16 THE NATURE AND ROLE OF GENERATIVE SYSTEMIC METAPHOR WITHIN INFORMATION SYSTEMS PLANNING AND DEVELOPMENT

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Abstract

Generative metaphors have a capacity to underpin the discourses and methodologies associated with the planning and development of information systems. A number of systemic metaphors are described here. These range from traditional viable systems models to those that can accommodate a multiplicity of interests and relationships, encompassing mutuality and collectivity as well as domination and conflict. The role of such metaphors in framing information systems development and its relationship to human behaviors within organizations, in this case of healthcare, are explored using a case study. The paper speculates on how systemic metaphor may underpin integrated development in which the objective is to bring about technological and human change simultaneously.

Keywords: Generative systemic metaphor, healthcare, information systems, SISTeM, IS development, SSM

1 INTRODUCTION

This paper explores generative systemic metaphors and demonstrates their utility within the planning and development of information systems as part of the transformation or creation of new organizational processes and forms using the Soft Information Systems and Technologies Methodology (SISTeM). A number of systemic metaphors and their variations are identified; these include the

viable, the systems collective, and the mutual viable system. Systemic metaphors are also described where supportive, competing, or even dominating interests are present. How these may be used to frame the relationships between information systems and humans within organizations is explored. These explorations are based on the relationships between managers and clinicians within UK health-care organizations and the information systems they deploy in practice.

Donald Schön (1979) said of generative metaphors "the framing of problems often depends on the metaphors underlying the stories that generate problem setting and set the direction for problem solving." The framing capabilities of the generative systemic metaphor described here and how they are overtly and covertly deployed in human actors' discourses, methodologies, and actions are illustrated through a case study of a project within a UK National Health Service Community Care Trust. A discussion explores the potential future role of generative systemic metaphors in underpinning processes of integrated develop-ment within organizations encompassing information systems and technologies, business processes, and human behavior.

2   GENERATIVE SYSTEMIC METAPHOR

Six generative systemic (Atkinson 1984; Atkinson and Checkland 1988) metaphors are presented here. They are all founded on the basic concept of the system as a viable whole (Von Bertalanffy 1968) that persists over time. These systems consist of a number of domains: the value set or sets inscribed in it, the systems orchestration and learning capacities, its transformation and agency. The metaphors here are not content free, simply laying out their processes and the relationships between the various domains within the system. These systemic metaphors are based on the concept of the actor network (Callon 1986; Latour 1987; Latour 1991; Latour 1992). The autopoietic (Jones 1999; Maturana and Varela 1980) intertwining of human and machine actors, in particular computer-based information systems (IS), recursively (Jones 2002) constitute the system. Within the system there can be one or more interests present, the result of which is that, in particular metaphors, there may be a single or multiple orchestrating value sets and a multiplicity of transformational processes. These interest driven value sets are inscribed within the IS (Walsham 1997) and other artefacts. Information and knowledge are properties of the whole system, not repositories to be tapped into by any actor. They are manifestations both of the system's inscribed value set(s) and its functioning. Finally, the systemic metaphors are replete with exercises of power, related to the system's continued functionality and persistence and the relationships between the human and machine actors, their interests, and value sets. The thing that is common to these metaphors is that the systems all exhibit agency: they act in concert or in dissonance, under

differing social and technological conditions. However, they are only tropes; no claim is made for their ontological status. Considering each systemic human/machine metaphor in turn.

2.1 The Viable System

The fundamental systemic metaphor (Figure 1), is the viable whole system (Checkland 1981), one in which a single value (VS1) set is embedded. This orchestrates from the top-down the system's input-output transformation process. These inputs/outputs may be corporeal, behavioral, or symbolic. Subsystems make up the transformation. The value set pervades the behaviors of the system's actors:

Figure 1. Functional Viable System

human, IS, and any other technologies. Artefacts have the overarching value set and interests inscribed in them. The system acts. The system's functional power enables it to survive its turbulent environments, both inner and outer. Knowledge and information pervade every aspect of the system's functionally. The system is both viable and persistent.
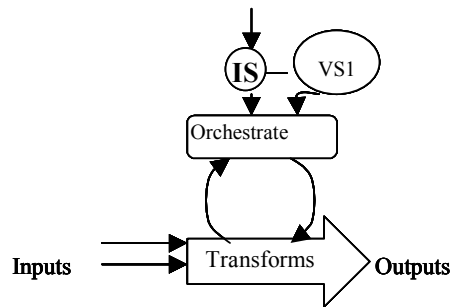
2.2 The Collective Viable System

Figure 2 provides an alternative conception of the viable system: the collective. Rather than top-down orchestration, multiple viable systems collectively orchestrate themselves from the bottom up. The functioning of the whole is based upon a collectivity's set of shared complimentary values (VSc). Within this metaphor, the system's transformation process is freely constituted out of a number of mutually supportive human/machine activity systems that are, unlike subsystems, themselves viable and autonomous. They have similar or differing but complimentary interests, identities, and value sets. Collectively, they share an IS capable of accommodating diversity yet inscribed with their emergent common value set (VSc). All throughout the system, access to information and IS is common. Power is that of the collective.

There are other versions of this metaphor. First is the one in which the value sets of the various constitutive systems overlap to some degree but are not wholly commensurate, so that there is a degree of mutuality and also competition or dissonance between them. Power, like information and knowledge in this metaphor, is both collective and also locally devolved

Another version of this generative metaphor is that of *a community of viable systems*. This is a diverse landscape of interacting systems,

Figure 2. Collective Viable System

where power and knowledge are captured locally and information is unevenly distributed across a systemic landscape that may or may not constitute an overarching system. They convene in the face of external threats but also compete to protect their own individual interests, viability, functioning, access to resources, and agency.
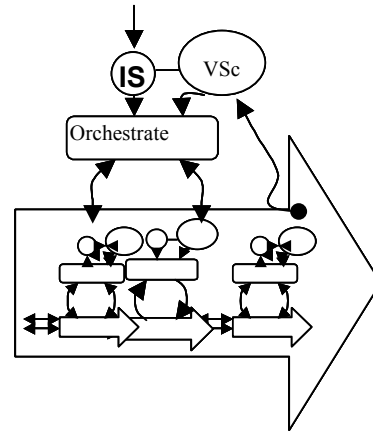
2.3 The Mutually Viable System

This next systemic metaphor has two (or more) differing and diverse values sets. Together they orchestrate top-down the systems for mutual benefit, drawing on a common IS and shared information and knowledge to do so. They have mutuality but also differences that they seek to ameliorate through sharing, orchestrating jointly the transformation process. They do this to achieve sustained functionality and viability and to get

Figure 3. A Mutually Viable System

what they want. There may be equality between the value systems, or there may not. There is a constant tension in the system. Power, knowledge, and information relate to the system's viability and the actors' capacity to function, in the face of internal and external contingencies.
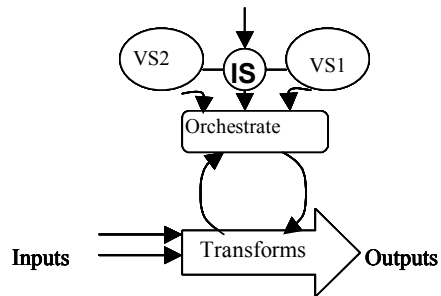
2.4 The Supportive System

A further variation (Figure 4) is the metaphor in which one actor's value set (or more) in the system supports or compliments the other and subordinates its own selfish interests for the sake of others, for altruistic reasons. It gives up its capacity freely to orchestrate the system to

Figure 4. A Supportive Persistent System

work primarily within the transformation and decisions-making processes to enable the other actor's value set to realize its interests. It embodies the concept of service. Power, as before, is functional, but it is also sacrificial, a capacity to give up ones power to the other for the sake of the collective good. Information and knowledge is passed from one to the other and shared in a mutually supportive process.
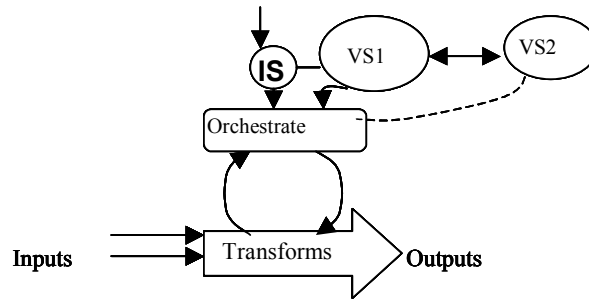
2.5 Dominating/Paternalistic System

In this systemic metaphor, one actor's value set is subsumed within and dominated by the other. The second value set is either absent from the orchestration of the transformation
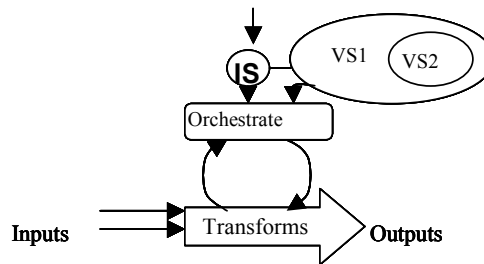
Figure 5. A Dominating/Paternalistic Persistent Viable System

process, it is subordinate to, or subsumed (see Figure 5) totally by the other or it is there in name only, a subject whose interests are appealed to but in fact are suborned by the other. Its presence within to the information system is either limited to supporting the other or taken away altogether. The whole persists by incorporation or repression throughout the system of one or more value sets by the other, functioning to the tune of the dominant value set, which justifies its position by disingenuously working on the other's behalf or just through naked ambition. Voluntary domination, as in consenting sadomasochism, is a variant, and important, form of this metaphor.

2.6 Conflictual Persistent Systems

Figure 6 presents a systemic metaphor in which there is open struggle, persistent competition, violence, even war between one or more parties' values sets. Both are dependent upon the transformation process, but individually they seek to orchestrate it for their benefit and main-

Figure 6. A Conflictual Persistent System

tain their own IS to do so. This struggle may take place within the orchestration process, the transformation process, or both. The actor's value sets in the system in their incessant struggle for domination may be equal or unequal in terms of their control of power, information, and resources as well as systems agency. "Conflictual autopoiesis" (Maturana and Varela 1980) is a potent metaphor.
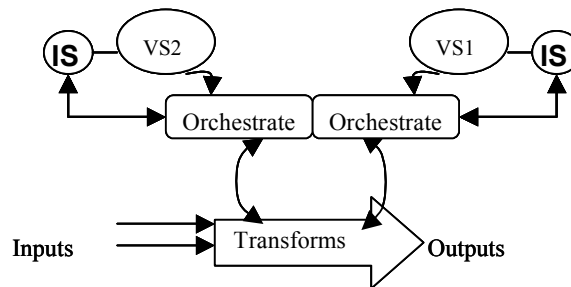
3   POWER, KNOWLEDGE, AND INFORMATION IN SYSTEMIC METAPHOR

In a similar manner to power, and intrinsically interlinked with it, knowledge and information within these metaphors are properties of the whole system, not resources or repositories to be drawn on when needed. Knowledge and power change as actors interact and their relationships come into being or change as a result of the incessant flux within the whole system's inner and outer environments. They are constituent qualities of both the functional capacity of the whole and its inner value arrangements. In dominating and paternalistic systems, they reinforce these conditions; where there is struggle, knowledge and information are stratified in line with the warring value systems. In situations of mutuality, empowerment and emancipation information and knowledge function within the system to reinforce these relationships.   The actor relationships within the system may enhance or detract from the functional power of the whole. As Introna (1997) points out, power, knowledge, and information are ubiquitously properties of the whole system. In the following section, examples of these systemic images and the forms of power, information, and knowledge within them are used as generative metaphors. Their role is to explore the range of possible relationships between the clinician within a healthcare organization and its managerial cadre and the nature of an information system this implies.

3.1 Systemic Metaphor in IS Planning and Development

Systemic metaphor may be deployed via the process of metaphorical transference (Lakoff and Johnson 1980), to support the planning and development of the information system within organizational contexts. They can be used singly or in combination to interpret situations, to challenge the inherent biases of existing worldviews within the process of problem setting (Schön 1979, 1983). Their use gives rise to differing images of all or parts of organizations, the relationships between people in organizations, what they do, and the role of associated IS. These metaphors (Schön 1983) may also be used normatively in modeling and any subsequent human/machine agency issuing from the processes of problem solving in response to the problems set.

To illustrate this metaphorical transference in using systemic metaphor as part of IS planning and development, consider circumstances within a healthcare organization. In a UK National Health Service (NHS) hospital, there is a strong demarcation between the doctors and the managerial cadre and, to a lesser extent, nurses and other clinical professions such as radiographers. These differences are professional, political, fiscal, cultural, and informational; they are based on strong competing worldviews and interests over patient care and resource use as well as differentials of power and authority. Generative systemic metaphor work to frame situations (Schön 1979, 1983) such as those found in healthcare. This framing may be illustrated by exploring the relationships between healthcare professionals and managers within a hospital in the delivery of care and its management and the nature of the information system this would give rise to. The patient role, for *illustrative purposes only* here, is seen as being passive. Consider each metaphor in turn.

The *viable system* would suggest that the interests of managers and clinicians are as one throughout a hospital which is orchestrated top-down and that managerial and clinical data should be available for all via an enterprise resource planning type IS at any time, any where.

In the *collective viable system*, the managers and the multiple clinical specialties or departments form a variety of individual viable systems that together make up the hospital. They collaborate well. A core hospital-wide information support system (HISS) with patient registration information, resources, usage, and performance target data is available to all. A locally developed electronic patient record is available in clinical departments but not linked to the HISS. Data is shared *ad hoc*.

With the *mutually viable system*, an alliance is formed between managers and clinicians for the benefit of the patient and the functioning of the whole hospital. Differences of interests are recognized, but everything is done to ameliorate these to provide excellent care and manage resources effectively.

The information system in this case is hospital-wide. It contains both patient and clinical data in the form of an electronic patient record, from which performance and resource usage information for management and planning purposes is captured all through a single HISS.

The *supportive persistent system* would imply that the managers are wholly sympathetic to the clinician's role. It is they who deliver care, therefore they should make the decisions about clinical services and how the hospital is orchestrated and performs. Managers are there as enablers and facilitators rather than top-down controllers doing the government's business. Their role is to provide a hospital infrastructure and resources in which clinicians can practice and manage for themselves. The clinicians own the IS. They provide the mangers with information sufficient to deliver an organizational infrastructure conducive to their practice.

The *dominating/paternalistic persistent system* metaphor emphasizes control by the managers of the clinicians (it could be the opposite). The managers' directly seek to intervene in the clinician's individual practices via not only performance indicators but also the introduction of prescribed, costed care plans and clinical protocols for specified diagnoses. Managers use clinician's instrumentally in order to provide a clinically conservative standard of care on behalf of the Department of Health (DoH). The managers' interests are inscribed in the operational IS in which the clinical protocols reside and an MIS that sits on top with which they can monitor clinical performance.

In the *conflictual persistent systems* metaphor, the clinical cadre and the managers are at loggerheads. There is mutual distrust between them and a constant war of attrition is being waged across the hospital. It pervades clinical care manifesting itself in managers' attempts to control clinicians' resource usage and also the way they carry out their duties, monitoring clinical performance. Conversely, clinicians will seek to inhibit or undermine any attempts by managers to undertake new initiatives ordered by the government and the DoH, unless it is in their interests. An intention by the manager to introduced information systems that will monitor clinician's activity, their use of resources and clinical outcomes is being vigorously resisted. Clinicians instead are building their own stand-alone patient information systems or sticking to paper clinical notes, which they constantly fail to return to the repository, return late or incomplete. Any clinician that gets involved in a managerial initiative to introduce the new information system is immediately branded a traitor and ostracized by their colleagues. The IS have the interests of each of the differing groups inscribed in them.

Metaphorical combinations and alternatives may also be used in the framing process. For example, the collective whole system may be used to explore the manner in which individual clinical departments form a hospital, as shown

above. However, the units themselves may also be explored using either the mutually supportive or conflictual metaphors.

The implications of using these differing metaphors for how healthcare IS are conceived, planned for, and developed would have to be considered in detail within the development or procurement of any application and its subsequent implementation. The use made of combinations of generative systemic metaphor in IS and organizational development within a healthcare setting are explored below. The next section provides a healthcare case study involving information systems and organizational development in which the use in of these generative systemic metaphors in problem setting and solving is explored.

3.2 A Case Study Using Generative Systemic Metaphor

A brief case study of an IS and organizational development project (Atkinson and Dunlop 1998) within healthcare illustrates the use of generative metaphor. It will highlight, first, how systemic metaphors, *denoted in italics*, are deployed spontaneously in the discourses of diverse participants as they make sense of their situation, including the author's own perceptions, as part of processes of problem setting. Second, it will narrate how these metaphors are used more overtly in problem solving, modeling, and decision making.

This case recounts the work undertaken by the author within a UK Community Services NHS Trust (WBCT) in the south of England. Using the *viable system* metaphor in the problem setting, the chief executive officer (CEO) and staff in the Trust identified that they had an old information system with limited clinical care capabilities and poor management reporting functioning, except for standard reports for the DoH on workload and patient contacts. Nurses and other clinicians spent significant time entering data that was of little or no direct use to their clinical practices and WBCT's overall functioning. In addition, any internal management reports had to be extracted from the data provided by the system via locally custom-built tools. The system was incapable of supporting the professional delivering clinical patient centered care or linking to other healthcare organizations. It worked directly against the Trust's functional effectiveness and viability. The incumbent CEO set out to specify, procure, and introduce a new clinically focused information system.

The Trust was going through considerable organizational and environmental change. The new IS was to be an important component of the reconfiguration of the services delivered by the Trust. A second component was the restructuring of community clinical services. This initiative was driven by the need, as the CEO saw it, to preserve the Trust's *viability* in the face of the then new Labour government's White Paper, "The New NHS Modern, Dependable" (DoH

1997), in which services in the community were to be primary care and general practitioner (GP) led. The CEO metaphorically conceived of the Trust as a *viable system* whose persistence he sought to secure. For him it existed within a wider *community of viable systems,* made up of other care services*,* some of which were hostile to the Trust's long-term viability. This landscape consisted of the newly emergent primary care groups (PCG) and primary care trusts (PCT) that had come into being as a result of government legislation (DoH 1997; Executive 1998).   He problematized that it was these groups that were threatening the Trust's viability by usurping its functionality. Providing clinical and IS services to them, the CEO envisaged, was the way to maintain the Trust's survival within that community of services providers.   There were also the patients and their care givers, local hospitals, tertiary hospitals, general practitioners, the Social Services, and other unitary authority services such as Housing. The Ambulance Services Trust, NHS Regions, the DoH, and many other bodies were also part of the context. All of these shareholders as actors had, in the shape of their spokespersons and representatives, to be in ANT terms (Callon 1986; Latour 1991) *translated* into the project's *viabl*e *problem addressing* actor network. They would become co-opted members of the Project Board set up by the CEO to address his problematization. Influential managers and clinical practitioners from within the Trust also had to be translated onto the Board. This was to ensure all of their interests were represented and aligned to keep them on board. In turn, they spoke on behalf of their own professional constituencies. The author acted as a consultant advisor. The Trust IS manger and a project manager were also translated. The Soft Information Systems and Technologies Methodology (SISTeM) (Atkinson 2000) was translated into the network to facilitate the work. A number of project teams made up of clinical professional managers and practitioners and local GPs, IS staff, and the author as facilitator were also set up within the network to do the work. Participants perceived the project actor network itself as a fragile *viable system* functioning within a wider collective landscape of, sometimes, hostile *viable systems*. The focus of the project was to specify and procure the community information system (CIS) within a restructured Trust and new services provision model. What the latter would look like was not fully worked out. As a necessary condition of the CIS procurement, this matter had to be explored within the project teams. The major issues they identified were:

• Government's forthcoming information strategies and NHS plans
• Initiation of primary care groups and later trusts
• Improving communications across the geographically spread Trust
• Clinical governance
• Technical quality and professionalism of services

- Search for efficiency
- Overall health of the Trust's catchment population
- Responsiveness of the service to the individual through patient focused care

The CEO and Board conceived of the Trust as a *functional viable system.* However, within it, discrete vertical *functional* departments offered specific professional services to each patient in the community. Examples of these were district nursing, occupational therapy, physiotherapy, and child health. In treating a patient, the departments presented as *subsystems* that would individually provide separate, not very well orchestrated, care. Through discussions in the Board, these arrangements were recognized as being inflexible and insufficiently responsive in meeting local and individual patient need. A CIS based on this metaphor would have discrete profession records only. They had to be reconfigured. The future overall structure of the Community Services Trust explored by the project teams used the metaphor of *community of viable systems.* Instead of discrete top-down professional departments there were to be locality services provided by semiautonomous multi-professional teams. These would be supported by Trust central *functional* services such as personnel, finances, quality standards, logistics, executive management, and information. The current relations between the Trust's services and GPs, while not perceived as an openly *conflictual system*, were not wholly harmonious. It was recognized by the project team members that a more *mutual viable system* of care delivered by the GPs together with the multi-professional community teams, focused on the patient in a locality, was needed. The new patient-focused CIS would have to first and foremost support devolved locality services in providing care to the patient, then the rest of the organization, linking to the GPs and eventually to other services. The question therefore was, what forms would a locality team take working with GPs and hospitals in providing care and the CIS actor supporting them?

The project teams explored three different forms of community care using two generative metaphors. First was the *viable (top-down) system*. Its use implied that there would be either a local patient care manager or the GP who would orchestrate in detail the care of each patient provided by what they deemed as appropriate professions in response to need. In this instance, there would be a single CIS electronic patient record (EPR) owned by the case manager, which the other professions could access and contribute too. Second, again using the *viable (top-down) systems* metaphor, the professional whose care was most prevalent would act as a local care manager orchestrating a patient's care. Here the primary profession would have responsibility for the patient's EPR to which others would contribute. Third was that professions would work as a self-orchestrating *mutual system* to offer care packages and link with general practices and other services on a needs basis. In this case, there would

be a general CIS EPR for the patient that all relevant professionals could access. This would also act as the domain of communication and coordination of patient care between them. In addition there would be a more detailed, specific profession patient record for each care profession involved with a patient. The CIS would be a powerful care and coordinating actor. All options were considered in detail by the project's teams and the latter model, based on the *mutual systems* metaphors (see Figure 2) was agreed upon and ratified by the Board.

Several root definitions (see Exhibit 1) based on the *mutual systems* metaphor were created by the multi-professional project teams using the SISTeM (Atkinson 1997, 2000) approach. Expressive models (see, for example, Figure 7) were constructed from these. Expressive models are so called because the participants, rather than an analyst or a consultant, create them to further their own discussions. Figure 7 emphasizes the way in which the CIS information system machine activities combine with the human clinical professional activities to form the human/machine mutual Stroke Care activity system. The care transformation process is constituted out of the self-orchestrated activities of clinical professionals with mutually complimentary values working first in the hospital and then in the patient's home. The CIS is a powerful orchestrating actor containing a general (**g**) and specific (**s**) profession patient record that has all the profession's value sets inscribed in it.

Having arrived at a number of expressive models picturing the manner in which the team would wish to deliver services in the future, the information the CIS, component of each activity in the model was delineated, again by the participants. Exhibit 1 provides an extract. These were subsequently aggregated to draw up a procurement specification.

Exhibit 1. Root Definition

A human/machine mutual viable activity system caring for stroke patients, owned by WBCT, undertaken and self-orchestrated by the appropriate community clinicians, the GP and other agencies and the CIS, with other clinical technologies, initially within hospital and then domiciliary settings.
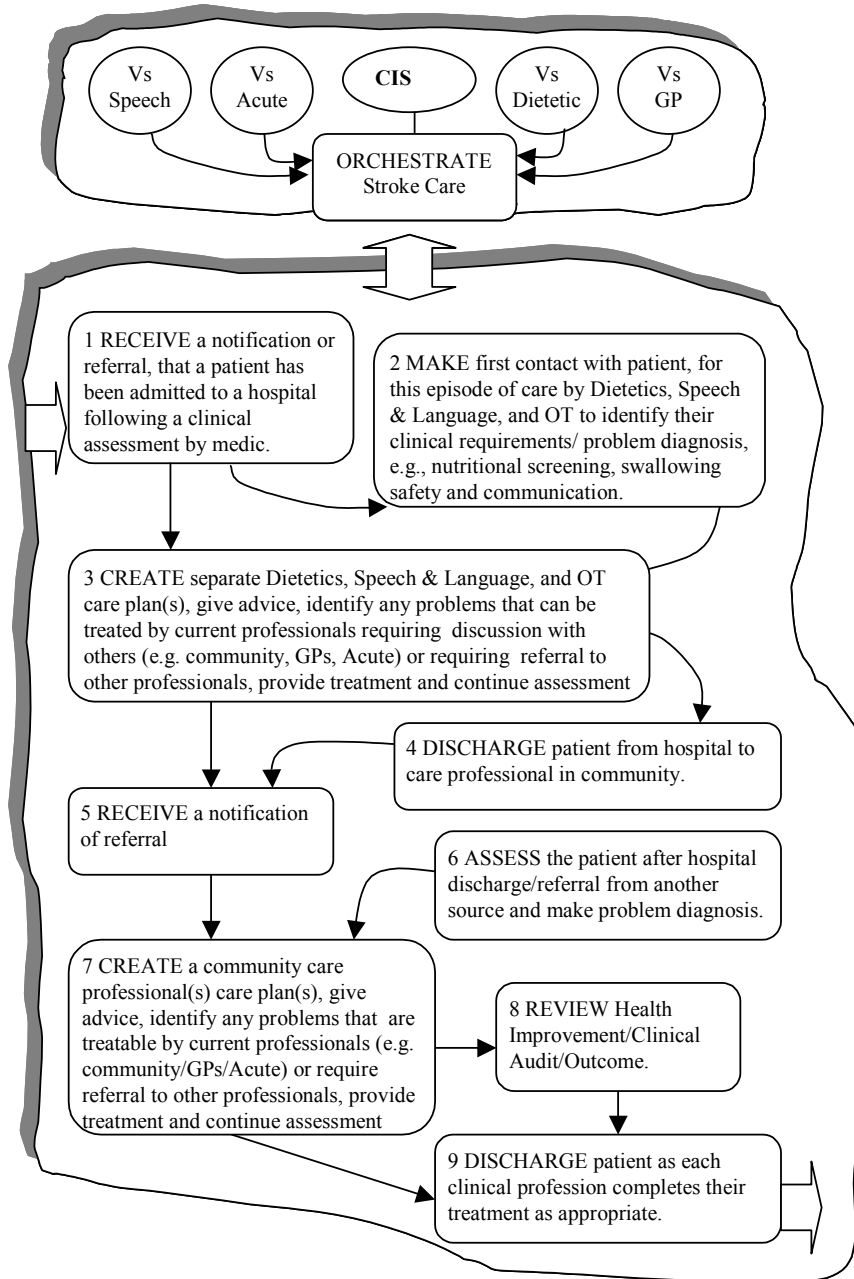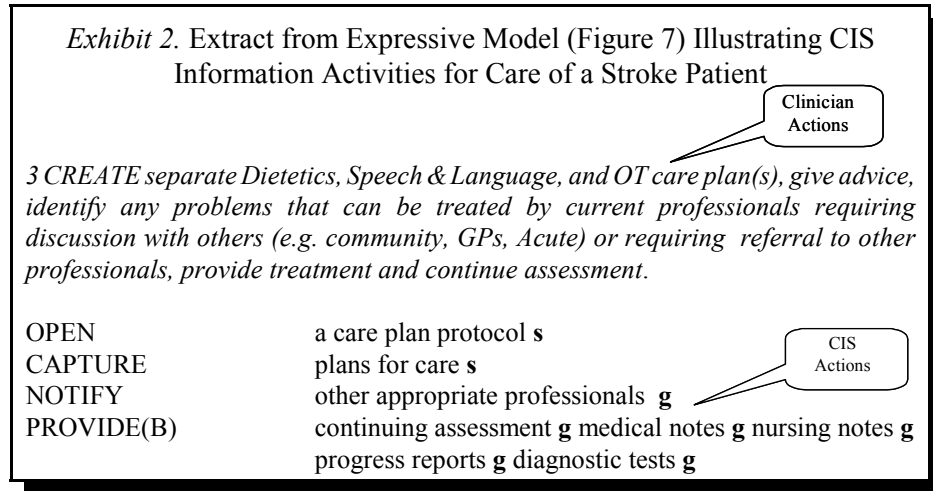
Figure 7. Stroke Care Expressive Model

Exhibit 2. Extract from Expressive Model (Figure 7) Illustrating CIS
Information Activities for Care of a Stroke Patient

Clinician
Actions

*3 CREATE separate Dietetics, Speech & Language, and OT care plan(s), give advice,
identify any problems that can be treated by current professionals requiring
discussion with others (e.g. community, GPs, Acute) or requiring referral to other
professionals, provide treatment and continue assessment.*

OPEN	a care plan protocol **s**
CAPTURE	plans for care **s**
NOTIFY	other appropriate professionals **g**
PROVIDE(B)	continuing assessment **g** medical notes **g** nursing notes **g**
	progress reports **g** diagnostic tests **g**

CIS
Actions

The team members and the clinical and IT professionals created a number
of these expressive models based on the *mutual viable system* exploring new
forms of multi-professional care and working practices, for example in Child-
care, and the role of the CIS within them. The systemic metaphor highlighted the
need for learning in the form of clinical audit and governance by each profession
and the locality teams as a whole. The CIS was to have a major role in collecting
and analyzing patient care delivery and outcomes data in supporting this.

The information component within these models was compiled to form the
CIS specification to underpin the procurement process. In addition to the
detailed work on clinical processes, use was made of other generative metaphors
to fully scope the CIS and its future role in the Trust. While the prospective
locality team clinicians viewed the Trust as professionally *mutual viable systems*
that convene to provide care, the CEO and senior managers envisioned the
whole Community Trust as a *viable system* (see Figure 1). It was one that had
to function effectively with good relationships between clinicians and managers,
the latter in support of the former. The CEO sought this through the involvement
of managers and clinical staff on the project board and teams. Managers, many
of whom had been clinical practitioners, nevertheless had to ensure that
externally set health improvement targets for their patient population were met,
delivery against service level agreements set by the PCGs and the Housing
Authority was achieved, and clinical governance implemented to continuously
improve standards of care, all within budget. In addition to supporting these
clinical front-line organizational functions the CIS also had to support central
administrative functions of the Trust such as personnel, finance and executive
and strategic management and link to their information systems. The interests

of senior managements also had to be inscribed within the CIS, as did the interests of clinicians. If the CIS was to be successful and adopted by all parties, their interests had to be inscribed within the functionality of the technology. The multiple systemic metaphors, brought out differing worldviews, as captured in the Trust's CIS use case (Figure 8).
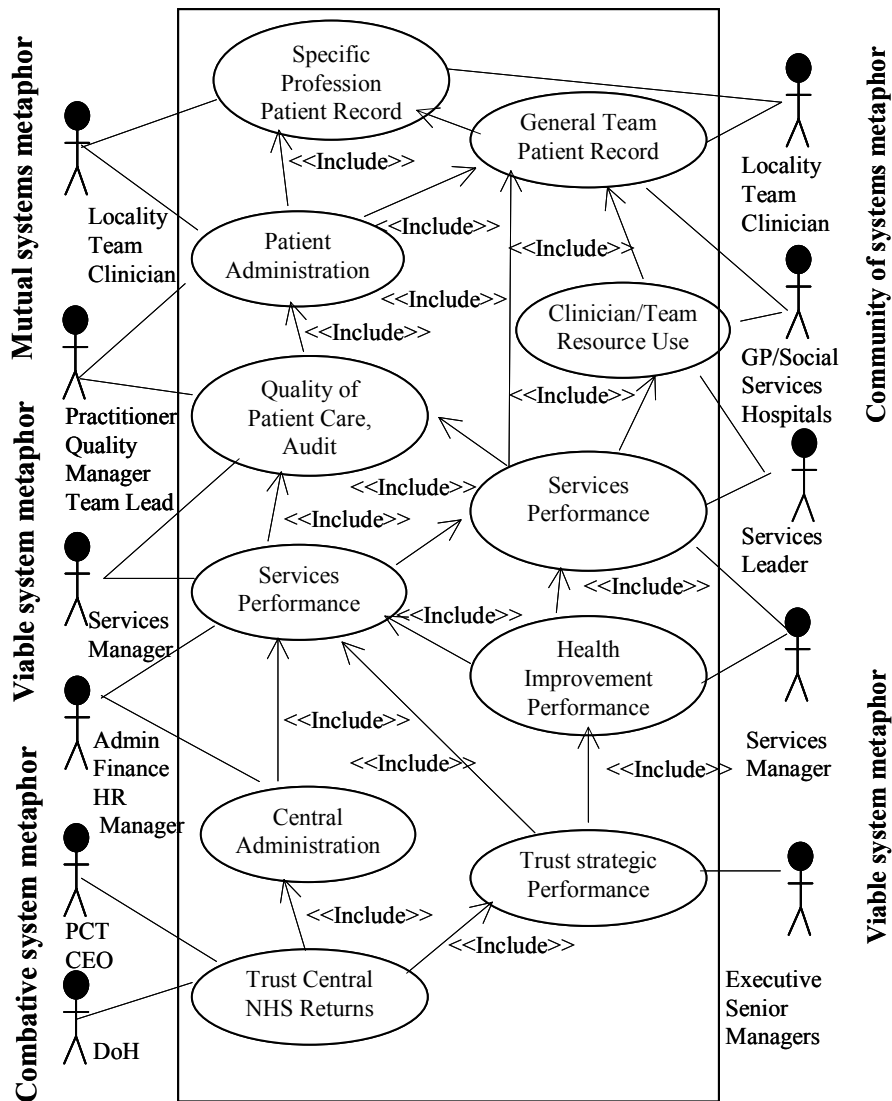

Figure 8. CIS Use Case and Underpinning Metaphor

The Project Board, through the *mutual and community systems* metaphors, identified that the Trust and CIS, if it were to be effective in the future delivery of care, had to link to the wider *systemic community* of care providers. These were the social services, PCGs, and local and tertiary hospitals. The CIS would have to support this by linking to the information technologies within this wider care community's information systems. These links were to be built in the procurement specification.

Finally the CEO, speaking through the *combative systems metaphor* in his discussions with the Board as to the project's underlying rationale considered that the Trust's very existence as a *viable system* was being threatened by the DoH and the emergence of the local *community* of *viable* primary care groups and trusts, themselves made up of a *community* of general practices providing primary care services. These PCGs had, he saw, the potential in the near future to provide locally their own community patient care and information services. The CEO felt that in introducing devolved multi-professional locality community services plus central services, payroll, HR, nursing quality, and the new CIS Information Services would ward off the PCGs' predatory and dominating advances toward his WBCT.

Unfortunately, this was to no avail. The WBCT ceased to be a *viable system* when the PCGs decided to deploy their community services budgets for themselves. The battle was lost due to what the project members saw as the *dominating* power of the DoH. One of the PCGs, itself to become a NHS Primary Care Trust in league with the DoH and Health Authority had negotiated with the community of other PCGs to take over and deliver the primary and community care information services and the CIS. The project team, driven by the clinicians involved nevertheless lived on as a *viable system* under the aegis of the emergent Primary Care Trust. Procurement of the CIS is now down to a final preferred supplier. The project team and supplier are developing the CIS application. The project team's clinical members have been active leading the selection and procurement process of the CIS where in the past this would have been solely the role of IS professionals and senior managers.

This case study has sought to demonstrate how generative systemic metaphors have been important and ubiquitous features in the IS planning and development in the discourses of all of the actors throughout the project. Overtly, as part of problem solving, within SISTeM modeling (see Figure 7); covertly, in the discourses of the Project Board and teams while problem-setting, exploring current issues, the future shape, and the very existence of the community care trust and its prospective links to other health and social services. How the metaphors mapped onto the CIS functionality and who uses it is captured in the use case (Figure 8).

3.3 Systemic Metaphor in IS and Integrated Development

Systemic human/machine metaphors, as shown above, have a role within in the processes of IS development, as part of problem setting or problem solving or both. At a general level, however, the concept of the human/machine present in all of these metaphors moves away from the dualism found in much of IS development where, on the one hand, there is the technology and, on the other, the organization. The latter made up of capricious human beings, techno-centrically termed *users*. (This dualism is mirrored in soft approaches. In them, technologies are adjuncts to human interpretation and agency; as in the Checkland and Holwell [1997] POMS model.) The metaphors here, drawing epistemologically on ANT, contain a duality of person and artefact. Together they collectively constitute "humanchine" networks. Organizations using these metaphors are viewed as ecologies of actor networks. When deployed in real world settings, they frame it through this duality. This is exemplified by the case study where the focus was on developing new forms of clinical or managerial practices constituted out of a duality of the agency of professionals and the CIS as well as other clinical artefacts such as drugs and protocols. When used, these metaphors underpin processes, of what may be termed, *integrated development* (Atkinson 2000, 2002b).

In practice, these metaphors are used in Cycles 1 and 2 of the SISTeM methodology (Atkinson 1997, 2000). The first cycle aims, as in the case study, to support stakeholders making decisions on what to do about the problems they have identified. The metaphors here are used to frame problems in real-world situations captured within rich pictures. In the past, within SSM Atkinson and Checkland 1988), this was often through the viable systems model where functional failures were highlighted. In SISTeM this too is possible, but all of the other metaphors are also available. Many of them highlight complex competing and complementary values and relationships of power between multiple interests and groups in a situation that may impact on the technological as well as the human dimensions when problem setting. Within the modeling of this cycle, conceptual and expressive models based on various metaphors may be used to enrich the debate between stakeholders on what to do about the situation expressed. In the debate, they raise issues not just of IS or business processes functioning but also current and future social, cultural, and power relationships. These can range from the relationships between sales and production in dealing with customer complaints to a women with breast cancer who wishes to wrest control from the clinicians and managers to make her own decision on her body, her future, and her care (Atkinson 2002b).

Cycle 2 focuses on operational decision making and realizing the change to address the original problem situation. If the decision is positive, systemic models of organizational changes depicting the integration of human and techno-
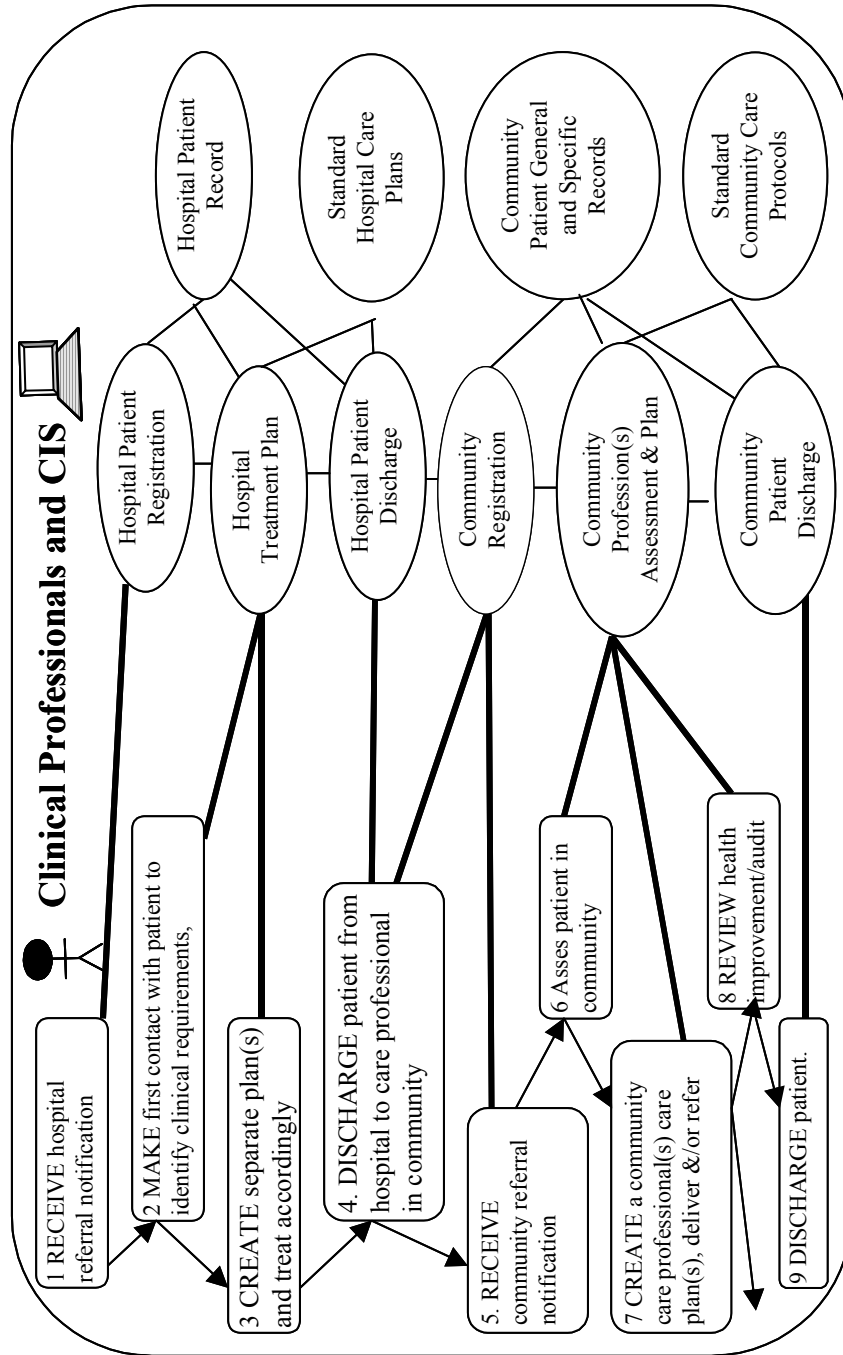
Figure 9. Integrated Development Case–Stroke Patient

logical behavior are formed. These have the same form as those shown in Figure 7 and Exhibit 1, although in much more detail. Based on these other models (such as the Integrated Development Case presented in Figure 9) are formed from which to migrate into other disciplines. In these models, use cases are joined with processes of human behavior based on soft systems models (Atkinson 2000). From these objects and object classes with their collaborations and services are identified along with the extended information component of the expressive model in Exhibit 1. UML (Bennett et al. 2001) interaction and sequence diagrams, along with dialogue boxes and screen design may also be created. In addition, business process modeling and simulation, human skills and competencies development, cultural change and the murky arts of politics and shifting power relationships may be delineated (Atkinson 2002b). As with IS, extensions of the original systemic models may be formed to migrate into these disciplines. These support the changes to existing, or the introduction of new, human and machine behaviors necessary to address the problem originally set, which leads to a new problem situation to be addressed, all underpinned by systemic metaphor.

The metaphors in this approach provide multidimensional transdisciplinary images (Judge 1991) for integrated development. It is not just the metaphors that are unitary, functional, and viable that predominate. Those metaphors expressing complex, diverse, or conflicting social interests, which through inscription the IS has to accommodate, have potency within the problem setting in SISTeM Cycle 1 and solving in Cycle 2 (for examples, see Atkinson 2002a). The systemic metaphors provide variegated patterns of humanchine relationships and agency that constitute future actor networks, which in turn make up the future organization. They resemble Alexander's (1977) proto patterns within building architecture, although here the focus is on an organizational architecture, resulting in the integrated development of humans and machines.

4   CONCLUSION

For Schön (1979), a generative metaphor "derives its normative force from certain purposes and values, certain normative images, which have long been a power in our culture." The various generative systemic metaphors identified here present powerful images from wholeness and viability to community and mutuality, support and sacrifice to paternalism and domination, dissonance and conflict, growth and dissolution, as well as encompassing the associated humanchine agency. They offer individually and in combination a lexicon with which to underpin discourses among problem solvers that go beyond that normally found within the practice of information systems development with its focus on functionality. They encompass the multifarious nature of the

organizational and human domains with all their Shakespearian complexities with which functional computer-based information systems interact and in turn form a constituent part. These metaphors offer the capacity to create frame conflicts, different ways of seeing, that have a demonstrable ability to frame discourses, create images, stories, and perspectives among problem solvers and developers resulting in new forms of humanchine agency. In turn, this leads to new images of information systems as part of organizational solutions that address the complexities of these problem situations. They seek to achieve this not by distancing IS development from organizational change or by being flexible enough to accommodate its vicarious changes, but by encompassing it within a praxeology of integrated humanchine development founded upon an organizational architecture of the actor network ecology.

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