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# APPLYING THE SOCIOLOGY OF TRANSLATION TO A SYSTEM PROJECT IN A LAGGING ENTERPRISE

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## ABSTRACT

*Although actor-network theory (ANT) is enjoying increasing interest in information systems research, we are still in the early stages of understanding and appreciating ANT's potential for drawing lessons and developing guidance for industry practitioners. This paper focuses on extending that practical understanding. Here, ANT is applied in creating an account of a human-services firm's experience in building its first major information system. Several practical implications are drawn that point the way toward further adapting ANT thinking for applied use in system-project contexts. Central among the insights are: the potential value in viewing project leadership in terms of actor-network management; the need to treat network management more as a matter of facilitation than control; the importance of recognizing that the effective management of interests may have to begin with the very constitution of those interests; the need to understand how indirect representations of key interests during software construction may break down when the interests themselves are directly engaged during implementation; the need to manage the particulars of critical issues on which network stability depends; and the importance of grasping the interdependence between network stability and adaptability in design.*

## INTRODUCTION

Actor network theory (ANT) is enjoying increasing interest among information systems scholars. This has been announced in conceptual works and reviews (e.g., Boland and Schultze 1996; Doolin and Lowe 2002; Hanseth, Aanestad, and Berg 2004; Jones 1998; McMaster, Vidgen, and Wastell 1998; Monteiro 2000; Monteiro and

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Hanseth 1996; Walsham1997). It has also been witnessed in empirical papers applying aspects of this perspective to organizational initiatives (e.g., Aanestad and Hanseth 2000; Mahring, Holstrom, Keil, and Montealegre 2004; Linderoth 2002; McGrath 2002; Vidgen and McMaster 1996; Walsham and Sahay 1999; Whitley 1999; Wilson 2002) and at the industry, institutional sector, and societal levels (e.g., Bowker, Timmermans, and Star 1996; Fomin, Keil, and Lyytinen 2003; Hanseth and Monteiro 1997; Marres 2004; Adams and Berg 2004; Allen 2004; Faraj, Kwon, and Watts 2004; Whitley and Pouloudi 2001).

ANT's appeal within the field is unsurprising. Its foregrounding of technology as a factor in the workings of human enterprises, its explicit attention to challenges posed by divergent interests, and its process-oriented perspective provide a compelling framework for developing rich and convincing characterizations of information-technology implementation efforts. Indeed, ANT can offer several advantages over alternative approaches to socio-technical analyses of IT – as the elaborated discussion in the following section will help to make clear.

To briefly summarize, ANT, in the first place, compels a dynamic perspective on implementation phenomena. In contrast to the static depictions afforded by variance-oriented styles of research (Markus and Robey 1988), which at their best uncover only statistical associations among the factors affecting implementation, ANT draws the researcher into direct investigation of the historical processes by which outcomes follow from pre-existing conditions and the strategies of key agents acting under constraint. Also, with its attention to competing interests ANT helps to bring political issues to center stage, in

## CONTRIBUTION

This paper makes a contribution to both research and practice in the domain of information-systems implementation by showing one way in which research might be brought closer to practice. The paper's originality rests in its effort to use actor-network theory (ANT) to draw practical implications for the management of systems implementation. While actor-network theory has lately commanded considerable attention in IS academic circles, relatively little has yet been said about how to apply its seemingly esoteric concepts and arcane vocabulary to situations of practice. This paper addresses that gap.

An intensive field study of a recent project demonstrates how key concepts from ANT can be used in interpreting the action in a system-implementation effort. The study reinforces prior ANT research by pointing in a broad way to the value of viewing project leadership in terms of actor-network management. However, the paper also provides a number of more specific insights not clearly drawn in prior applications of ANT. Among these insights are that actor-network management may often be more a matter of facilitation control; that the effective management of interests may have to begin with the very constitution of those interests (implying that learning must find a role, when ANT is applied in IS studies); that a crucial moment in network management will often occur during implementation, when the indirect representations of organizational interests that underpin software design confront the real interests themselves; that close attention to the particulars of critical issues can make the difference between project success and failure; and that system evolution requires managing a paradoxical tension between stability in the actor network and flexibility in system design.

This research is expected to be of considerable interest to researchers involved in field studies of systems development projects, and of general interest to researchers engaged in applying actor-network theory to various problems in the information-systems field. It should also interest scholars concerned about finding ways to extract practical insights from theoretically grounded research. While addressed primarily to academic researchers, this paper may also be of interest to IS managers and practitioners seeking fresh perspectives on the obdurate challenges involved both in getting effective user participation in systems development and in integrating new systems into the business processes and work systems of firms.

marked contrast to our community's frequently genteel, conflict-neutral research on change. ANT accordingly shares some advantages with stakeholder approaches; however, a key difference lies in ANT's focal attention on the actions of technologies in working out the interplay of contending parties.

In this regard, ANT undercuts one of three commonly unquestioned assumptions that underpin much of our community's research: the categorical dichotomy between human and non-human actors. In particular, where an information system, as a non-human actor, is granted a place to act within heterogeneous networks according to the interests inscribed within it, a clearer account of both the technology's design and the technology's effects can be gained. Thus, while ANT is akin to other constructivist approaches (broadly speaking), an ANT analysis can more readily get beyond regarding IT as mere "structure" that enables and constrains. (For a comparison of ANT and structuration theory in this vein, see Hanseth, Aanestad, and Berg 2004.) This points to a second assumption common to implementation research that ANT helps undo: The stepwise partitioning of technology design from technology use (Hanseth, Aanestad, and Berg 2004). In this regard, ANT transcends such congenial perspectives as adaptive structuration theory (e.g., DeSanctis and Poole 1994) in leading the researcher to consider not just variations in user appropriation, but the impact of use via feedback on the very heart of technical design (Ramiller 2004). Finally, a third assumption which ANT exposes is the one associated with the use of *a priori* sociological levels (e.g., individual, group, organization). In its place, ANT focuses on the identification of networks of actors, where the networks themselves are seen to become actors, as the scope of analysis widens. This affords a flexible framework that makes the "levels" in implementation research a matter for empirical discovery rather than stipulation, and that helps thereby to foster a greater realism in capturing the action that takes place.

Notwithstanding the growing appeal of ANT in scholarly inquiry, aspects of ANT can readily strike some observers as highly esoteric. Perhaps most foreign is ANT's elevation of technology to the status of an actor on a par with intentional social actors. This has been an important point of debate among the anthropologists, sociologists, and historians in science and technology studies (STS), whose foundational work gave rise to ANT. However, the idea of technology-as-actor can also elicit discomfort and an impression of exoticism in our more applied field. The associated vocabulary (*inscription*, *interessement*, *black-boxing*, and the like) seems further to widen the gap that must be bridged between an ANT analysis and what we might hope to cast as useful guidance for practicing professionals and managers.

Nevertheless, given ANT's advantages applied scholarship will benefit from efforts to get beyond this surface impression of ANT as abstruse and counter-intuitive. In pursuit of that goal, this paper applies a selection of concepts from ANT in an analysis of a major systems project, and then uses the organization's experience as the basis for drawing a number of practical implications that suggest ways to apply ANT thinking in other project contexts. The goal here is to be helpful, without pretending to comprehensiveness. The project at hand, being a "sample of one," naturally provides the opportunity only for selective insights (March, Sproull, and Tamuz 1991). Even so, the situation is a particularly rich and promising one for inferring certain practical implications.

The organization in question is a not-for-profit human-services firm characterized by a lagging position in IT investments and experience. Although the firm is a technological laggard (Rogers 2003), the objective here is not to draw a categorical difference between lagging enterprises and the relatively advanced firms that are more commonly the subjects of study. Rather, the intention is to exploit the firm's relative immaturity for its potential to set in sharp relief certain issues of imminent practical concern that hold across a broad range of organizations. Brought especially into focus is the centrality of *learning* in the creation and play of interests in the project's evolving actor network. The immature and emergent character of the interests engaged invites a re-examination of what it really means to speak of "interests" in ANT work. Also clearly highlighted, because of the prominence of the

firm's regulative and normative institutional context (Scott 1995), is the importance of attending to *scope* and *heterogeneity* in the practical application of ANT to the analysis of interests.

Our discussion continues by considering selected ideas from ANT that are useful in interpreting information-systems projects like to one to be examined here. A discussion of the case study then follows. There we begin with some background on the organization in question. The data-collection approach is next briefly considered. ANT is then applied in providing an account of the developments in the case. The paper concludes by considering a number of potential points of application, based on observations from the case.

## ACTOR-NETWORK THEORY AND THE IDEA OF TRANSLATION

Actor-network theory (Walsham and Sahay 1999: 42):

> *… examines the motivations and actions of actors who form elements, linked by associations, of heterogeneous networks of aligned interests. A key feature of the theory is that actors (or actants as they are sometimes labeled) are taken to include both human beings and non-human actors such as technological artifacts. A major focus of the theory when applied in particular contexts is to try to trace and explain the process whereby relatively stable networks of aligned interests are created and maintained, or alternatively to examine why such networks fail to establish themselves. Successful networks of aligned interests are created through the enrollment of a sufficient body of allies and the translation of their interests so that they are willing to participate in particular ways of thinking and acting that maintain the network.*

As this quotation suggests, the pivotal concepts of *translation* and *enrolment* (Callon and Latour 1981; Callon 1986) offer a crucial focus for organizing and interpreting data in IT projects such as the one investigated here. To these we will add the idea of *inscription*, which is central to understanding how technological artifacts, like information systems, participate in actor networks.

Translation describes the overall process by which a focal actor attempts to align the interests of other actors with a program or project which that focal actor is championing. "Translation" suggests establishing a linguistic equivalency among interests. And indeed translation has been defined as the "authority to speak… on behalf of another actor" (Callon and Latour 1981). Thus, "A translates B" means that A defines B (Callon 1991). Translation also suggests movement, and some studies in actor-network theory have accordingly used spatial representations to represent the bringing-together of interests around a project (e.g., see Callon 1987: 206). This act of bringing-together or making allies (see the quote above) is a matter, first, of defining the equivalency of interests and, second, of persuading the real participants to act in accordance with the roles into which they have been cast. This need for persuasion means that rhetoric plays a key role in translation (Walsham and Sahay 1999: 42).

The process of translation has further been characterized as advancing through four stages: problematisation, interessement, enrolment, and mobilisation (Callon 1986). *Problematisation* identifies and characterizes the project and links it to the problems of the other actors. At the same time, it positions the principal actor as indispensable to the others. *Interessement* is the process undertaken by the principal actor to lock the other actors into the roles that have been defined for them. If successful, this is said to produce *enrolment*. (We will speak about the "enrollment" (admission) of clients in the case study. Accordingly, to minimize ambiguity we will use "enrolment" (with one "l") for the ANT concept.)

*Mobilisation*, then, arises from the fact that enrolment is based on representation. The outcome of enrolment is that selected individuals are induced to speak as representatives for a larger group; for example, a lead user might speak for the needs of other users in the organization, a selected portion of code might speak for the reliability of an entire application, and so on. The challenge in

mobilizing an entire group is that those spoken for may "betray" their representatives, *dissent* from the program, and divert themselves away from the project toward a contrary course of action (or "anti-program"). Of course, the representatives may themselves reverse positions and defect. With significant *dissidence*, the network of heterogeneous interests will fail to stabilize. Latour remarks (1991: 127):

> *… a program's capability to counter an anti-program obviously depends on how well an actor's conception of others corresponds to their conceptions of themselves or of the said actor. If this convergence is weak, the actor will populate his world with other beings; but these beings will behave in an unpredictable fashion, attaching or detaching themselves to the program from version to version. If, on the other hand, this convergence is strong, the actor can begin to make predictions – or, in any case, to guarantee the consistent behaviour of the beings constituting his world.*

When the convergence Latour identifies is strong, the actor network is said to move toward a state of *irreversibility* (Callon 1991). The *commitments* made by enroled parties, in the form of resources brought to their engagement on behalf of a project, can be said to become "black-boxed" (Klischewski 2002), in that they are taken to be reliable and can become the basis for enlisting further commitments. Where technology design is an issue in, or even the focus of, the project, the design itself achieves irreversibility and taken-for-grantedness by degrees, in consonance with the larger actor network.

It is readily apparent how these concepts might be applied in creating an account of an information systems project. The analytical task would focus on identifying the efforts of certain focal actors to translate the diverse interests of other crucially positioned parties into alignment with the main thrust of the project's goals, and the practical moves they undertake to lock in the necessary commitments. However, this framing, while fine as far as it goes, is merely sociological rather than properly socio-technical. An actor-network account must also identify how the technology itself acts with interest and force in the project. Of frequent concern in ANT analyses is how the technology may fail to 'cooperate,' whether as a function of misunderstood physical properties or as the result of a fatal immaturity. However, of greater import in many systems projects is the way in which the technology actually does 'perform,' so that it reflects the specific interests inscribed in it by virtue of its design. *Inscription*, then, is another key idea for consideration when applying ANT to systems projects (Monteiro 2000).

The particulars of an information system's design necessarily, if implicitly, express a normative view of the future. It reflects certain parties' perceptions of how things ought to be. As such, design is invariably partial to the interests of some actors and not others. However, inscription is not merely a matter of one or another party's interests being reflected in and served by the technology. As an actant in the organizational setting, the system can in fact *prescribe* patterns of action for others. An information system, by its very design, involves assumptions about the relationships that will hold between the technology as artifact and the people who will use it and whose work will be affected by it. Thus, a "machine… tells or prescribes the roles that it… expects other elements in the network to play" (Klischewski 2002: 312).

Inscriptions may indeed constrain the behavior of other participants in the actor network. However, the notion of dissidence suggests that inscriptions are not necessarily utterly dictatorial. The technology's users, in particular, may deviate from the system's embedded prescriptions and adapt the system to their own practices and preferences. More broadly, where innovative technologies or applications are involved, means-ends relationships may be difficult to fully anticipate, and so design choices may produce unintended consequences in use. In this light, the failure of the technology to perform because of natural limitations or immaturity appears as a special case of the potential fragility of inscriptions. In ANT terms, in defecting a technology reveals itself to be a

problematic ground for the inscription of interests.

Actor network theory has given rise to a number of other concepts. For our purposes, however, the core concepts of *translation*, *enrolment*, and *inscription*, combined with an appreciation for the potential for *dissidence*, will serve as an effective point of departure in analyzing the case. We consider background information on the case next.

## RESEARCH METHODS

### The Field Study Site

The organization, North Bay Services (a pseudonym), is a not-for-profit firm that provides an array of services for at-risk youth and the developmentally disabled, including counseling and psychiatric services, foster care, group homes, on-campus residential facilities, employment-placement support, and special education. Its annual budget is approximately $25 million dollars. The firm operates in a changing environment, in which competition for resources from similar firms is increasing and new demands for accountability are being imposed by external funding bodies and oversight agencies. As a result, North Bay is simultaneously under pressure both to operate more efficiently and to provide documented scientific evidence for the effectiveness of its care and treatment programs. Achieving both of these goals requires far better capabilities in information capture, tracking, and utilization than North Bay currently has in place.

Although "laggard" is a relative term, the label nevertheless applies to North Bay by several obvious measures. Prior to the project that is the subject of the current study, only a small percentage of the workforce, mainly administrative and management personnel, had used computers in their work. Beyond desktop software for individual use, the only enterprise applications in place were email, a basic corporate financial package, human resources software, and a package for tracking fund-raising efforts. No system functionality existed in the core of the business, where the tracking of patients ('clients') and documentation of their treatment continued to be handled by poorly integrated, incomplete, and inaccurate paper-based processes. Internal technical expertise was limited to a tiny staff dedicated to PC and LAN support. Managers and clinical staff, by their own admission, were "dinosaurs" in terms of their understanding of information technology. Meanwhile, pressures to limit administrative expense had caused the firm to fall behind in its IT investments. In a research interview, the CEO conceded that the current project was basically reactive to the pressures of the "reimbursement climate," suggesting that the current project would likely not have proceeded, despite a variety of motivations, if North Bay were not under pressure from outside entities to satisfy increasingly demanding reporting requirements.

The project was the organization's third attempt to build a core information system. Two previous attempts had been abandoned, the second after some two years had passed and several hundred thousand dollars had been spent. The new system was created using an agile development strategy (Cockburn 2002; Highsmith 2002), under the leadership of an independent consultant, with implementation directed by a small in-house project team, and most programming work done by an outside development firm. Up through the period covered by the current study, two major releases had been implemented and put into active service, supporting referral, enrollment, and tracking for clients in the residential and day treatment programs, the management of associated clinical records, and documentation of special procedures.

### Data Collection and Analysis

Data collection focused on conversations with the project leader, which continued throughout the project, and interviews with major participants, including the system owner (the senior vice-president in charge of the affected organizational units), her primary reports, in-house project team members, key users, and North Bay's chief executive. Detailed notes were taken during the interviews; as soon as possible after each interview, an extended write-up was developed based on the notes. The interview conversations were supplemented by attendance at joint user-developer design sessions (these were tape-recorded), observation of training sessions and system demonstrations (recorded in notes), review of

project documents (use cases, screen mockups, screenflow diagrams, and the like), and study of written communications (mainly email messages).

Analysis of the diverse textual data that resulted from these efforts proceeded on an interpretive basis (Walsham 1993, 1995). Multiple readings of the data were made, and memos (Miles and Huberman 1984) were developed during the process to capture the higher-order generalizations that emerged. This style of analysis entailed shifting in hermeneutic fashion between the general and the specific: Grasping how the overall pattern presented by the case informed the interpretation of particular elements alternated with the consideration of how the elements dictated revisions to the image of the whole (Boland 1985). Data analysis commenced while field activities were still underway, so that insights gained from analysis could inform the on-going data-collection efforts.

Actor network theory was adopted early in the course of the study as a basic interpretive framework. Hence, observation and analysis came to be structured around the identification of categories of actors, the associated interests engaged, crucial events and developments, and the actions taken by participants. Of particular interest, relative to actions, were efforts to affect project direction and system design, and to shape others' perceptions of the proper configuration, scope, and goals of the system. Also, in light of the concept of *inscriptions*, pains were taken to identify ways in which system features appeared to put pressure on the expectations and conduct of human actors occupying various roles in the organizational setting.

During the analysis, work was also undertaken to identify a *developmental structure* within which to create an account of the project's history. However, this involved neither an appeal to an *a priori* sequence of stages (e.g., the system development lifecycle), nor the grounded creation of a phase structure based on the facts of the case themselves. In fact, this effort abstained altogether from delimiting discrete phases in the project timeline. Instead, the developmental structure that came to be drawn was a more fluid and imprecise one based on the emergence, growth, and resolution of *critical issues* over the course of the project. (This is consistent with what Holmstrom and Robey (forthcoming) have characterized as the "episodic character" of actor translations in IT projects.)

What we will regard, here, as a *critical issue* is a situation or set of events that demands resolution in order for the project to advance. As such, a critical issue sheds light on the interplay of interests and exposes, in one or more ways, the vulnerability and potential reversibility of the project's network of support. Getting past a critical issue invariably entails the translation of the interests of particular actors whose commitments are vital to its resolution. Multiple critical issues can overlap in time, and a critical issue might need to be addressed more than once.

Defined in this way, a critical issue corresponds closely to the concept of the *obligatory passage point* in actor network theory. To use a spatial metaphor, an obligatory passage point is a situation through which the heterogeneous actors involved in a project must be made to pass (Callon 1986). This means that the actors must be convinced that their interests are tied to the particular resolution advanced by a focal or principal actor (Callon 1986). In the course of such a passage, accomplished through a cycle of *problematisation*, *interessement*, and *enrolment*, the focal actor is said to make itself/himself/herself indispensable to these other actors.

At North Bay, while the project as a whole might itself be regarded as an overarching obligatory passage point, the quest for empirical concreteness calls our attention to constituent situations, or 'localized' obligatory passage points, that emerged during the course of the project. This, then, is where the idea of critical issues comes in.

The emerging system itself was a focal actor in regard to many of the critical issues, because of the manner in which it implicitly attributed particular interests and roles to the other actors. This, once again, is the idea of *inscription*. For example, certain design features relating to data collection entailed changes to the work processes and cognitive scripts of users; reporting capabilities carried

implications for the information-usage behavior of staff analysts and managers; and organizational restructuring and business-process transformations induced by the new system posed changes in leadership responsibilities for managers.

Of course, for a system under development these kinds of inscriptions are only emergently material. Prior to its implementation, the form of North Bay's nascent system required representation by other actors. The project leader, in particular, spoke on behalf of the emerging system, identifying and engaging the critical issues that defined the system's own sociotechnical requirements, and attempting to draw about the system, issue by issue, the necessary network support. Thus, the representational labor of the project leader brought this human actor and the emerging system together as a kind of hybrid focal actor (Hanseth, Aanestad, and Berg 2004).

The project leader, then, naturally became a focus of attention in data gathering and analysis. Despite her status as an outside consultant, she was the central representative for the system, steadfastly speaking on its behalf and authoring many of the translations demanded by the project. The executive system owner, by contrast, had a very distant relationship to the details of the project and essentially no involvement in design decisions, and she interacted relatively little with other project participants. In this managerial vacuum, the project leader's scope of activity evolved well beyond the nominal role of a technical consultant "putting in a system"; she increasingly became an organizational change agent whose efforts embraced a range of sociotechnical design initiatives.

Although the project leader was a focal point in the study, in keeping with Latour's counsel to "*compare the different versions* given by *successive* informants…" (Latour 1991: 127), careful attention was also given to the problematisations posed by other participants. These shed light on the practical status of the project leader's efforts in translation. This provided, in some instances, indications of potential dissidence that could threaten to undo the network the project leader was struggling to build, and successively to extend, on behalf of the emerging system.

In summary, the strategy for telling the story of the North Bay project was based on using ANT to identify and interpret the emergent issues that had to be addressed in order to maintain and extend the actor network behind the new system. It was a matter, then, of writing history based on successive translations and the resulting enrolments (and defections). As noted, this approach does not produce a neatly segmented chronology: Issues extend unequally over time, and can appear and disappear only to reappear again. Nevertheless, the following account entails a temporal structure, in that it introduces the issues in the order in which they came to prominence during the history of the project.

## THE NORTH BAY PROJECT: AN ACTOR-NETWORK ACCOUNT

Figure 1 provides an overview of the factoring of the project's history into critical issues. The figure is intended mainly for orientation. The onset of any given critical issue is difficult to pinpoint precisely, and its ultimate resolution usually cannot be established definitively. Accordingly, while the figure establishes the relative position in time when each critical issue surfaced, and the lengths of the lines suggest durations, the reality defies precise representation.

### Dismantling a Legacy Network

A suitable place to begin the story is with the arrival of the project leader. In a fashion befitting the emergent causality entailed in ANT analyses (Holmstrom and Robey, forthcoming), the project leader did not start out as the project leader, at all. Nor, in fact, was there a project to lead, at this point in time. Rather, the consultant who would eventually become the project leader was hired by the senior vice-president, on the basis of a serendipitous connection, to spend two weeks evaluating the second system effort (recall North Bay's history, described above), which was then still underway. A great deal of money had been spent at this point, most of it going to a local contract development firm. The functionality installed had fallen well

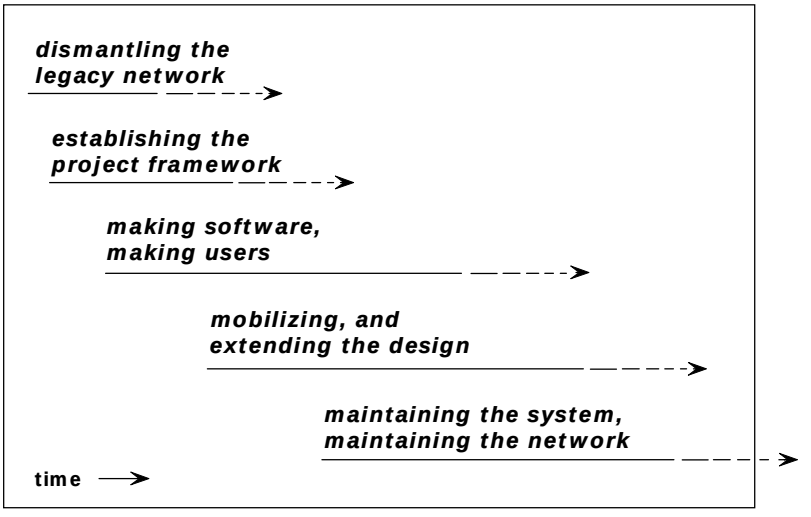


**Figure 1. Project History by Critical Issues**

short of expectations, users found the system difficult to use, and communication problems between the users and the contractor had reached the point where further progress seemed unlikely. After a brief period of time during which the consultant and senior vice-president explored possibilities for salvaging the existing project, it was decided to abandon it.

ANT investigations of systems projects typically do not remark on the need to clear out actor networks associated with prior activities. But everyday observation suggests that the persistence of old network elements can impede the initiation and conduct of a new project. The challenge here is more than a matter of cancelling contracts, dealing with legal issues, reassigning internal staff, and the like. It also involves changing people's expectations and undoing their enrolments in the abandoned effort. It can also mean dealing with a kind of *legacy of dissidence*: Those whose enrolment in the earlier project was problematic may be predisposed, based on their negative experience, to resist enrolment in the new project on the basis of a cynical, "Here we go again."

North Bay's failures in two earlier projects, and particularly the costly and frustrating experience in the second effort, would ensure that the challenge of dismantling the legacy network would persist as a critical issue for a considerable period of time. According to several informants, of greatest importance in helping participants break cognitively with past experience was the manner in which the in-house project team interacted with the users. In following an agile development approach, which involved frequent and intensive communication around focused issues of work process and system design, the team offered a distinct contrast to the previous system-development regime. In that earlier project, interaction was sequestered in occasional requirements meetings driven largely by the contractors; otherwise the development group had little on-site presence.

The technology itself also played a role in putting distance between the new project and its predecessors. As pieces of functionality began to be rolled out, the new system introduced itself to its future users through a significantly superior and friendlier interface design (thanks in great part to the design skill of the contract development firm). The technology, as actant, thereby won adherents among the reluctant well in advance of its large-scale implementation.

**Establishing the Project Framework**

A collection of basic decisions set the initial course for the new project, determining much about how it would be developed, who would play what roles in the development process, and what the scope of the new system

would be. All three concerns would help to determine whose interests would be, and had to be, engaged. This period of decision-making should not be construed as a planning exercise; to the contrary, it clearly represented an extended improvisational exercise involving a succession of interdependent selections and exclusions concerning the basic "how," "who," and "what" of the project.

**The project's *How*.** One basic issue had to do with choosing between a package solution and a custom-development strategy. The core problematization, in this case, came to focus on the ability of the available packages both to support the diverse services of the organization (rather broad for a firm of its type) and to deliver those services, over time, across a geographically dispersed organization involving multiple facilities. Given this geographic challenge, a Web-based solution came to be regarded as a requirement. Vertical package options were, one by one, evaluated and rejected, and the firm came to settle once again on a custom-development strategy. Here, North Bay relied heavily on the opinion of the consultant. It seems apparent that North Bay's executives and board fell short of fully grasping the technical reasoning behind this position. What they did understand, in the circumstances, was that the consultant would exit under a package scenario (she had made this clear), to be replaced by experts in implementing the package chosen. Significant trust had already been established in the consultant, and management was uncomfortable proceeding further without her guidance. Trust, accordingly, substituted to a substantial degree for management knowledge and judgment in the IT domain, and foreshadowed the emergence of the consultant as the focal actor in the situation.

The decision to take an agile development approach, also an aspect of the project's basic "how," followed the choice of the custom-development path. The consultant, in fact, first offered management a more structured vision of how the project should be conducted. However, after a short time the users' and managers' lack of prior participation in systems projects, combined with their inexperience in using information technology, made it clear that a more evolutionary approach would be needed. The development team improvised the use of visual use cases (a blend of screen mock-ups and use cases) to facilitate user participation in the early stages of system-component design; these were followed as quickly as possible by the introduction of working pieces of software, which selected users could work with and provide feedback on. This design cycle was pursued relentlessly as more and more functionality was rolled out to the organization. In this manner, users were enlisted to work closely with the development team throughout the project.

As noted, a Web-based architecture emerged as another founding premise in the project. Microsoft's .Net technology was chosen at the recommendation of the development firm (see below) as the basic platform for developing the new system. In a system project, components of the enabling technology are themselves actants that must be enroled and made to behave as required. Of course, because of immaturity, poor fit, or fundamental physical limitations they do not always do so, and this can threaten the stability of the project's actor network. Here, the bleeding-edge choice of.Net seemed to present a textbook case of risk. Nevertheless, it proved unproblematic. The organization could not be so sanguine about its own computing and network infrastructure. For an extended period of time, it seemed uncertain that the network administrator (see below) would respond with a program of adequate upgrades to support the new system. This issue lingered for nearly a year, until it was eventually resolved with the replacement of this individual.

**The project's *Who*.** Once the consultant had shepherded the organization over its break with the previous project, and management had once again advanced down the path of custom development, the consultant outlined a preliminary project-team structure in which the senior vice-president would play the role of system owner, and the network administrator (this was before he was fired) would be the project manager. The consultant would stay on as system/business analyst and help with requirements determination and system design. A staff person with medical-records training and a

broad knowledge of the organization would join the project team as a kind of cross between lead user and analyst. A startup firm, comprised of individuals who had worked for a package vendor in the industry, would do most of the programming. Their development work would be supplemented by a new hire at North Bay, a recently graduated information-systems major, whose main focus would be on database design and development.

As was true for the bleeding-edge technology, the initial composition of this core project team appeared to pose high risk. Although the individuals in the outside development firm brought considerable experience to the table, the firm *per se* was brand new, and it was accordingly unclear what kind of process difficulties this might cause between the two firms. The junior internal staff (the lead user/analyst and database programmer) had next to no project experience. The network administrator had never managed a software project, and the senior executive had never sponsored such a project. While this initial actor network could accordingly be expected to be highly fragile, only the network administrator failed to rise to the new role into which he had been cast. Falling far short in basic knowledge, organizational abilities, motivation, and communication skills, he was discharged from the project leader role in fairly short order. The consultant (reluctantly) took over as project manager at the behest of the executive sponsor. This far from eliminated the risk at this "node" in the actor network: The consultant, despite having many years of software-related experience in diverse roles and industries, had actually never managed a software project.

Besides essential aptitudes and basic knowledge, what appeared to give this unlikely collection of actors the potential to cohere as a stable network core was a high level of communication and trust. This permitted the actors to find an alignment of interests, where each party's prospective gains – in employment, career enrichment, firm success, solutions to management problems, and so on – were effectively equated with the advancement of the project. Of course, this translation of interests was not instantly realized. Instead, it represented an emergent property, worked out and proven in the process of working together on the early tasks of the project.

The new system's prospective users, of course, also represented an important "who" in the project. However, they are best viewed as bringing a separate set of critical issues to the project, ones coming to prominence once the work on requirements definition and system design began in earnest. In this process, the precise "who" of relevance were discovered and enrolled as actors over a period of time, as the system's functionality grew and its organizational scope of applicability became clearer. We will visit the users, accordingly, in the next section.

The how and the who, of course, were interdependent. Much as the who depended on the how – note that the hiring of the outside firm depended on the choice of a custom development path – the how also depended on the who. It was the project leader's trust in the technical leadership at the outside firm, for example, that made the seemingly risky choice of .Net reasonable. In some instances, the direction of causality remained unclear. For instance, did the retention of the consultant depend on the decision to pursue custom development, or was custom development chosen in order to retain the consultant?

**The project's *What.*** Relative to the issue of *what*, our interest at this point is in the broad scope of what the system would be designed to do. The specific features and capabilities of the system were a matter to be worked out, in detail, in downstream project activities. However, as part of the initial project framing there was the more basic question of what services within the firm the system should support.

As work began in earnest, the executive sponsor announced her priorities to the project leader, and situated enrollment and tracking of clients at the center of the firm's information management needs. Of course, organizational needs, however well-reasoned, do not tell the entire tale: It must be possible to extend the project's actor network in ways required to support the associated software-development work. In this case, even though the executive sponsor had specifically identified enrollment in the foster care unit as a high priority, the

evasiveness of that unit's director made extending the project's actor network into that area highly improbable. In particular, her engagement and the participation of her subordinates would clearly be inadequate to produce a sound and useful design. The project leader subsequently steered the development work, with the executive sponsor's tacit consent, around the foster-care services unit. (The unit remains, today, largely unsupported by the system.)

Here, the what and the who clearly interacted. The scope of the system, as laid out by management, appeared to dictate who had to be brought into the actor network. But that scope proved, in practice, to be more negotiable than might otherwise have been envisioned. The requirements of the actor network, and limitations in the organization's ability to satisfy them, in the end affected the constitution of the system. How the system would actually work, what it would actually do, and where it would actually serve took shape in response to how soft spots and obstacles in the existing fabric of the organization defined the possibilities (and impossibilities) for extending the project's actor network.

ANT analyses often treat the technology as an actor once it has been built (its inscriptions put into place) and implemented, and can then begin to affect materially the activities of the human actors. Now, in a systems project based on agile development that moment of material engagement comes sooner than in traditional "structured" projects, as working pieces of software begin to be put into the users' hands at an early point. However, it was clear in the current project that even as a concept, the new system became an entity invested with a measure of *power*. Rather like a magnet beneath a piece of paper strewn with iron filings, the mere idea of the system generated a kind of socio-cognitive field, with the capability of compelling attention and diverting cognitive resources within the firm. The developing discourse about the system began to affect expectations and beliefs within the firm, even before the system itself had begun to exist as a material artifact (Ramiller 2001). The range within which the system, as such a discourse object, could make its effects felt, corresponded closely to the expanding actor network for the project.

That network expanded outward from the core project team to take in larger portions of the organization, as users were brought in to engage in conversations with the core project team about the emerging material features of the system and their eventual use in the work processes of the firm. The particular challenges involved in network construction changed in certain ways, as this new population was engaged. This phenomenon is examined in our next section.

**Making Software, Making Users**

User engagement in requirements definition and system design – note that in agile development regimes, the on-going adaptation of the system based on users' continual feedback makes it impossible to draw a clear distinction between the two – essentially began with the inclusion of the medical records professional as a business analyst in the core project team (see above). Her knowledge of the organization, its procedures, and the information requirements of outside agencies provided much of the basis for the earliest efforts in data, application, and interface design. Nevertheless, the circle of engagement progressively expanded to include other prospective system users whose specialized knowledge was needed in the project. Of particular importance, at this stage, were the administrative personnel, clinical staff, and unit supervisors involved in front-line data capture where the enrollment, tracking, and treatment of the clients took place. Selected individuals in these roles were enlisted to review and revise visual use cases and, subsequently, the working pieces of the system.

In this manner, user engagement in system design took on a two-tier character, in which a lead user with a more general view of the organization was involved broadly in the effort and others were brought in to address selected issues. Over time, the role of lead user shifted from the business analyst to an employee of long tenure in the organization who held the curiously inadequate title of "medical transcriptionist." While she did indeed transcribe doctors' dictation for inclusion in client records, the original role

reflected in her title had placed her in a position where a variety of client-related documents routinely passed over her desk. As a result, her actual work had long since informally (although never officially) expanded to encompass data-quality monitoring and enforcement. She became a primary user of the new system, as sufficient system functionality came on line, and the project leader sought her out on a regular basis, as efforts continued to refine and extend the system's functionality.

This period in the project witnessed the first significant business-side commitments to the system – beyond, of course, the project approval and funding granted by the senior management and board. Most significantly, business knowledge was now being committed in a sufficiently concrete way to begin shaping the design of the system. On the other hand, the participants' inexperience with information technology and information-systems projects proved problematic. Many prospective users lacked the pertinent cognitive frames to support effective participation.

ANT studies commonly treat interests as unproblematic in themselves, and straightaway ask how interests do or do not become aligned (Walsham and Sahay 1999), and how commitments do or do not get made (Klischewski 2002). But North Bay, in its laggard status, brought into sharp relief the fact that sometimes a project must entertain the *constitution* of interests. The task of translation depends upon a certain level of subject competence that may not yet exist, especially in circumstances where actors lack the knowledge even to understand why and how and when to enrol (or dissent).

This possibility adds an important dimension to the concept of translation. In order to get actors "to participate in particular ways of thinking and acting that maintain the network" (Walsham and Sahay 1999:42), their interests may need to be constituted through the very processes of translation by which their enrolment is sought. *Learning* accordingly can be seen as an integral part of the process of actor engagement. This, obviously, also expands our view of the responsibilities of the focal actor in the North Bay project, who had to create a minimum threshold of business-side capability for thinking about IT and information management in the firm.

Part of the project leader's challenge was getting user-participants to recognize the basic contestability of the system's design, their own potential for influencing it, and the inherent limits in the technical team's knowledge and authority. The restricted participation afforded users in the previous system project made this challenge even more pronounced, because of the expectations that it helped to create. In response, the project leader fostered user engagement through measures expressly crafted to give users a large voice in the design proceedings. Design sessions focused on users' own narratives concerning work, in the context of hands-on engagement with visual use cases and working software. Problematisation, interessement, and enrolment were thereby accomplished, in a concrete way, by bringing relevant functional elements of the system directly and tangibly into the users' work activities.

Users were also encouraged to engage in creating representations of how the new system might affect, and be affected by, the larger organizational context. Thus, their engagement was not simply a matter of reflecting on the new system's features relative to immediate work tasks and business processes. This led the users, in turn, to consider the potential implications of system features for other interests not directly engaged in the design process. For example, participants reflected on the information demands of funding agencies, the requirements of outside review agencies (like the Joint Commission for the Accreditation of Healthcare Organizations, or JCAHO), and the needs of family interests. They also commented on the requirements of other parties within the organization (e.g., "What Dr. X wants to see, at this point in the process, is Y."). In this manner, the participants learned to position themselves as *representatives* of interests that had no direct voice in the design process at the given point in time. This effectively served to expand the actor network in a virtual sense, and to foreshadow lines of network extension during the system's subsequent large-scale implementation.

In summary, during this phase the project in effect created its own users, even as the system itself was being built. Each of these "construction" efforts helped to provide the context for the other. In a sense, however, all of this work was prelude. Design would begin with a vengeance with the rollout of the system to the wider organization. That brings us to the next critical issue in the project.

**Mobilization, and Extending the Design**

Analyzing implementation from an ANT perspective involves attention to shifts in the representational activities of the actors in the network. Representation, as noted a moment ago, is a defining aspect of the period during which major specification and construction take place. For example, users involved in requirements definition and interface design speak for the needs of other individuals within the firm, and for the interests of their units and, where relevant, their clients. Executive sponsors and participating managers speak on behalf of employees and other managers, and for the organization, its larger goals, and its stakeholders' interests. The project leader speaks for the organizational fit and value of the future system. Technical personnel speak for the capabilities and requirements of the infrastructure that will have to support the operation of the new system. Components of the emerging system speak for the performance of what will, at some point, become the full production system. Initial data-loads speak to the quality of the operational data that will eventually populate the database.

While, narrowly speaking, the actor network comprises the actants that are actually engaged in and making commitments to the project, there also exists a kind of virtual network that embraces a much larger population of actants *spoken for* but not (yet) speaking on their own behalf. Figure 2 illustrates this phenomenon for the North Bay project, based on statements made by participants in interviews, meetings, and written communiques. (The figure does not attempt to address the substantial representational work that occurred where actors at North Bay spoke on behalf of other actors who were also within the boundaries of the actor network. Were it to do so, the figure would show the project leader, in particular, at the center of a dense web of internal representations.)

Again, as Latour also points out, although an actor "may populate his world with other beings," it remains to be seen "how well [the] actor's conception of others corresponds to their conceptions of themselves"; the result may be that those whom the actor claims to represent may "behave in an unpredictable fashion, attaching or detaching themselves to the program from version to version" (Latour 1991: 127). In a systems development project, it is at the point where large-scale implementation takes place that many elements in the realm of the spoken-for now must be *mobilized* and moved from the virtual into the real actor network. Limitations inherent in the activity of representation mean that expanding the real actor network can be far from unproblematic; dissidence and defections, in fact, are likely.

Figure 3 suggests the shift in scope of the actor network at North Bay, under the mobilization brought about by the large-scale rollout of the system. A number of categories of actors that previously were without direct voice in the project now entered the actor network. (For readability, the lines depicting representation that appear in Figure 2 have been removed.) Mobilization does not imply that acts of representation now ceased. To the contrary, representational activity expanded and increased in intensity in certain areas, especially where the growing complexity of interests directly engaged within the actor network fostered increased conflict. Nevertheless, as more actors began to speak for themselves through direct participation, the boundary beyond which representational work generated the world of virtual actors got pushed farther out.

A key aspect of this representational shift is that the system became a more complete and far more pervasive actor. While the earlier period focusing on software construction had involved a steady increase in user enrolments in the actor network, with full-scale implementation the project witnessed a

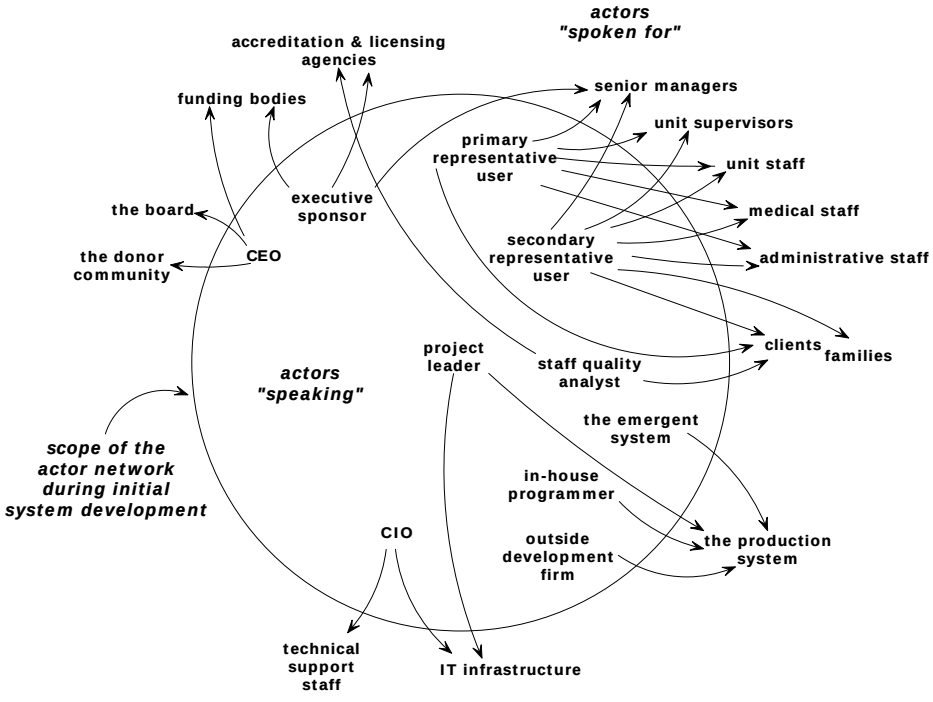


**Figure 2. Representation in the Actor Network**

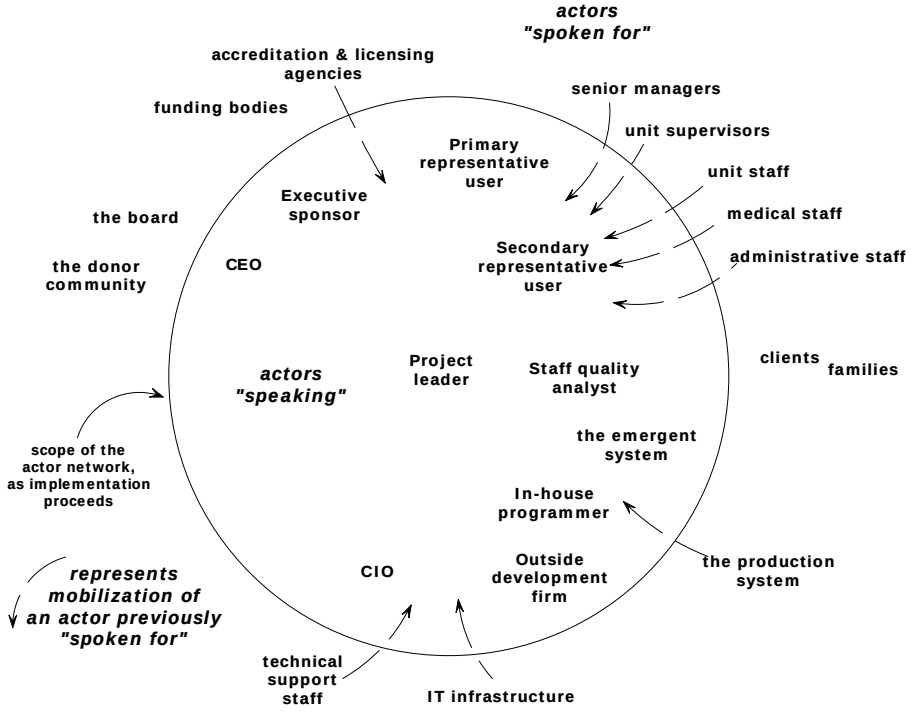


**Figure 3. Mobilization in the Actor Network during Implementation**

discontinuous jump in the numbers and variety of organizational actors who directly encountered the system. These included users not previously involved in the design effort, managers only nominally engaged before, and technical personnel with infrastructure responsibilities who would now be placed under significant new demands. In short, the bringing of new actors within the sphere of the project's actor network was to a substantial degree occasioned by the shift of the system-in-development to a production system.

The consequences of such a significant expansion in a project's actor network are complex and difficult to predict. It is prudent, however, to anticipate significant dissidence, threats to the stability of the network and even, potentially, the rejection of the new system. At North Bay, a great many new enrolments had to be sought, which engaged the project leader and other system champions in extended efforts to convince other actors that their interests were in alignment with the inscriptions entailed in the new system.

This convincing expanded the organization's learning in two major ways. First, it entailed a collective effort to determine how roles and responsibilities ought to be changed in light of the new system. These changes could not be planned in advance, but had to involve the organization in a process of discovery and sensemaking (Weick 1995) that could fully commence only upon direct engagement with the production system. Second, individuals and units within the organization had to develop the knowledge and skills demanded by their new or transformed roles.

Clinical staff and administrative employees had to come to understand, and to accept, what the system expected them to do, especially in the area of data capture. Analysts and managers, as information consumers, had to learn what the new reporting capabilities might entail for their work. Managers, in their role as agents of control, had to grasp their responsibilities for restructuring and incentivizing changes in users' behavior; they also had to learn how the new level of information generated by the system might affect the visibility of organizational practices to outside parties. Members of the IT organization had to learn what demands the system and its users would place on the IT infrastructure and support services.

While the new system thereby placed a variety of demands on the human actors, in such a situation the latter do not necessarily comply passively with the dictates of the system. Even as their own work and conduct are under pressure to change, users and managers may in various ways *act against the system*. This was clearly witnessed at North Bay in the early stages of implementation. Relative to data capture, for example, some administrative and clinical personnel balked at providing certain data stipulated by the system's screens. The consequences of this behavior for data quality posed an obvious threat to the system's long-term viability, because of the potential loss of support for the system from other actors dependent on this data. Beyond such passive resistance, users also acted directly against the system by proposing a variety of changes to its design, in an attempt to accomplish shifts in what data would be captured, when it would be captured, and by whom.

In the discussion to follow, we will take a closer look at the mobilization of three main interests in North Bay's implementation effort – the clinical and administrative staff, the managers, and the technical support unit. In keeping with an ANT perspective, we consider both how the new system impacted the expanding network of human actors, and how the human actors responded with their own moves to reshape the technology.

**Mobilizing the users.** In the early months of regular system use, a number of data-quality problems began to appear. In some cases, clinical and administrative staff were not entering data the system was designed to capture. In other cases, erroneous data were being submitted. Some records were not being "closed" as required by formal procedures. Other records were not being properly "signed off" by supervisors. While insufficient training in system-related work processes could be faulted for some of the trouble, it was apparent that the issue ran deeper than this. Users were in many cases balking at entering the data the system was designed to expect.

For example, administrative personnel doing enrollment processing (client intake) were found to be systematically leaving certain data-entry fields blank. This gap was discovered by the staff analyst in charge of performance quality assessment, who required the information for certain reports he needed to produce for outside agencies. A process of negotiation ensued, adjudicated by the project leader, in which issues of responsibilities, work-process change, and system design all entered into the mix. The staff analyst lobbied heavily for making the fields in question required – in effect, a call for building new inscriptions into the technology that would dictate the behavior of the intake personnel. The intake personnel counter-argued that the information needed was not available at the point in time when enrollment took place. Analysis of the work process revealed that this claim was partially factual – timing was indeed an issue for certain pieces of data. On the other hand, the intake staff could obtain some of the needed information with extra effort. The resolution, then, turned on getting accommodations out of the intake personnel, combined with a restructuring of the work process and associated screen re-designs. It also entailed changing the staff analyst's expectations about when he could expect to get the information he needed.

Problems also surfaced among the clinical staff. One crucial area of system functionality was the recording of "special procedures," physical measures taken to intervene with clients whose behavior posed an immediate threat of harm to themselves or others. As clinical staff engaged this feature of the system, a variety of difficulties appeared. Some records were only partially completed; others included questionable or erroneous classifications of client behaviors; in some cases, multiple records were created for the same incident; many records were not formally closed and forwarded to supervisory personnel for review and signoff; and supervisors were often giving records inadequate review. Even more seriously, the data that were being captured by this system feature appeared to expose the excessive use of special procedures, at odds with organizational policies and external licensing standards.

A great deal was at stake in this issue, because for firms like North Bay special procedures come in for particular scrutiny from outside agencies. The gravity of the matter brought a variety of supervisory, managerial, and executive personnel into discussions of possible changes in staff training, work procedures, and system design. The issue became intensely rhetorical (Latour 1987), as participants invoked a variety of other interests that had no direct voice in the current discourse (again, see Figure 2a). Thus, the interests of clients, the clinical staff (whose own safety was an issue), and accreditation bodies came to be represented in the discussions. Overlapping and conflicting objectives were also advanced as having a legitimate bearing on the system's inscriptions, including social control, regulatory compliance, adherence to professional standards, and retention of staff. Although a redesign of the data-capture screens for special procedures was settled on, it remained doubtful (at the time fieldwork concluded for the present study) that a definitive resolution had actually been reached.

Other problems with information capture in the residential and treatment units spoke to a failure to enrol clinical staff in new and essential roles in information management. Clinical personnel were the only ones able to record certain data at the point where the data were generated – specifically, in their work with the clients. However, occupational identity presented a significant barrier to getting these actors to see front-line data entry as aligned with their interests. As a number of managers observed during interviews, staff in the units viewed client care as their primary professional responsibility. By contrast, they saw the information-generation aspects of their work as secondary (if not completely expendable) and "clerical."

In summary, the mobilization of users for essential data-capture activities raised a series of challenges in sociotechnical design, demanding creative and adaptive efforts in restructuring work roles and procedures, enroling staff, and re-designing system features. This process was continuing at the point where the fieldwork for this study concluded, and in some cases successful resolutions to the emerging problems were

even then not clearly in hand. Particularly serious was the persistent ambivalence of staff toward the information-management duties the system implicitly enlisted them in.

In interviews, managers equivocated on the question of getting their staff to take up these duties. Some managers even suggested that, notwithstanding the organizational importance of the new system, the matter of professional identity presented an intractable barrier. The managers' own ambivalence on this matter, then, suggested that mobilizing management was also problematic. We turn to this issue next.

**Mobilizing management.** As staff directly encountered the new system, it became increasingly clear that management too had to become more deeply engaged. The system put managers under pressure to make their own kinds of commitments, especially in regard to how they would manage their subordinates' behavior within the work processes being transformed by the new system. Where managers invoked "professional identity" to excuse employees from attending properly to data-capture tasks, they tacitly validated user defections from the actor network. The long-term implications were potentially grave: A sufficient number of such defections could perpetuate a pattern of failure in information management that would eventually lead to an utter loss of confidence in the system.

Mobilization threatened to founder on three pervasive characteristics of the management group at North Bay – its *immaturity* in IT matters, a predilection for *disengagement* from operational specifics, and an *ambivalence* toward the information the new system would provide.

Relative to *immaturity*, North Bay's managers shared with the staff a lack of experience in the development and use of information systems. Learning was accordingly of the essence in mobilizing management. Of particular import was management's need to learn that the new system was not just the technology involved. To the contrary, the true "system" – the investment that would move the organization ahead in information management – comprised the technology in concert with appropriate organizational structures, work process designs, job definitions, employee knowledge, and incentive schemes. In conjunction with recognizing the sociotechnical scope of the new "system," management also needed to learn how to draw the logical implications for its own responsibilities in change leadership. These lessons, however, were difficult to learn. A common impulse was to put the onus for outcomes back on the technology. Emblematic of this naïvete was the statement of one manager: "We have a half- million dollar system now. Why can't it do what I want?"

Overcoming this immaturity in thinking about "systems" was hampered by a managerial predilection toward *disengagement* in operational details. A vicious circle was thereby set in motion, where disengagement meant abdicating opportunities to gain knowledge about the new system, and lack of knowledge in turn further discouraged engagement. A rather extreme form of delegation ensued, in which crucial knowledge about the complex interactions between the system and the organization pooled with individuals apart from the firm's management. These included, notably, the project leader who (as a consultant) was expected to exit the firm in the not-too-distant future, plus her young team members, who would likely seek greener pastures based on their experience with the project. Thus, even as business-side knowledge built up in the system's actor network, it threatened just as quickly to leak away. Crucial knowledge also pooled with the lead user (the mis-named "medical transcriptionist"), whose tenure was more stable than these other actors, but who neither had, nor particularly wanted, the ear of management.

Compounding the problem of managerial disengagement was the fact that the prevalent culture of decision making at North Bay entailed a diffuse, consensus-based approach, in which the responsibility for implementing decisions and doing follow-up was often poorly specified. This made it difficult to clearly establish the commitments of individual managers. The resulting elusiveness in accountability made it relatively easy for managers to reverse prior commitments.

The endemic disengagement appeared to be exacerbated by *ambivalence* concerning the larger movement in the industry toward enhanced information management. Management simultaneously did and did not want some of the data the new system could potentially provide. While organizational-performance measurements – to the extent they are valid, an issue raised in interviews by the firm's own clinically trained managers – might promise to support improved practice, they also threatened increased exposure. As the comments of management informants suggested, poor organizational performance was not the only concern. Negative outcome measurements might also foster doubts about the viability of the disciplinary practices in social work and human services on which the enterprise's core legitimacy was founded. Were its clinical practitioners indeed scientifically-grounded professionals or something closer to prison wardens?

When it came to the challenge of mobilizing managers at North Bay, then, immaturity, disengagement, and ambivalence made it difficult for the project leader and her core team to gauge managers' interests, to predict their behavior, and to rely on their commitments. Randomness and disorder in the project's actor network accordingly increased as the project moved forward into large-scale implementation. The behavior of the director who supervised the majority of the units affected by the early system releases typified the challenge. In addition to an unwillingness to engage his subordinates on the issue of data-entry responsibilities, he made comments well into the project to the effect that North Bay "should have gone with a package."

**Mobilizing technical support.** As Figure 2b (above) suggests, implementation also entailed bringing within the project's actor network the IT infrastructure necessary to run the new system on a production basis in the firm. This required new investments in server and network capacity, plus operating system upgrades. It also meant mobilizing North Bay's small technical support staff on behalf of the system. As noted earlier, North Bay's network administrator had started out as the project manager but had quickly failed at the job; his subsequent recalcitrant behavior then raised concerns about the proper preparation of the infrastructure. Doubts over the network administrator's enrolment were rendered moot, however, when the CEO decided to hire a CIO, on the independent recommendation of two outside consultants.

While it seems likely that the move to hire a CIO was due in part to the boost the new system gave to the salience of information technology, the effect was fraught with irony for the project itself. Although the new CIO fired the problematic network administrator, his own behavior soon raised fresh concerns. Inside of his first few days at the firm, the CIO began stating to people on the business side that he "would have done a package" instead. Meanwhile, to junior members of the core project team, then in the midst of training and other intensive user-support activities, he announced that "it was time to pull away from the users," in order to get started on other activities he had in mind. In short, the CIO made it clear that he did not view his own interests as aligned with those of the new system; in fact, he appeared eager to encourage others to defect from the project's actor network. A prickly relationship at once ensued between the CIO, on the one hand, and the project leader and the system's executive sponsor, on the other. The threat that the IT infrastructure would not be enlisted in support of the system accordingly persisted. It also remained to be seen how the CIO might influence the CEO, or how he might affect the views of mid-level managers whose support was necessary to get compliance from the users.

The situation was eventually resolved with the escalation of the conflict to the CEO. The CEO affirmed his enrolment in the actor network by separating the new CIO from any authority over the system project, while making infrastructural support for the system the CIO's highest priority. The translation of the CIO's interests was more fully accomplished, some months later, when the tenure of the project leader ended (due to budget constraints), and accountability for the system was formally transferred to the CIO.

Beyond the obvious importance of making the infrastructure and the people who build and support it allies in a systems project,

the tale of the new CIO also illustrates the hazards that *random introductions* potentially pose to an actor network. A new actor who by virtue of formal position holds power and influence not only represents a potential point of dissidence, but may also inspire or actively foster the defection of others and, hence, destabilize the actor network .

**Postscript: Re-designing as institutionalization.** In a project based on the classical systems development lifecycle, significant changes to the user interface, application logic, and database are resisted, on principle, during rollout and implementation. Of course, many such projects witness these kinds of changes anyway, because of the problems with fully specifying requirements before users actually have the system to work with (Highsmith 2002). At North Bay, by contrast, the agile development strategy made on-going system design an integral part of the implementation activity. As noted here, organizational members took advantage of this regime by proposing various changes to the system, in response to *mobilization crises* that exposed problems in sociotechnical adjustment between work practices and workers, on the one hand, and the system, on the other.

Some of the proposed changes had the potential to diminish the system's organizational role – producing, in effect, localized *de-inscriptions* that would reduce its power to determine other actors' behavior. However, at another level the very activity surrounding these proposals was indicative of a solidification in the system's actor network. Efforts to re-design elements of the system helped to earn it a taken-for-granted status among the human actors involved, because they amplified people's engagement with the system and increased their level of commitment to it. Re-design hence became a form of symbolic validation, and helped to institutionalize the system.

### Maintaining the system, maintaining the network

The final critical issue (refer again to Figure 1) is an incipient one, in that it had become apparent only as the field study was being concluded. Nevertheless, it provides a good place to wrap up our story of the North Bay project.

The project leader departed North Bay at the end of 2003. The departure would prove, in fact, to be a hiatus, and the project leader is (at the time of this writing) back at the firm on a part-time basis. In her absence, various data quality issues continued to arise, signaling the need for on-going design refinements, detection and diagnosis of accumulating errors, and changes in work processes. The firm's difficulties in actually addressing these problems spoke to the continuing inattention of the managers to the larger information-management challenges in the firm, as well as to problems in developing effective change-management processes between the IT group and the business and clinical side of the organization.

In short, the exit of the project leader from the actor network appeared to hamper further advancement in the system. This points to the potential perturbation that critical departures, like the random introductions noted above, can cause to a project's network. More broadly, it calls attention to the fact that system maintenance depends on the parallel maintenance of a viable, heterogeneous actor network, much like the kind that is required in development and implementation. At the conclusion of this study, it was not yet clear whether executives at North Bay, including the CEO and CIO, fully grasped the need to make the requisite investments in the actor network, including hires in key roles that would continue in championship of the system. Conflicting priorities, including potentially attractive and symbolically visible new system initiatives, combined with persistent notions that the original system was basically "finished," raised doubts about whether adequate support would be forthcoming for the now-established system.

## DISCUSSION: ACTOR NETWORKS AND THE PRACTICE OF PROJECT LEADERSHIP

The goal of this discussion section is to draw some implications from the North Bay study regarding the broader application of actor-network theory to the practical management of systems projects. (On this theme, see also Atkinson 2000, Klischewski 2002, and Underwood 2001.) While

generalization is the objective, this is obviously not a matter of statistical generalization. Actor-network analyses do not aspire to variance models based on predictor variables and decontextualized statements of the form "more X will produce more Y." Rather, ANT necessarily entails a process-oriented view (Markus and Robey 1988). In that regard, it is important to acknowledge that we are dealing with a single case, and therefore broad claims concerning patterns of process are out of bounds. The goal here is more modest. Using ANT as a lens, we simply want to examine the case for insights into the kinds of things management should be alert for, in any complex project involving multiple interests and actors.

**Project Management as Network Management**

In ANT perspective, managing a system project is tantamount to managing the project's actor network. Only on the surface is building an information system the technical affair it is commonly taken to be. Instead, creating a stable, heterogeneous actor network is integral to the overall undertaking. This is true not only when it comes to supporting the construction of the technical artifact, but also in establishing the web of relationships that integrates the system into the business processes of the organization.

A further lesson we can take from a network view of the project is the need to be alert to the proper scope of the actor network. Figure 2a (above) suggests the potential scale and complexity involved.

**Network Management as Facilitation**

What is also clear is the inherently political nature of actor-network management. Garnering the enrolment of, and commitments from, key actors should always be regarded as potentially problematic and a challenge to the project leader's skills in rhetoric and negotiation. The need for rhetoric and negotiation suggests, in turn, that actor-network management is not principally about control, but instead is much more a matter of persuasion and facilitation. (Underwood (2001) also makes this point.) The project leader is not outside of the network, but is really just one more actor within it. As such, she can influence developments only from a particular position within the network. The possibilities for control are further limited by the emergent, path-dependent character of network evolution. Predictability is low, and the project leader must rely more on sensemaking and improvisation than on forecasting and planning.

Even so, to the degree the project leader is successful in getting herself centrally located within the actor network, rhetoric and negotiation can be powerful tools. At North Bay, as one after another key actor became enroled, and one after another defector became marginalized, the project leader came to sum up her striking level of influence using the literary shorthand "lathe of heaven" – a reference to Ursula LeGuin's *The Lathe of Heaven* (Le Guin 1971), in which the protagonist's dreams change the physical reality that he awakens to.

**Translation and Learning**

The idea of "translating interests" is obviously central to actor-network theory, and any attempt to apply ANT in practice must focus on this activity. Nevertheless, after looking at a technologically lagging enterprise like North Bay, it becomes apparent that there are situations where certain "interests" may hardly deserve the label. Now, although a lack of organizational sophistication in IT will make the immaturity of interests more pronounced, this phenomenon is also likely to occur even in more experienced organizations. This implies that accomplishing translations may not merely be a matter of alignment (as the earlier quote from Walsham and Sahay suggests), but may also demand the fostering of sensemaking and learning (Fomin, Keil, and Lyytinen 2003).

ANT analyses commonly assume interests to be relatively stable (Allen 2004). But in a systems project like the one at North Bay, actors discover and define their interests in a changing context of work that emerges hand-in-hand with the introduction of the system itself. Thus, even as participants weigh in on issues of system design, they are themselves transformed, "redesigned" as organizational actors, as they learn about the possibilities of the technology, establish their own identities as system builders, and move

toward a view of themselves as users that must know certain things and work in certain ways in order to function in the changing environment shaped by the new system.

Accordingly, the project leader is well-served by viewing the project not just as an effort in system construction, nor simply as an undertaking in network building, but also as an occasion for organizational learning. Learning on the part of key actors will prove indispensable to the project leader's efforts in problematisation, interessement, and enrolment. At North Bay, for example, the project became a vanguard effort to create a minimum threshold of business-side capability in thinking about information technology and information management in the firm. In short, the project leader had to do more than just "put in a system." She also literally had to "change people's minds" – to transform managers and users into the kinds of actors who could act knowledgeably and effectively in their engagement with IT.

**The Politics of Representation**

As the North Bay story makes clear, the indirect representation of interests outside the actor network was essential (again, see Figure 2b). Representation helped shape system design in ways that would affect actors yet to become part of the network. In other cases, the interests represented would never become active participants in the system project *per se* (e.g., the clients, state funding agencies), but were crucial participants in other actor networks in which the system itself would eventually function as an actor.

Of obvious concern to a project leader, then, is identifying how the actors participating within the actor network actively represent others' interests, in addition to their own. Questions to ask include: Who is speaking for whom, by what right do they claim to do so, and how effectively do they do it? These are crucial issues, because the design of the system will be shaped in part according to the representations put forward by those who have a voice in the process. The resulting inscriptions can have a potentially significant impact on other members of the organization. At North Bay, for example, we witnessed the staff analyst speaking for the interests of outside agencies, as he tried to get redesigns to system screens that would change the work of the intake personnel. Understanding representation is also important because it can help the project leader to anticipate where the attempted mobilization of parties not previously engaged may come up against resistance because of mis-representation. This may influence crucial decisions about the scope of participation in requirements definition and system design, and the management of power and authority in the project. It can also affect how the leader sequences and times her translation efforts, for example, bringing certain actors into the project earlier rather than later.

As noted, the project leader is not, in Machiavellian fashion, above the actor network, but is instead an integral part of it. As such, she too is an agent of representation, and will commonly be an active one, at that. Being in this position demands more than a modest amount of self-reflectiveness. Whose interests should she be representing, and how should these be served through system design? The answers are not always clearcut, and invariably involve political and ethical considerations. They can also raise difficult internal conflicts between the project leader's own interests and the varied interests of the other participants directly, and indirectly, involved.

**Managing by Critical Issues**

This paper's presentation of the North Bay story has used the device of *critical issues* as the basis for its historical framework. Critical issues, of course, also constitute real matters with which the participants have to contend. Managing a project's critical issues requires the leader to recognize them for what they are and to deal effectively with their particulars.

Critical issues, again, are situations that present challenges to the extension and stabilization of the project's actor network, as things move forward in time. These involve problems in accomplishing the stable enrolments of actants who emerge as essential over the course of the project. Stabilization is always a matter of degree, and subject to reversal. It follows a complex, path-dependent process that demands leadership that is alert to

crucial developments, and that is then persistent and creative in handling them.

Creating and maintaining stability in the actor network also demands attention to the details, as they emerge. Effective leadership, in this regard, is not a matter of getting all the right pieces arranged at the outset, and then sitting back and letting matters take their course. As noted a moment ago, the inherent limits to prediction make this a matter instead for vigilant and mindful attention to the facts (and interests) as they evolve. The circumstances also call for a realistic view of the scope of one's own influence over events.

Managing by critical issues also suggests that timing is central. A critical issue will develop in its own good time. The specific pattern of extension in the actor network must therefore be dictated by the evolving project itself and the issues it produces. Critical issues provide the salience, motivation, and opportunities for learning that actors need in order to engage in the network. For the project leader, premature efforts to translate particular interests are likely to be at best a waste of attention and energy, and may produce negative effects, including the invoking or hardening of resistance.

### Managing the Paradox of "Stability"

In applying ANT in the information systems context, an important distinction must be made between the stabilization of the project's actor network and the stabilization, or "blackboxing," of the system itself as a technological artifact. The two things are not the same (Fomin, Keil, and Lyytinen 2003). While ANT studies often imply that there is a strong correlation between the two – and some studies perhaps even conflate them – in the system development context we face a seeming paradox. Accomplishing stability in the actor network, in the form of appropriate enrolments and strong commitments, may actually be a prerequisite for successfully suspending stabilization in the design, so that the emerging system retains its plasticity and adaptability. For example, at North Bay, the project leader worked doggedly on lining up allies faithful to the project and to the larger idea of the new system. At the same time, she directed the project using a consciously agile methodology intended to forestall premature closure on the features and capabilities of the system.

This paradox of stability, while perhaps more clearly manifested in a systems project conducted in the agile manner of North Bay's, is likely to hold more generally. As Holmstrom and Robey observe (forthcoming), practically speaking an information system is never really "black-boxed," because the system must continually evolve to meet changing business needs. Their concept of "negotiation loops," then, expresses the idea that a system should be open to a succession of revisions without any necessary endpoint. This leads us to another apparent paradox, of which the project leader needs to be aware. The institutionalization of a system – getting it to a taken-for-granted status in the eyes of the organization's members (Scott 1995) – may depend on a maintenance strategy that fosters the system's flexibility and readiness for change.

## CONCLUSION

This paper has considered the possibilities for garnering practical insights from actor-network theory for the management of information systems projects. Drawing on the particulars of an intensive field study, a number of observations have been made about how actor-network theory might be used not only to produce a scholarly account of a systems project, but also to help manage the developments taking place in the project. Although ANT has enjoyed growing interest among IT academics because of its potential for rich explanatory characterizations of the course of project events, to date the literature has offered relatively little in the way of specific ANT-based guidance for management. Accordingly, a primary contribution of this paper has been to identify a number of issues, cast around the central idea of actor-network management, that may warrant managerial attention in systems projects.

Such issues include finding the right balance between a facilitative stance and a control-oriented one; the potential need to constitute interests, as well as to align them; the hazards and pitfalls of representational activity among project participants; the handling of critical issues and phase shifts that

present new challenges to the stability of the project's actor network; and the need to manage the paradoxical tension between network stability and system flexibility. Also of crucial practical importance for managers is the recognition that they, too, are part of the actor network; as such, their own enrolment and commitments demand serious self-reflective scrutiny.

The case study has also provided some more general insights, with relevance to both theory and practice. One is that the construction of a project's actor network does not necessarily start on virgin ground, but may require the dismantling or disabling of actor networks that already exist. Also, the very design of the system itself will tend to respond to the opportunities and limitations which the existing fabric of the organization presents to the construction of the project's actor network. In this regard, even the best efforts to plan such a project must give way, by degrees, to improvisation, as the project unfolds. Yet another insight, not often explicitly considered in ANT analyses, is the need to attend closely to the effects on networks of actors' entrances and exits.

Although limited in generality by its "sample of one," the analysis offered here nevertheless suggests some of the rich possibilities for using actor-network theory to advance the practice of information systems. Future research in this vein would seek to develop additional ANT-based stories for projects in other organizations and, on that basis, to refine and extend the guidance outlined here.

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