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Christopher Atkinson
Brunel University

Laurence Brooks
Brunel University

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Chris Atkinson
Brunel University
Christopher.Atkinson@Brunel.ac.uk

Laurence Brooks
Brunel University
Laurence.Brooks@Brunel.ac.uk

Abstract

This paper seeks to provide an under-pinning theoretical framework for, not only understanding how humanchines (the duality of human and machine artefacts, or the humanchine actor) and their networks come into being, persist and change, but for envisioning and developing them. This will be accomplished by exploring the idea of integrating structuration theory (ST) and actor network theory (ANT). The result is a hybrid theory with which to understand and ultimately underpin research and interventions in the world that encompasses humanchine change (integrations of human and technology) within organisational network ecologies. This hybrid framework is given the working title of the hybrid neologism 'StructurANTion'.

Keywords: Actor Network Theory, Structuration Theory, StructurANTion framework

Introduction

The American gun lobby justifies the right of the individual in the USA to posses a firearm by saying, 'that it is not guns that kill people, but people that kill people'. Those who oppose them, and wish to ban personal firearms argue it is 'guns that kill people'. Bruno Latour's (Latour 1999) response to both these positions is that it is 'people *and* guns that kill people.' In medicine, it is not only the clinicians, the doctors, nurses and related professions that diagnose and treat a patient, but the clinicians and a wide variety of medical technologies, including an electronic patient record, protocols, drugs, instruments, beds and, on occasions, a clinical decision support system. This duality of the human and machine artifacts, this hu*manchine* actor, is a ubiquitous feature of the modern world. They act purposefully, convening together to form networks and through their integrated and intentional agency provide goods, services, dispense law and even prosecute war. Multiplicities, ecologies, of these hu*manchine* networks constitute organisations and networks of these networks (Latour 1993) constitute societies. As Latour (1999) says 'Purposeful action and intentionality may not be properties of objects, but they are also not properties of humans either. They are properties of institutions [collectives of humans and non-humans], apparatuses, or what Foucault called dispositifs.'

This paper seeks to provide an under-pinning theoretical framework for, not only understanding how such hu*manchine*s and their networks come into being, persist and change, but for envisioning and developing them. This, we will argue and demonstrate, entails modifying and melding two existing theoretical perspectives together: namely actor-network theory (ANT) (Callon 1986; Callon 1991; Latour 1987; Latour 1991) and structuration theory (ST) (Giddens 1984a, 1984b). We employ actor-network theory to posit the notion of the networked hu*manchine* duality and to provide a translational account of how, in response to problems, such networks come into being and are subsequently changed by events. We use structuration theory as a point of departure to explain how, over time and space, hu*manchine* networks persist and recursively self reproduce, exhibiting both a duality of structure and agency. The former provides a framework encompassing the diachronic dimension of the networked duality, the latter the synchronic, though it is not quite as clear-cut as this.

This approach of using two theories and modifying/melding them together in the face of observed phenomena is something that is not often found within the information systems (IS) paradigm. Although IS deploys many theories from other disciplines (Checkland and Holwell 1997) to underpin research and practice, the usual approach, particularly to interpretive studies (Walsham 2002) is to adopt a framework and deploy it as given, *sui generis*. Researchers use these frameworks, often in organisational

settings, as a means of facilitating an analysis of the data captured in a study that involves computer based information systems (CBIS). Using an established theoretical framework not only facilitates analytic rigor, it also confers legitimacy on the study – though this will not be without argument from the framework's detractors. Given that this is the norm, within the IS community, why should we seek such a risky strategy of mutating underpinning frameworks from other disciplines; particularly as we are neither philosophers nor sociologists? We do it because of what we see as the failure of CBIS design and development practices to encompass the ubiquitous duality of the hu*manchine* and its concerted agency.

The focus of Information Systems (IS) practice and research is, we contend, the design, implementation and adoption of CBIS by humans and the effective deployment of its information within organisational settings. Its holy grail is the search (Lycett and Paul 1999; Paul 1994) for an IS design and development approach that produces applications and technologies capable of rapid self adaption to ever changing organisational settings. Such organisational settings however always exist outside the IS bailiwick. Much IS research, particularly that based on interpretivism, focuses on how humans are or are not persuaded to adopt the CBIS, extract the information from the data it provides and subsequently deploy it effectively or not. None of these approaches focuses on the agency of the human and the artefact as a duality, in the manner conceived of by Latour. A machine and human dualism, we would argue, exists at the heart of the IS practice and research. In it the technology, the CBIS, is the core fixation of its practitioners, around which all else acts as it's 'other' (Paul 1994). The IS discipline's term for human beings as the CBIS 'user' reflects this technocentric relationship. Conversely, for those who take a humanist view of the organisation, such as soft systems (Checkland et al. 1997), technologies are the 'handmaidens' of human intentionality. For each perspective the human or the machine is its ontological 'other', i.e. the piece of 'kit' or the 'user'. It is a dualism that is at odds with the networks of the hu*manchine* duality that abound in the world and which we, and a few others (Lyytinen 2002), would argue ought to be the locus of organisational interventions. Further, the integrated emergent agency of both CBIS information (and any other) technology and humans is the focus for our inquiry and development (Latour 1999). Our interest here is not primarily on how the human and machine meld together; they may be in states of perfect harmony or in conflict. For now, though, to elucidate our approach, we will consider the relationship to be one essentially of mutuality. It is what they 'do' together as a duality, what results from this and how they change together that is our primary concern. It should also be stated that the concept of a duality implies only a relational state not a numerical one. There may be only two actors or a thousand in any real-world network. We will argue that only a melding of the two theories of persistence and change, centred ontologically on the hu*manchine* actor, provides a framework for appreciating the duality of the person and the computer based information system, its real world agency and manifestations: For the brevity required of a conference paper, we will assume that the reader is familiar with the basic tenants and terms of both actor network theory (ANT) and structuration theory (ST) and therefore proceed to explore the structured humanchine actor-network. For those who do wish to explore and better understand the underlying ideas behind each of these theories from the IS tradition, the reader is directed towards Jones (1999) and Walsham and Han (1991) for ST and towards Walsham (1997) for ANT.

Structuration and ANT: The Structured Humanchine Actor-Network

A twinning of the theoretical ontologies of actor network theory (ANT) and structuration theory (ST) enables an argument to be made that structures exist not only within people's heads but are also sedimented within an artefact's functionality. These 'structures' underpin the rules of behaviour that both humans and artefacts draw on for their combined agency as a duality. An amalgamation of humans and artefacts constitute the 'humanchine' actor. To perpetrate its agency these humanchine actors draw upon rules of behaviour embedded within their structures. In doing so, they both recreate and/or change those structures; by what intrajection 'mechanisms' this occurs we will leave to later in our explorations.

It can be argued that a 'structured order', a commensurate and mutually reinforcing set of states in the actor-network's structures of domination, legitimation and signification (+ *emancipation, see below for an explanation of this*) will exist at a particular point in time. These will be internalised by the network's actors, underpinning the humanchine agency within a network. This will, in turn, recursively recreate that structured order. Therefore, a common structured order is present within the mind of the human and sedimented within the functionality of the machine artefact of any humanchine duality.

The current role of IS practice, from the perspective of the humanchine duality being explored here, focuses on:

- Designing and developing a CBIS with an existent or anticipated structured order inscribed within its effective functionality and informational content.
- Ensuring that the informational component of the humanchine network and its agency has the current or anticipated structured order inscribed within it.

- Bringing into being (implementing) the informational component within the CBIS technology of a humanchine network with the current or anticipated structured order underpinning its functional behaviours.
- Ensuring humans have a capacity to use the CBIS, as a necessary informational component of humanchine agency and interactions. Note, achieving the internalisation of a structured order within humans is outside the remit and/or tradition of current IS practice.
- Modifying the CBIS and its use as a new structured order emerges. Facilitating the mutability of the artefact (and the human with respect *only* to the use of the latest version of the CBIS application and its information). This manifests itself as CBIS maintenance or the latest software release and the training of people in its use.

Therefore, understanding how the above has successfully or unsuccessfully achieved in real world practice is the focus of IS research. Processes that inculcate the structured order 'X' or changing it within humans are however outside the scope of IS practice, eg. ERP and CRM implementations purport to have structurating capabilities but often fail due to lack of a language and/or praxicollogy encompassing the humanchine, (see Lyytinen 2002). Humans, by effectively deploying the CBIS, reinforce the existing structured order 'X' of the humanchine network. CBIS consolidates a network's structured order if its structured order is commensurate with that of the humans. Technologies, as Latour points out, are society made durable but not immutable. If they are incommensurate it leads to disruption of the humanchine network and/or the rejection of the CBIS. On other hand, as Orlikowski (2000) cogently points out, there is often a melding together of the human and the CBIS over time and an emergent agency ensues. Out of this is reinforced the existing structured order or a new one emerges. A 'persistent structured order' is one that is recursively constituted out of a multiplicity of humanchine actors' agency and interactions within the network over a period of time. Structurated orders do though change, both incrementally or dramatically.

Structurated orders (Giddens 1984b), change incrementally within a network because of a range of factors. These include, the multiplicity of changes that constantly occur in the patterns of the network' actors' agency and interactions. The reflexive monitoring of the humanchine actor of its own agency and that of others also induces incremental change, resulting in an accumulation of the unintended consequences of such agency across the network. However structurated orders also, we would argue, change dramatically. Politics, revolution, competition, the exploitation of cultural differences, war or even business processes reengineering, are attempts to surface an existing structured order and change it. They address, overtly, the 'problematisation' raised by a focal 'humanchine' actor, through the creation of a new humanchine network and its accompanying structured order.

Structurated orders may change overtly and sometimes dramatically by:

1. contradiction and conflict between groups or individual humanchines *within* a network (Walsham 2002);
2. competition between groups or individual humanchines *within* a network (Walsham 2002);
3. conflict *between* humanchine networks;
4. rejection of an existing structured order by humanchines within a network;
5. rebellion *against* a structured order and /or subversion of it by individuals or groups of a network's humanchines
6. a network seeking to translate another actor or network into itself;
7. individuals or groups of humanchines overtly seeking to *impose* by what ever means a different structured order on their or another network;
8. humanchine actors within a network, individually or collectively, engaging in crime that will subvert the existing structured order and its associated agency, only to replace it with one of *criminality*
9. a humanchine seeking to eliminate a threat by another humanchine or network to their identity or longevity.

Changing a structured order entails drawing, sometimes overtly, sometimes covertly, upon the rules of conduct embedded within what we identify as an 'emancipatory' structure. The term 'emancipation' here refers to achieving 'freedom from', overturning the existing conditions of domination, signification and legitimization, of a particular structured order. It does not necessarily entail (as in 1-9 above) a search for the 'good', a network free of domination. It may motivated be by greed or power. 'Freedom' is a transitory state, as capable of being followed by lawlessness or an even more oppressive structured order, as by a 'good' liberating network. Emancipation is a fleeting moment between an existing and a new emergent structured order. Emancipation is, nevertheless, always present in its absence within all humanchine agency and networks. Emancipation is like a 'latent' gene, it needs certain conditions of contradiction and conflict within the network and the agency of its actors to 'switch' on. Otherwise, it exists only overtly as a potentiality within any structured order. The conditions that switch it on, we suggest are those of 1-9 above.

Drawing on ANT and its focus on overt and sometimes dramatic change we can explore the dynamic of humanchine transformation. A 'focal actor' initiates the creation of a new actor-network by the 'problematisation' of an existing structured order and deconstructing the associated rules of behaviour manifest within an existent humanchine network or ecology of networks and the agency exhibited by it actors. (Note the focal actor may be an individual or a whole network of 'humanchines'). In term of the ANT moments of translation:

- *Problematisations* entail a focal humanchine actor in the deliberate act of surfacing, deconstructing and subverting a particular persistent structured order made manifest in the agency and interactions of actors within existent networks.

- Alternatively, they can use direct reflection and challenge the existing dominatory, legitematory and significatory structures by surfacing them. Habermas' 'ideal speech situation' or the post-modern creation of a new 'genre' are both examples of this process of collective reflection on the structured conditions of action and their deconstruction.

- The focal actor humanchine agency that drives this 'problematisation' draws upon an emancipatory dimension present within the structures all humanchine networks have and thereby recreates it.

- The moments of translation enacted by the focal actor in forming the new humanchine actor-network, also draw upon the emancipatory structural dimension and its rules of conduct to underpin the agency necessary to (re) construction of the new network.

- Passing through the ANT moments of translation: *problematisation*, *intéressemment*, *enrolmen*t and *mobilization* (re)constructs a persistent structured order of those humanchine actors and their agency, deemed by the focal actor, necessary to address a real-world problem situation. In addressing the problematisation, the actors traverse an obligatory passage point. This marks the cusp where, to address the problematisation, their agency draws upon (and recursively recreates) the rules of behaviour necessary to (re)construct a network with a new structured order.

- This newly established humanchine network's own structured order defines what it is legitimate to do, signify the meanings allowed, and aligns with the dominant focal actor's interests.

Emancipation may also be seen to be present as a structural dimension underpinning the humanchine actor's 'reflexive agency' of its own and others intentionality. This is at the heart of the 'slow' incremental network change of structuration theory (Giddens 1984b). Reflexivity however does not have to be a private or unacknowledged act, it may, as above, be overt. Figure 1 illustrates how the relationship between a humanchine network's structure, modality and agency, from Giddens' structuration theory are augmented by Latour and Callon's moments of translation drawing on an emancipatory structure. In the next section we explore this concept drawing on an integration of structuration and actor network theory.
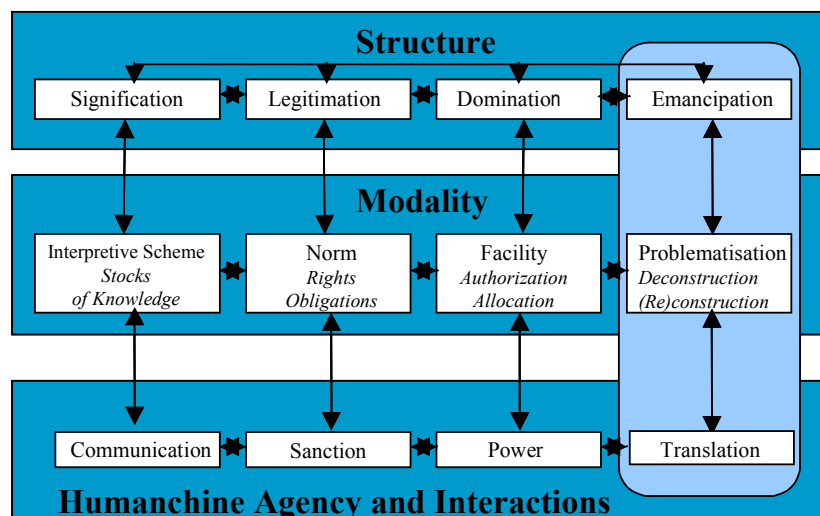

Figure 1. Structuration/ANT Hybrid Framework (StructurANTion Framework)

An Illustration of the StructurANTion Framework: Breast Cancer Decision Making

'Today, a woman with breast cancer has many treatment alternatives. To undertake the decision-making process, she must be provided with information, support, and a health care network capable of meeting her needs. Surgeons are now faced with new roles in the decision making process as the choice is no longer theirs. They must be educated not only to keep up with the technical aspects of breast surgery, but also to modify their behaviour in order to become more flexible and open-mind (Levy 1986).

To illustrate the concept of the humanchine actor-network and the role of emancipatory structures in changing a humanchine structurated order this paper draws on an intervention example (see Atkinson 1997; Atkinson 2002) examining the multidimensionality of clinical care as actor networks.

Until recently, clinical decision-making in breast cancer treatment had been the prerogative of surgeons and the oncologists. Nurses had the essentially clinical role of preparing the patient for a procedure and carrying out postoperative nursing care. The existing information system in the hospital provided basic patient demographic data, opened an episode of care on admission and captured a simple coded initial outcome along with post hospital discharge, outpatient contacts, medication and any further treatment related to that episode. Essentially, the hospital information support system captured a coded episode of care and provided management with uncosted aggregated hospital activity data. The real patient information used in the process of patient care was in the form of hand written paper case notes accessible only to clinicians.

These notes were actors essential to orchestrating patient care by multiple clinicians in time and often disparate locations (Berg1996). As a means of clinical auditing and improving patient care, the data captured within the IS paper notes was limited. However, they did support case conferences. Until recently, the patients did not have access to these notes and even when they were available, a patient could not understand their arcane language and structure without a clinician interlocutor.

The structurated order was such that it was legitimate for the surgeon focal actor to behave in a paternalistic manner toward 'their' patient; often signified not by their names, but their morbidity, namely 'CA breast' or treatment, 'lumpectomy'. The clinician had the dominatory power to access knowledge and information, both internally from their own training, and experience, as well as how to retrieve it from other artefact (re)sources, such as test reports and the pathologist's commentary, clinical protocols, the hospital information system and the paper notes. They also had the power of their own expertise to underpin the investigative processes and ultimately the sanction to carry out the clinical procedures or not as they saw fit; as well as authorizing theatre staff and other medical resources to do this. The converse was true of the patient. Their translation into the breast surgery actor-network converted a women patient into a passive recipient of its services.

Under criticism from women patients within the clinical care network and from a newly appointed lead consultant in the department, the incumbent surgeons were persuaded to explore new ways of becoming more women centred in their diagnosis and treatment. Many of the women, as long-standing actors within the breast cancer care, actor-network, were unhappy with the clinical decision-making process, treatment and support given, as well as the follow up and expressed it openly at meetings with the clinical team and managment. They formed a 'survivors' group within the network that included sympathetic clinicians and sought the advice of legal professionals familiar with clinical litigation. Drawing on the rules of behaviour embedded within their emancipatory structure, this coalition of women led by a powerful individual, the focal actor, and newly appointed lead and sympathetic consultant, overtly problematised the situation. They set out to openly challenge the existing structurated order by problematising the role and power of the clinician in clinical decision making and treatment. They made it not only an issue within the hospital but offered a way forward for long-term care and support. To achieve what they sought out of the problematisation, women centred care; they would have to translate the interests of not only incumbent but also any new actors within the system in line with their interests. Part of this entailed identifying how, the soon to be procured information system could be translated to help the women and any sympathetic clinicians in providing a patient centred care regimen. They achieved this by translating the CEO into their network and used her to then leever the IS team to work with them on the systems functionality to ensure it would have a patient centred structurated order enscribed in it. Other translations and mobilisations included, enhancing the role of the mainly female nursing staff to become closer to the patient mobilising them as advocate and support within the clinical arena. Some of them became breast counsellors and patient advocates. The process of translation focused on inscribing their, and the patient's interests, within the network's structurated order and agency, in particular the clinical protocols and treatments and procedures, plus changes to those of the incumbent consultant surgeons' world view and behaviours. The new patient centred CBIS, soon to be procured with the involvemnt of the focal actor, would manifest the new humanchine network's societal structurated order. Table 1 summarises this transaltion.

Table 1. Summary of Humanchine Analysis of the Brest Cancer Care Network Translation

Structure	The Humanchine Brest Cancer Network Physician Centered Structurated Order	Problematisation Translational and Mobilisation of the Humanchine Brest Cancer Network into the New Order	The Humanchine Brest Cancer Network Patient Centered Structurated Order
Signification **Interpretive Scheme** **Communication**	Physician dominated language and vocabulary that excluded the patient. Initial lack of shared understanding; the information system is relevant and useful to clinicians only, as it contains information in a language and protocols that only they can use. Communication is ultimately one way from the physician to the patient.		Development of the information system in consultation with the patients, nurses and other care practitioners. Creation of shared language, signification structures, is vital for the success of a new patient centred IS. If the organisational actors do not perceive the system as a useful resource, they may rebel (Markus 1983). Communicative practices become two-way and participatory.
Legitimation **Norm** **Sanction**	Given the current norms of actions/ relationships within a clinical setting, the usual/legitimate way of working is reinforced, reproduced and supported by the IS, which in its current state prevents the status quo from being changed. It is not legitimate for the patient to make their own decision on their care, only the physician.		The patient is the legitimate decision maker in the breast cancer humanchine decision making and treatment network. S/he is supported in this by the IS access and its patient centred protocols. A Homogenous fit with the new organisational relationships with a patient centred IS enables a smoother systems implementation/adoption as a powerful actor within the humanchine network
Domination **Facility** **Power**	Old order reinforces the strong hierarchy of the clinical profession, and surgeon's expertise in decision making; often resulting in feeling of powerlessness by patients; issues of domination important, with both allocative and authoritative means of domination. The CBIS meets the needs of the surgeon not the patient. It contributes towards clinician domination.		New order reflects the changing nature of the interactions and level of potential on the part of the patients; requires that the actors involved re-define their roles, both internally and externally, and also re-define the types of relationships involved. The patient's interests are predominant and not (re)presented through the machinations of a clinician. Her interests dominate the networks and are inscribed in the IS
Emancipation **Problematisation** **Translation**	The patient's current status with the humanchine actor network was one of passivity, an artefact that has little power to translate the others within the network in line with their interests. Problematisation of the situation by the patients and their focal actor representative along with supportive clinicians and the influence they sought in the procurement of the new patient centred CBIS and other clinical artefacts that were or could act in the physicians and not their interests. Chief Executive and the IS team were translated		Using a weight of experience and research, the decision was made to 'fight' for a new and more woman-centred system. Either by replacement or persuasion, but not without a conflict, the incumbent surgeon's, minds and/ r behaviours are changed to become supportive of the patient in their decision-making. The information system would be upgraded to an electronic patient record, accessible to both a woman patient and clinicians. It would include access to information, often in graphical form, definitely in lay language understandable and empowering the patient so that they could see outcomes and have their decisions captured in the IS.

With respect to Giddens' structures of signification, legitimation and domination, the agency of translation underpinned by the emancipatory structure of the breast surgery unit had, with respect to Latour and Callon's actor network theory, to lead to a new humanchine patient centred breast cancer actor network with a new structured order and agency. It was one that freed the women, the clinicians and the technologies or artefacts within the actor-network from its current structured order of paternalism, to one of women centred care.

Concluding Discussion of the 'StructurANTion' Famework

This short vignette and the preceding discussions of the conjoining of actor-network and structuration theory have been used to posit the concept of a hybrid theoretical framework with which to explore the ontology of the networked 'humanchine' hybrid. Both theoretical and ontological hybrids we argue provide not only a framework for understanding the 'slow' almost imperceptible change that goes on within the social and organisational ecologies of humanchine actor networks that abound within the world but the dramatic and overt change that takes place, both driven by what we identify as 'emancipatory' structure. These occur when we introduce a new information system into an existing actor network within an organisation or conversely change human practices or both, done to as here, for example, address discrimination, or to improve competitiveness, or seek to reconfigure humanchine organisational processes, even create new organisational network ecologies out of the old. They are overt disruptions to the existing structurated order, by a focal humanchine actor, whose declared purpose is to bring about a new one. Such interventions could range from the mundane to the criminal to the 'transformationally sublime' (see vignette above). All though involve the translation of a humanchine network and its structurated order. Together hey constitute the double duality of structure and agency and humanchine.

We are motivated to do this for two reasons, both based on what Giddens (Giddens 1979) calls the double hermeneutic. Namely, the use and mutation of theory, not only to understand the world, but as a cognitive device with which to change it. Giddens (Giddens 1979; Giddens 1984a). As Law and Urry (2002) acknowledge theory is a 'conceptual artefact' capable itself of being enrolled and translated into a real world humanchine network and used as a mutable 'theoretical actor'. '…it (theory) can help to bring into being what it supposedly discovers.' When translated into the 'real' world actor-network theory is mobilised as not only a means of understanding the world but changing it. The corollary to this is that the research and the interventions that we seek to affect will be centred not on the computer based information system and its 'user' but on the dramatic and overt changes surrounding humanchine and the humanchine ecological networks. To that end, we have given the hybrid framework the hybrid neologism 'StructurANTion', whose translation into future humanchine inquiring and problem addressing networks we hope will be fruitful in framing problematisations and facilitating humanchine translations as well as informing research and development.

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