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Inter-organisational systems:a neo-socio-technical perspective. a neo-socio-technical perspective.

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Abstract

This paper explores the conceptual challenges of inter-organisational systems from a socio-technical perspective. It introduces the concept of information communications (IC) system paradigm as distinct from the conventional data processing and distribution (DPD) systems paradigm as a requirement to support multi-organisational partnerships based on shared intentions in the face of complexities of sharing data and information between organisations.

Keywords: Inter-organisational systems, sociotechnical systems, architecture, communication

1.0 Introduction: The integrated enterprise versus inter-organisational systems

The enterprise systems paradigm and methods, within which we build and deploy integrated solutions, which has evolved over the last four decades, is based on the assumption of a clear demarcation between an inside and an outside. Within, we assume a set of operational norms and expectations which are coherent with the purposes and objectives of the enterprise. Any contradictions or problematic deviations are assumed to be faults which will be rectified by means of internal control mechanisms. As a consequence of these assumptions of coherence and rationality, we further assume that the requirements on the system can be fully expressed in terms of use cases and business logics, that is to say, purely in terms of functional behaviours. Such systems are defined by what they do, their purposes remain implicit because they are taken to be completely expressed and embodied in explicit rules, logics and procedures. The concepts and language associated with the acquisition, processing, distribution and storing of data can express all that needs to be expressed about these systems.

When we consider inter-organisational systems, where the relationships between the members are transactional and delimited by explicit contracts and protocols, these assumptions remain more or less valid. Thus, supply chain and customer relationship management systems, and the like, are defined and implemented within the data processing and distribution (DPD) paradigm we have outlined.

When the relationships that are supported by inter-organisational information systems becomes more relational and, as a consequence, less predefined and predictable, the DPD systems paradigm begins to exhibit some limitations. Note that we are now talking about the nature of the relationships between the organisations themselves which are supported by an inter-organisational information system; this has two very significant implications: Firstly, we have to consider issues of:

- infrastructural capacities, by which we mean shared reusable and, indeed, re-purposable resources,
- the structural systems that makes use of infrastructure to communicate and manage information, and

- super-structural systems that govern this use and communication.

In the face of these distinctions, and this complexity, we can no longer assume that purpose and intention can remain implicit.

The second and related implication is that, with this shift to this more inclusive view of inter-organisational systems, we have transitioned from a technical to a socio-technical conception of our subject. It is clear that the complexity and ubiquity of automation and information technologies has changed radically since the original mechanisation context in which Emery and Trist originally coined the term "socio-technical" in the mid twentieth century. Even the developments of the earlier phases of informatisation of the economy and of some aspects of wider society in the 1970s and '80 through separate developments in the information processing, tele-communications and mass communication/media sectors have now been radically superseded, so it is important that we re-establish a concept of the socio-technical which is able to take into account the complexities of our current, and foreseeable, situation. To do this we must go back to basic principles.

We will consider two gradients of systems complexity as a tool to re-examine and re-establish a concept of the socio-technical which, perhaps, we should now refer to as the "neo-socio-technical". The first gradient is concerned with the interacting units within the system which creates the horizontal axis of increasing internal component complexity. We will partition this axis into objects, mechanisms and organisms, recognising that the boundaries between them are, in practice, zones rather than sharp and absolute demarcations and that there are many significant subdivisions within each of them.

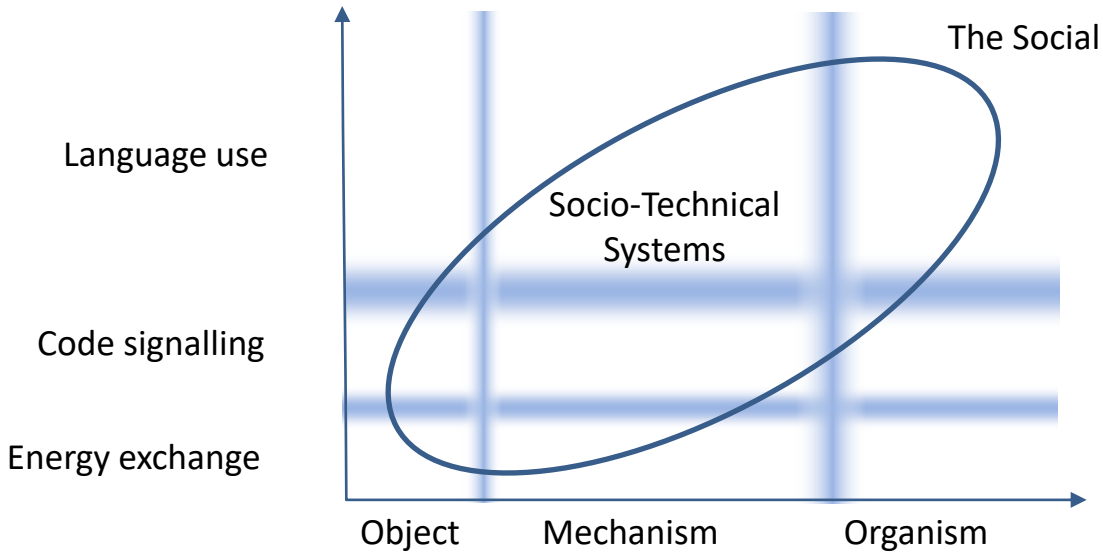

Fig.1: Internal and external complexities in socio-technical systems.

The vertical axis is concerned with the increasing complexity of the interaction mechanisms which operate between the components. We partition this gradient into energetic exchanges, code signalling and language use, again noting that the demarcations are, in practice, somewhat gradual and blurred. Note that there are many zones of the space we have created with our two axes that are not occupied: these axes are not orthogonal and independent and the two sets of terms are, to some extent, mutually defined. So, objects are things that only interact through the exchange of energy, mechanisms are complex objects that are capable of

interaction by signalling and organisms are complex mechanisms that signal and the most sophisticated of which use language and engage in conversations[1].

We can first demarcate the social in this gradient-space as the upper right zone of high internal and external complexity. The social also includes some code signalling organisms, indicating that we accept the concept of social animal or insect communities and we also accept that there are animal species that must be classed as language users on the basis of the evident range and complexity of their interactions.

We can demarcate the scope of the socio-technical system in this space. We do this so as to include components that are social, organic and mechanistic together with physical objects. The implication of this scope is that, if we are to design socio-technical systems, we require an architectural language which is capable of representing all of this different types of entities and the relationships and interactions that can take place between them. But this presents a significant challenge because the epistemic stances required to deal with a world of objects and mechanisms is not the same or even commensurable with one required to deal with a world of conversational relationships. The former are handled in the DPD we have discussed, the latter are not. In this paper we argue that the we require an augmentation of the DPD paradigm to one of Information Communications (IC) in which information is generated and interpreted by entities that are defined by their purposes and intentions rather than simply by their functions.

2.0 The information communications system paradigm (IC) and the data processing and distribution systems paradigm (DPD)

At the most abstract level, we conceive of DPD systems in terms of aggregations of information objects and a set of capacities to store, transmit and transform them. The information objects may be generated directly by user-subjects or created automatically from sensing and measuring instruments. Such an information system has relationships with a set of external things (entities, processes and relationships) which are its application domain. Information technology design and deployment processes conventionally have the purpose of regulating the state of, and changes in, the application domain. The underlying formalism here is the dyadic or two-place relationship between information objects and creating and using subjects.

In the class of DPD systems we have considered so far, events are transactional in nature and defined simply in terms of pre-conditions, transactional process and a set of post-conditions, which have been formalised in logics, rules and procedures. The purpose of the DPD system is to effect these transactions and also to provide the record and evidence of their occurrence and legitimacy. In the traditional view of information processing systems, the definition and design epochs and the use epochs are strictly separated, this is to say, the specifications of a transaction cannot change while it is in progress. This separation makes the DPD system first order and closed, while in use, and this means that the evaluation of appropriateness and legitimacy is a matter of logical predication involving the comparison between an account of a sequence of states and events and a specification or set of rules. It is not a matter of interpretation or subject to re-interpretation. Such events are themselves interpreted as external actions *on* the system not within the system.

[1] This approach is not intended to provide complete definitions and characterisations of these terms or scales, we are developing an architectural abstraction which focusses on interaction and, eventually, information, communication and conversation.

If we are to address the requirement for relationality that we have identified, we must consider an extension of the DPD paradigm which makes inter-subjective exchange explicit, rather than simply considering the transmission and reception or transformation of information objects. In this approach, which we call the Information Communications (IC) paradigm, we make the relationship between the communicating subjects explicit and this involves the creation of a triadic or three place relationship, (a Peircean third, see below) rather than the combination of dyadic relationships. The consequence of this move is to establish a clear distinction, within a communication system, between *content*, the information objects that are processed and transported in various ways, and *context*, which corresponds to the roles, norms and intentions of the communicating or processing parties who generate and interpret these objects. We will refer to an information object that contains information about the context of a content information object the *provenance* of that object and this provides us with a clear and precise distinction between DPD and IC systems: the former deals with information objects which are interpreted in terms of their denotations alone – the meaning is in the relationship between particular sets of content and the coding scheme under which they are generated and used - while in the latter, interpretation of content must include the additional consideration of its specific context as represented in its provenance.

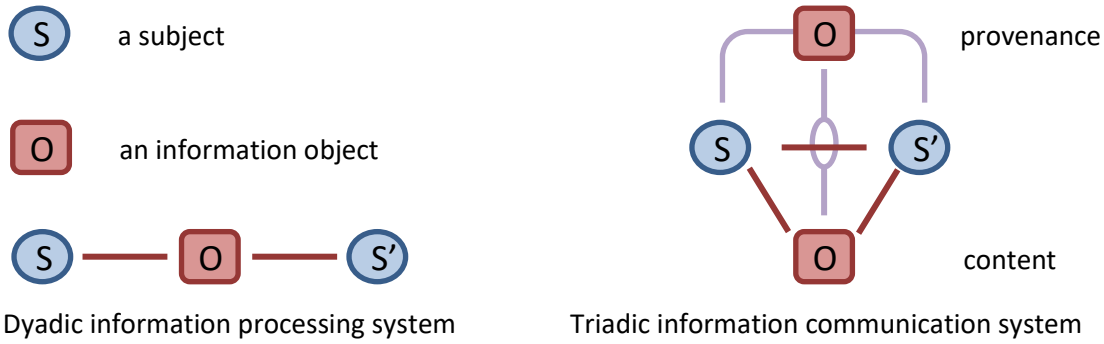

Fig.2: The data processing and distribution (DPD) versus information communications (IC) systems views.

It is clear from fig. 2 that an information processing system is a sub-system of a communications system. In C. S. Peirce's terminology, the processing system represents a singly degenerate form of the triadic relationship of communication. Parker[2], quoting Peirce, observes:

> "Just as a real pairedness [dyads] consist[s] in a fact being true of A which would be nonsense if B were not there, so now we have Relational Threeness which consists in A and B being really paired by virtue of a third object, C." (Peirce's Collected Papers vol.2 paragraph 86). 'The attacker murdered the victim with a rock' would be such a case. We can try reducing the statement to two dyadic relations: 'the attacker threw the rock' and 'the rock struck and killed the victim', but in doing so we lose the intentional element which joins the attacker, the rock and the victim in the relation "murder". If we eliminate any of the three, we eliminate the murdering relation altogether.

[2] Parker, Kelly A: The continuity of Peirce's thought. [1998] Vanderbilt University Press. ISBN 0-8265-1296-8 pp.65

This analysis explains why content and provenance cannot be subsumed, with each other, into the traditional single coding scheme or data model of a DPD system and for provenance or context and purpose to become simply an extension (or meta data) of content in a flat data model or ontology. The shift from the dyadic to the triadic creates the possibility of the inscription of relationality in the information system: in the above quotation, murder is the relation between the perpetrator and the victim. But this move is not sufficient to allow for the explicit inscription of intentionality. To achieve this we must identify the means by which the relationships between instances of provenance and their related content, *both expressed in terms of triadic relationships*, can be established and maintained within the information communications system.

In the legal example, the question at stake is "What did the accused *mean to do* when throwing the rock?" If the answer is "To clear an obstruction in the highway" then the verdict cannot be murder but may range from negligent manslaughter to misadventure. What we have here is a representation or account of a sequence of events that have been observed and recorded in a realist determinist frame. We are mapping this sequence onto other sequences of rational (or possibly irrational) mental states and asking the question, given the evidence, which of these purposes do we believe was the motivation of the perpetrator? The two representations are constructed within two distinct conceptual categories: purposes or ends and actions or means. The relationship between them is semiotic, that is to say, within a community (of language and interest), it is the norm to take *this* (sort of behaviour and context) to mean *that* (purpose). Thus, within a communications system, the way that contextual information modifies the meaning of content is a matter of shared interpretation and commitment, and is, essentially, socio-cultural in nature. Parties who are communicating are the performers of acts in the context of roles not simply the sources and sinks of data.

If, as is often the case, we are required to capture, formalise and represent these commitments, intentions and purposes, then, if we are to maintain the distinctions we have established between DPD and IC systems, and a belief that only the latter are expressively adequate in the informational support of relational, multi-organisational networks, this capture and formalisation must be dynamic and maintained by an ongoing, deliberative process of governance which examines the consequences of the operation of the system. As we have observed, it cannot be a matter of fixing them by functional design or by a system of rules and conventions. This questioning involves the comparison between (representations of) purposes and outcomes and can be articulated by the questions of governance which become: "Is this what we intended?", "Do we still intend this?", "How can this be improved?" *This*, here, is how the multi-organisational system has been used as evidenced in the logs and records while what we intended must be captures in models and specifications of the roles and conversational relationships we have committed to. The first two governability requirements ensure that governance is informed while the last ensures that it can be put into effect. The question regarding *who* gets to participate in the governance of the system, the *we* in the last paragraph, represents the central challenge in the establishment and maintenance of the ethos and moral ordering of the system.

Note we are distinguishing governance from the concept of management which does report on whether the rules and plans have been followed and the stated objectives achieved. In the class of co-operating and collective multi-organisational system we are considering, both are needed and neither can be simply imposed through hierarchy. The socio-political term for this alternative is Federation and the IC systems approach, what we are describing corresponds to open federability.

2.1 Introducing the epistemic registers: an everyday example.
Before we examine the stack of epistemic registers of the architectural discourse of socio-technical systems in detail, we will first explore a simple everyday example of what they are and how they operate in order to provide a clear introduction and overview. Consider traffic lights. Although quite simple, they do represent a socio-technical system and, because of this, must be described, and can only be fully understood, in terms of the four architectural layers.

First we have a finite state machine made of timers, actuators, indicators, sensors and power sources deployed as street furniture. This is designed to perform a repeating pattern of behaviours and this can be modelled in terms of

- buffers – the roads and sidewalks,
- stocks – stationary, waiting vehicles and pedestrians and
- flows – moving vehicles and pedestrians.

We are at the ***empirical engineering*** level of Forester's systems dynamics[3].

Next consider the (symbolic) concepts of combinations of red, amber, green and the (iconic) concepts of the upheld palm or the walking or standing figure appearing in specific (indexical) the differing positioning of components at locations in the intersection. These have the denotations for the users of: stop, get ready to go, go, get ready to stop, cross or wait. This is observed and decoded by drivers and pedestrians. This is the ***semiotic-informatic*** level in which all the terms that have a meaning in the system are defined.

"Do not jump the lights, and do not treat them as the starting signal of a race" adopting the role of the racer or "Do not dawdle and delay on green" are assertions and norms of the roles of road user. The traffic engineers who designed the system and set the timing parameters are also discharging the responsibilities of roles pursuing the principles and intentions of safety, efficiency and fairness for road users. Drivers and pedestrians engage with the intentions of courtesy, responsibility and mutuality expected of them. This is the description of the socio-technical system at the ***conversational-hermeneutic*** level. What actually counts as dawdling, racing or fairness is an interpretation.

Finally we have the experience of the vagaries of urban and rural road use and the styles and habits of different populations and national communities. This reflects the fourth level associated with concepts of the identity and histories of societies[4]. Anyone who has driven around the world will have experienced these differences. In Tokyo, we observe pedestrians patiently and obediently waiting for the walk sign even though there are no vehicles to be seen; In Florence, the traffic lights seem to represent the "field of play" in a rivalry between scooters, cars and pedestrians. This is the ***socio-cultural*** level of the experience of a socio-technical system.

While the idea of traffic lights as the context for communication might seem rather mechanistic and unrepresentative of socio-cultural complexity, consider the spontaneous coordination, by road users, to allow the vehicle with the flashing blue light and the siren sounding through the junction, against the red, as a spontaneous and dynamic exception to the rule. The explanation of such an event involves mechanisms of communication and coordination at each of the levels of the stack but can only be fully understood in terms of the

[3] Industrial Dynamics, Jay W. Forrester. MIT Press 1961. SBN 262 06003 5

[4] For example, in Australia, amber means hurry up to initiate your transit of the junction and is consequentially of longer duration than the "get ready to stop" meaning in Britain. This is an example of local evolutionary cultural diversification percolating through the registers.

relationships and co-ordinations that have involved across all the levels, that is to say between the different sorts of meaning and causation that they entail.

2.3 The epistemic registers in detail

We will not consider the basic information technology platform layers of persistence, transmission and processing in this account but commence our discussion with two layers which correspond to an information processing system we have already discussed. We have called the first of these the empirical-engineering layer. Here, we are concerned with the handling of chunks of data: bits and bytes. In this perspective we can talk about exactly where the data is and how and when it moves; we can measure the quantity of information present in any situation and identify and fully characterise the medium within which it is being maintained, transformed or transported. But the engineering view says nothing about meaning. From a management perspective, we could also refer to this level of information as the accounting layer: its core is detection, measurement and record of concrete identifiable events.

Socio-Cultural View	Individual and Collective Identities, Values and Principles.	New meanings and values come into being
Conversational View	Roles, relationships and responsibilities	Meanings include intentions.
Informatics View	Codes, terms and objects.	Meanings are pre-defined and concrete.
Engineering View	Bits – terra-bytes, channels and bandwidth.	Measurements but no meanings.

Table.1: The different views of communication and the concepts of meaning.

But, as we have already discussed, our approach goes beyond the basic data transmission model of Shannon and Weaver[5]. In the structured communications of what we might now re-term the "middleware layer", the parties have explicitly designated, or dynamically assumed, roles as well as having names and addresses, and, because these roles are explicit in the type of communication, this allows us to encode and keep track of the norms and intentions associated with their communications. The chunks of content that are being exchanged can be labelled (assigned a provenance, see Fig. 2) under a taxonomy which has been generated as a result of commitments documented at the higher, conversational level which is associated with the communications system that the processing layers we are considering, support. Thus, at the engineering middleware level, we can detect that a certain message is, for example, a referral which is an intentional designation. We can assert that the originator and the addressee have clinical roles and we could operationalise a function that says: if a corresponding discharge is not generated within a defined timespan, generate an exception message. The point here is that, while being a referral is treated as an attribute of a message at the engineering level, there is a link from this attribution to a set of specified norms represented and maintained at the conversational level. These articulate referral processes not simply as transactions of care, i.e. ordered changes in states of affairs, but also as the operation and discharge of sets of responsibilities and intentionalities which are relationally situated. On the basis of such links, a particular example of a "referral", and its context, might be intended to be interpreted as a withdrawal from and termination of the relationship of care

[5] Claude E. Shannon and Warren Weaver (1963). The Mathematical Theory of Communication. University of Illinois Press. ISBN 978-0-252-72548-7. This work has provided the universally recognised, positive realist approach to understanding information in terms of data to be measured and coding schemes to be enumerated and analysed statistically.

by the referrer, in which case, a discharge would be meaningless. Whether such a dynamic reinterpretation is allowed is the subject of a higher order of regulation and governance of the system but it implies the same sort of dynamic exception process we described in the case of the traffic lights. The argument here is that, unlike closed information processing systems, multiple orders of regulation and governance must be regarded as *internal to the system of care and the information system that supports it rather* than as external inputs from legislative or design domains.

The next layer in our model of communication is concerned with the meanings, rather than simply the handling, of data. In what we will call the informatics or linguistic view, we are concerned with codes and their denotations, i.e. direct correspondences between terms and elements in an external world. Here we have the concepts of dictionaries, thesauri and taxonomic schema or data models on the one hand and of messages and documents, as units of communicational activity, on the other. In the standard approach to information processing systems, meaning at this level is an explicit function of these codes, headings and mark-up which have been fixed or standardised externally and a-priori in the terminologies and data models of a closed system. Systems engineers have appropriated the philosophical term "ontology" for these data modelling and coding schemes. In a communications systems approach, the content of the informatics layer has to be more dynamic because it must be able to respond to the changes demanded by governance. And these changes are not simply first order ones concerned with the modification of the parameters of processes or the adjustment of targets and thresholds. They may involve the reclassification of existing or introduction of new terms and the renegotiation of what counts in the situation. These are the ongoing, deliberative sense-making processes of governance which transforms the processing system into a communications system in the sense we are developing here. In terms that the determinist engineer would understand, this involves the introduction and rearrangement or evolution of the buffers, stock and flows, not as a redesign of the system but as a reconfiguration, in use.

At the conversational level, we consider the world in terms of the roles and relationships which form the contexts in which information is generated and interpreted. Here, meanings include intentional concepts such as obligations and responsibilities. The objects in which the traces of these conversational moves or acts are preserved and transported are termed the instruments of the conversation and take the physical form of the messages and documents which are transported and managed by the lower informatics and communications levels. At this level, we can talk about an instance of a document such as a discharge summary. This represents an instrument which signifies the transactional closure of a specific, temporary transfer of responsibility of care as part of a referral conversation between a GP, a Hospital Specialist and a patient. It also provides the medium for a set of communications content which is the outcome of an act of summary by the discharging physician.

The final and highest or most inclusive view of information is from the perspective of society and of culture. At the socio-cultural level, information encompasses identity, values and principles and shared significations and meanings come to be accepted. This is the level at which we have concepts such as individual and collective identity and voice.

2.3. Systems

This particular set of layers appears in a number of different disciplinary and philosophical literatures. Danial Dennett's concept of the intentional, and other, stances[6] provides a

[6] The intentional stance. https://ase.tufts.edu/cogstud/dennett/papers/intentionalsystems.pdf

philosophical link to purposefulness and meaning and the way we make sense of the complex worlds we co-construct and inhabit. He refers to:

- the physical stance in which explanations depend on concepts such as causality and the laws of physics,
- the design stance in which explanations are expressed in terms of function and utility, and
- the intentional stance which explains situations in terms of the purposes of the agents who have made them so to achieve their objectives.

These stances correspond precisely to the epistemological commitments of the first three architectural levels we have described.

Krippendorff, who adopts a cybernetic stance, talks about the different ways in which we articulate our determinations of the nature of systems. His levels are as follows:

> "Systems whose behaviour is deducible from a finite history of recorded observations are *observationally determinable.* This reflects the epistemological stance of detached observers who seek to discover systems properties by testing all possible hypotheses about that systems structure against the data it produces[7]"

This corresponds to our Engineering and Accounting View which measures and compares (or predicates) but does not interpret.

> "Systems that can be built and set in motion are *synthetically determinable*. This reflects the epistemological stance of designers who have access to the structure of a system having determined its makeup.[8]"

This corresponds to our Informatics View where, in the world of information technologies, design involves the production of an object or data model and the collection of functional logics and use cases which are implemented through software. This produces synthetically determined systems in which users are operators: to fully understand such systems you must read the code and examine the logics of the operational procedures which constitute their design as indicated by Dennett's second stance. Here, we make sense of the world because we assume its deterministic nature and can therefore depend on the relationship between structure and operation, programme, platform and performance.

> "Systems that can be lived with or utilized by interacting or communicating with them competently are *hermeneutically determinable,* for example [some] computers as well as people.[9]"

We might question the term "interacting" here as being too weak but fully endorse the term "communicating"; the implication is that we have made a qualitative move from the functional use case and the simple operation of objects as implements. In our framework, the interactions between hermeneutically determinable entities is conversational and its determination involves meanings and purposes which are interpretations: we have arrived at Dennett's intentional stance.

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[7] Ross Ashby's information theory: a bit of history, some solutions to problems, and what we face today. Klaus Krippendorff, International Journal of General Systems, Vol 47, page 204, Published online: 30 Jan 2009

[8] ibid

[9] Ibid. Siri and Alexa are examples of hermeneutically determinable system which are artificial. The intentionalities and purposes of this system are primarily inscribed in the business plans and models of Apple Inc. and Amazon, however, and only indirectly in the code and information resources that produce their responses to commands and questions.

> "Systems that can be understood [only] by participating in them are *constitutively determinable*. The latter especially applies to social systems, constitutively involving knowledgeable human participants. They also include what second-order cybeneticians do.[10]"

Krippendorff's constitutive determination corresponds to the fully blown socio-cultural where the determinations of itself, by itself, are the purposeful operations of the system(s) under consideration bearing in mind that, at this higher level, we are adopting Ashby's stance with regard to the reality of the system:

> "It is important to stress that Ashby defined a system not as something that exists in nature, which underlies Bertalanffy's (1968) *General Systems Theory* and fuelled much of the general systems movement. He did not distinguish systems from their environment and generalize what makes such systems viable. Ashby always insisted that anything can afford multiple descriptions and what we know of a system always is what he called an ―observer's digest.[11]"

This view is taking a constructivist stance which recognises that, in any social setting, and, therefore, any socio-technical setting, participants foreground and attach significance to certain elements which, inevitably means that others are relegated to the background or, indeed, fail to be recognised at all. The socio-cultural level is about the experience of being human and this is necessarily an experience of being together and of communicating. Systems at the upper two levels of our scheme are part of our conceptual framing and sense making of intentions and values while those at the lower two levels take a deterministic and positivist stance regarding tangible realities. This underlines the observation that the different layers in our stack represent distinct epistemological registers with regard to information, systems and communication.

What counts as systematic, or as an explanation, is different at each of our levels because the nature of system components and of the relationships between components are different in each of them; there are different sorts of equally necessary work to be done in all of them. The purpose of the Architectural Discourse of Communications Systems is to coordinate work within these levels and sustain the conversations that must take place between them rather than to assert the hegemony of any one epistemology. This is not an attempt to create a grand unification of theories in a single epistemology but rather an economy and ecology of theories and epistemologies.

2.4 Further examples of the Epistemic Registers in operation

We considered traffic lights as a simple example of the description of a socio-technical system through the prism of the epistemic registers. We could also consider language itself in this four level framework. At the engineering level we have graphemes and phonemes – the written characters and articulable, audible sounds of a language: they can be detected, measured and counted. Next we have the lexicons, syntax and semantics of a language which corresponds to our informatics level. Then we have the pragmatics of a languaging community representing its practices and norms defined at the conversational level. Finally we have the rhetorics and poetics which reflect the shared or distinctive identities and personalities of language users: this corresponds to the socio-cultural.

We will also briefly consider the current (U.K.) legal framing of information governance in the context of personal information in this architectural framing. In any concrete situation of

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[10] Ibid.

[11] Ibid.

formal information governance, data is either personal or is not personal, there are no gradations. All personal information has an explicit controller organisation and any organisation, other than the controller, that operates on, or with the data, other than blindly transporting it, is a data processor or the sub-contractor of a processor, under the law. The roles, rights, duties and liabilities of controller, processor and subject are explicit and the definitions are assumed to be exhaustive and a matter of predication rather than interpretation.

This represents the first order regulation of a set of operations at the equivalent to a definition at the engineering and informatics levels; if interpretations outside of the frame are called for, they take place in the separate context of a court of law which is a corresponding second order regulation, i.e. a means of clarifying, reforming or reinterpreting the first order regulations. Personal information governance legislation is based on the information processing paradigm. A shift to a communications paradigm would involve the incorporation of second order regulation as part of the system rather than in a distinct and supervening one.

This second order approach corresponds to the traditional governance principles of care such as "Do no harm". What counts as care and harm in a palliative care setting is quite different from a remedial or developmental care setting and the nature of the care setting itself is the subject of ongoing negotiation and accommodation as part of the relationship and conversation of care. The required form and content of Information Governance in Communications Systems, in the face of these complexities is currently an open question.

2.4 Using the registers analytically

When we consider this "stack" in terms of the relationship between the layers we can observe that having a voice and an identity, being a *self, or a proxy* acting on behalf of and in the interests of *a self*[12] in relation to *others* at the socio-cultural level, implies the assumption or allocation of roles and the engagement in real conversations in which obligations and responsibilities are transacted according to a set of norms. A prerequisite for such normalisation and conversations is a shared language and vocabulary in which what counts in those conversations can be articulated and negotiated. The development and evolution of language takes place through interactions between the conversational and the informatics levels in socio-cultural contexts. Finally, communications and language are mediated through the channels and media defined in a physical environment which is created and maintained through the engineering and management of physical infrastructures.

Just as each level facilitates and enables, or is infrastructural, to the ones it supports, it also provides constraints and controls: channels and media define limits to expression and communication, language constrains the possibilities of roles and the distribution of power and control is an aspect of any role definition which in turn grants or denied a voice to individuals or groups. Thus the stack of registers provides a powerful analytic tool to understand the relationships between the different levels of structure and process that culminate in socio-cultural phenomena in context of socio-technical environments.

2.5 Using the registers architecturally

It is however, as an architectural tool for synthesis, co-construction and governance, rather than analysis, that this concept of the stack of epistemic registers could have its most significant potential impact. The specification, design and governance of such platforms, and of the service sets they support, involves work at all of the levels of our stack and each level

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[12] Alasdair MacIntyre, Dependent Rational Animals – (1999) Ch. 12

comes to represent a distinct “projection” of a proposed, or of an operating and evolving, system and environment.

When representative groups of stake holders involved in the creation or transformation of multi-agency partnerships come together, they bring a range of conceptual framings, languages, organisational cultures and practice to bare: facilitating constructive conversations in these circumstances, in the initial stages of engagement, involves the nurturing and encouragement of mutual sense-making and the development of shared language. Only when progress is made at this level can the transition to constructive co-design take place. Thus, the architectural process is one of enabling and supporting conversations within a discourse, bearing in mind the definition of architecture we have adopted, represents a fundamental change in the traditional roles of architect from that of problem analyst and designer-in-chief to one of facilitator and interlocutor.

The a common practice in such gatherings of stake holders and users, if appropriately encouraged and facilitated, is to generate, share and elaborate rich pictures of their worlds and their visions which include and combine elements from all the different levels we have discussed[13]. So informal pictures are a good place to start the mutual engagement but, in the approach we have developed, this material is not regarded as simply a requirements gathering process by which programmers or designers can obtain insights and understanding of users’ worlds, needs and preferences. In the sorts of contexts we have been considering, there is a need to give users an ongoing voice in the design and governance processes not simply in the articulation of needs and the evaluation of prototype responses.

The rich pictures are initially used to create and juxtapose mirrors to, and windows on, the different perspectives within the room and, thus, as tools to promote conversations of mutual sense making. What elicits recognition from one group of participants by mirroring some salient aspects of their world and interests may, at first sight, seem strange and incoherent to another group while the next exhibit might reverse these reactions for these participants. When the two exhibits remain visible, side by side they can become a powerful provocation to explore, explain and resolve cognitive dissonances and misunderstanding. This is captured and sustained through the creation and curation of sets of mimetic exhibits which may be a combination of the outcome of field work with material elaborated by participants using the conventional media of white boards, post-it notes and storytelling. The key factor is that this emerging material is maintained as a set of boundary objects which are initially perceived and understood in different ways by the different groups of participants but which nurture and encourage a convergence of understanding and language.

A key factor in the encouragement of this convergence is a background curation task which progressively sorts the material that is being generated and is evolving through discussion, into the categories of the four different levels or registers and maintains separate and evolving (sets of) diagrams in the different projections of the emerging shared vision. A set of representational styles and conventions have evolved, or have been appropriated, to produce the different projectional representations and this constitutes a transition from informal, unstructured rich pictures, which remain at the socio-cultural level in the sense that they can only be interpreted by, and in, participation, to a form of specification in which systematic

[13] Peter Checkland, Soft Systems Practice.

interpretations at the conversational, informatics and engineering levels can be applied to those aspects of the emerging socio-technical system for which they are appropriate[14].

In terms of participant experience, this presents itself as an unthreatening and accessible way of organising complexity and structuring the negotiation of design options and decisions. The work that takes place around these projections, which are juxtaposed and maintained in parallel, is that of signification, that is to say, the negotiation of what counts in the vision of the emerging system. These include:

- The rhetorics of values and principles which usually remain in the form of slogans and assertions but can take the symbolic form of icons.
- The norms and intentional forms of networks of roles, responsibilities and relationships such as doctor, patient, carer, councillor, etc. together with the instruments they generate exchange and interpret in the "act-flows" of care.
- The "work-flows" and pathways that represent the operations and activities that will be performed.
- The physical resources and capacities that will provide the operational platform to respond to expected demand.
- "Presentation level" prototypes of user interfaces and content together with animations of the underlying consequences and behaviours of User interface events.

It is characteristic of these projections that they segregate intentional and extensional views of the system inviting and re-inviting the question "Do we take this to mean that?" where *this* might be an situated work-flow or process in our informatics design and engineering projections associated, for example, with clicking a button in a session and *that* is the intent embodied in our conversational and rhetorical projections about a particular set of roles, relationships and responsibilities reflecting the values and ethos of our enterprise.

3.0 Conclusions

One of the main context of multi-organisational systems' construction and deployment, which has provided the context for the development of these concepts of the neo-socio-technical, has been the planning, coordination and delivery of health and social care in communities. In particular it has been concerned with how these systems respond to complex, long term conditions that involve multiple problems and pathways.

The complexities of these contexts and the failure of conventional DPD approaches, such as the development of shared electronic records at the national or regional level and attempts to develop joint assessments of need across different organisational and care settings, have resulted in our critique of this approach to joining up and coordinating care and wellbeing services. We have outlined an alternative approach based on what we have called the IC paradigm. We have developed an initial, theoretical framing and justification for this and indicated some practical approaches to implementation.

In the analysis and discussion we have identified a number of requirements associated with the governability of multi-organisational systems of care. These are:

- *Extensional record*, they must make what has happened, how the system has been used and what the consequences have been, dependably evident and accessible for the purposes of governance,

[14] A companion paper: Inter-organisational systems: a historical perspective, (Martin and Wilson in this conference) provides an example of Aa conversational projection using the example of a brokered, information service infrastructure.

- *Intentional record*, which captures and maintains with appropriate completeness, precision and rigour, the prevailing commitments and intentions of the users, beneficiaries and governors of the system,
- *Configurability* which makes the consequences of governance actionable within the system, through reconfiguration in use, rather than requiring redesign.

In addition, systems of care must be open because they are always situated in wider social contexts which demand some element of independent and external purview. Thus, a system of care (and development) cannot be entirely self-governing but must involve the representation of the wider communities in which they are situated and which they serve.

Finally, we observe that the symmetries and asymmetries of care relationships in human wellbeing are wide ranging and dynamic from infancy through adolescence, maturity, seniority to dotage. There is a requirement on systems of care that they are morally re-orderable, according to circumstances and practice, at the level of the individual relationship, at the community level and at the wider socio-political level. This implies the operation of both first and second order governances as we have defined them in this paper, and the regulation of the relationships between them.

We have argued that the conventional, Data Processing and Distribution paradigm is not able to address these requirements and refer to the platforms and service support environments that do as *neo-socio-technical systems* which are defined under the Information Communications paradigm.