zone. Holmström and Stalder’s ANT analysis on networks and actors is relatively very short, and the entire cash cards implementation process is not conceptually subdivided in analysis, hence, events play minor role. Walsham and Sahay base their analysis on the configuration of the actor network: creating the network, maintaining the network, and extending the network. These configuration stages are clearly demarcated by project phases in the description. Finally, Vidgen and McMaster focus their analysis on different actors’ interests based on quasi-objects and mediated networks. However, the accidents identified in the case description do not play any role in the ANT analysis.

We can summarize the review of ANT studies of IT-based organizational change as follows. While events generally play a role in structuring and presenting these studies, the relative importance of events varies across the cases. Some presentations are structured using project phases as they were planned or executed. Other presentations are structured using events that the authors have identified or conceptualized as being of particular interest to the case. While all papers in this way identify and describe events as part of the case presentation, events play minor roles in the analyses of the cases. Naturally, the choice of focus in the analysis influences the choice of structuring mechanism. Some analyses focus on the creation of actor-networks, processes of enrolment, and others on specific issues of interests. However, authors are not explicit what triggers those process of network formation and changes via translation and negotiations and most ANT analyses are largely independent of, or not aligned with the events and encounters identified and used in the paper to structure the case description. Contrasting the emphasis on events and encounters in process studies of social phenomena, these findings from ANT analyses of IT-based change suggest that events are underutilized as a means to structure and present ANT studies.

**EVENT-BASED ANT ANALYSES**

The question is then how events can be used more systematically to structure and report ANT studies of IT-based organizational change. More specifically we ask what the advantages and disadvantages of such an approach would be and whether it helps manage the veritable mass of details that ANT studies represent.

The key advantage of adopting critical events or encounters as a structuring mechanism is that it requires the researcher to interpret the overall change process and make appropriate selections of important areas of interest. Walsham (1997) points out that ANT emphasizes detail, and recognizes that complexity problems are real and needs to be addressed. Concentration on key encounters can guide the researcher to initially separate concerns and focus on different subsets of data. Our proposal is therefore:

- To structure and present ANT studies of IT-based organizational change into encounters and related episodes as suggested by Newman and Robey (1992).
- To focus the analysis of each resulting episode on issues like:
  - What is the nature of the triggering encounter that threatens current equilibrium?
  - What network configurations are impacted by the encounter and how?
  - What are the responses in form of translations, negotiations, or new inscriptions?
  - What are the impacts of these responses?
- To integrate (or synthesize) the analysis of each separate encounter and episode into an overall interpretation of the change process.

This approach directs the researcher towards specific dynamics that change or radically challenge process trajectories. Focusing on selected encounters and episodes can, metaphorically speaking, become a useful approach to ‘scaffolding’ the analysis. In our initial explorations of this approach (Nilsson and Mathiassen 2004) we found that the selection of encounters helped construct a chronological order that led to a strict and succinct analysis well suited for presentation in the limited space available in research papers. Further development and validation of this approach to structuring and presenting ANT analyses are, however, needed.
The flip side of the proposed approach is that reduction of change processes into episodes can lead to ignoring subtle changes taking place continuously over the entire process. The encounters are, of course, chosen based on the researchers' interpretation and they become a means for emphasizing important dynamics. However, selecting certain events while deliberately keeping quiet about others can be misused to carefully craft a desired conclusion, as a way of anticipating the reader’s objections and controlling the reader’s possible sense making (Latour 1987).

The aim of our proposal is not to identify superior ways of structuring and reporting ANT analyses. Nor do we claim that the proposed approach can be applied to all studies framed with ANT. The approach will be useful to those ANT-based studies that address change process. Longitudinal studies (Pettigrew 1990) and process studies (Langley 1999) do, however, face the same problems as ANT analyses: process data are generally complex and making sense of them is a constant challenge. Process data deal mainly with sequences of events and they involve multiple levels and units of analysis whose boundaries are ambiguous. Data analysis and theory building therefore becomes rather a challenging task (Langley 1999). One particular strategy for theorizing from process data is temporal bracketing in which the study is presented and analyzed in successive episodes separated by encounters (Langley 1999; Pettigrew 1990; Newman and Robey 1992). This strategy has been successfully adopted to study a variety of issues related to IT and organizational change. Robertson, Swan and Newel (1996) illustrates its use in relation to diffusion of innovations in organizations. They focus on encounters that change the diffusion agenda, lead to decisions on approaches to diffuse, or involve changes in ways of working as a consequence of innovations. Weinberg (1997) illustrates the strategy in relation to changes and improvements of software practices. He emphasizes events that disrupts old status quo and leads to periods of chaos, in which events can make the organization revert to old status quo or successfully move towards a new status quo. Our proposal suggests applying these insights to ANT analysis of IT-based organizational change.

CONCLUSION

Walsham states that one of the major criticisms on ANT is that studies guided by the theory have a problem describing and reporting complex and messy data (Walsham 1997). We note that this problem is not confined to ANT studies, but shared with process studies of social phenomena in general. One of the important issues regarding process data is how to separate what is really significant from what will be treated as merely noise (Leonard-Barton 1990). We suggest that focusing on encounters can provide researchers using ANT to study IT-based organizational change with means to organize their data analysis and report their findings by sorting out significant data from mere noise.

REFERENCES