

---

## ERDIP revisited

Third Draft 08/01/10 mjmm

---

The Greenhalgh et al review of EPR<sup>1</sup> research makes somewhat depressing reading. At one end of the spectrum, we have academic work re-enforcing manifestly inadequate approaches to the conception and construction of complex socio-technical systems. At the other, it is observed that "home grown" and locally evolved systems seem to have the highest probability of success. But the contexts and occasions where this happens seem to be rather rare and each tends to be unique and difficult to replicate. And between these we have an assortment of conceptualisations struggling for critical insight but making little practical contribution to understanding or progress.

This situation, regarding information systems, is not limited to the EPR but is widespread in the caring and developmental public services where the concepts of multi-agency, partnership working, information sharing, common assessments and personalised budgets represent the current rhetoric of development and change. These demands are widening the gap between what can be delivered by rationalistic, control oriented management structures and processes and the real needs of clinicians, their patients and all who participate in the delivery and governance of care.

The EPR, however, represents a particularly useful focus for understanding the underlying methodological, managerial and social challenges associated with the informatisation of care. This paper presented here stands in contrast to the one sighted above. Rather than attempting to be encyclopaedic in its coverage, it focuses on one small piece of work which made only a local impression at the time and which has since been largely forgotten. The time of the Durham and Darlington EHR project was the ERDiP (Electronic Records Development Programme) of 1999-2002. It produced two items of evidence which generated not only a trans-disciplinary account of the problems associated with the very concept of a shared care record but also provided at least preliminary evidence of an approach which was clinically, managerially and, equally importantly, socially and ethically, appropriate and effective. The first item of evidence took the form of a rapid prototype demonstration of a conceptualisation of a shared electronic patient record and the environment in which it operated, while the second concerned the impact of a small audio-visual scenario which was used as a boundary object and stimulus for engagement of the health care community in discussions about the implications of information sharing in health.

I will describe and illustrate both of these in the first section of this paper and then explore some of the theoretical underpinnings upon which they were based in the second providing a meta-discourse which, I believe, makes some interesting and productive connections between some of the meta-discourses described in Greenhalgh et al. But before we can do either of these we must identify the primary, serious flaw in the conventional concept of a shared clinical record. Taking the initial quotation from the Greenhalgh et al. paper:

---

<sup>1</sup> <http://eprints.ucl.ac.uk/18821/1/18821.pdf>

“Electronic patient records (EPRs) are often depicted as the cornerstone of a modernized health service. According to many policy documents and political speeches, they will make healthcare better, safer, cheaper and more integrated. Lost records, duplication of effort, mistaken identity, drug administration errors, idiosyncratic clinical decisions and inefficient billing will be a thing of the past.” (Department of Health 2008; Institute of Medicine 2009).

This powerful rhetoric has an inevitable consequence when it impinges on the rationalist discourse of information systems design. To understand the consequential focus on the EPR as a physical artefact and a set of behaviours, and the problems that this generates, we must look at the basis for our scientific, engineering and managerial rationality. This amounts to considering the meta-discourse of all of the different scientific meta-discourses that have been considered by Greenhalgh et al. which share the common concepts of rationality which are at the centre of our Western scientific culture. Because these concepts are so deeply embedded in our ways of thinking, they tend to remain implicit and unexamined. We need, at least briefly, to examine them, asking questions about what is common rather than what differentiates these disciplinary approaches.

There are two theoretical foundations that underpin our Western scientific tradition. The first is model theory which defines what we take to be a rational, scientific argument and the second is systems theory through which we define what we take to be a scientific explanation. These represent the boundary constraints not only of our analysis and understanding of the scientific disciplines and their literatures but also of any attempt we make to develop new and improved approaches whether this is by synthesis and reconstruction within and between current disciplinary fames or by the creation of new ones.

Model theory has its origins in early Greek philosophy and mathematics, Euclidian geometry being the paradigm. The core idea is that the transformational operations of a calculus which take axioms as inputs and produce assertions as outputs are able to preserve the truth conditions of the former in the latter. By “calculus” we mean a group of logical or mathematical operations and the rules of their application. This means that there are two distinct sorts of scientific argument: the first is about the selection of axioms and the second is about the rigour and precision of calculation: what we take to be facts and the quality of the work we do in drawing conclusions from the evidence they present.

The American logician, Charles Sanders Peirce, provided a useful formulation of scientific model theory which is relevant to our current discussion. In it, he distinguishes three sorts of reasoning:

- Deductive, which is formal and tautological,
- Inductive, which is probabilistic,
- Abductive, which is speculative.

The last of these represents the boundary of science and also the locus of the discovery of the new and of innovation.

The second common underlying assumption in Western Science is that, as Bunge’s first hypothesis states: “... the universe is not just a heap of things but is

a thing composed of interconnected things – i.e. a system.”<sup>2</sup> A systematic approach demands, as a precondition, that to provide a scientific explanation of some phenomenon, it must be conceived of in terms of parts which are organised into wholes and wholes which are situated in environments, this is to say as hierarchies of entities and relationships. It further asserts that there are causal links between the properties and relationships of parts that account for properties of wholes and for the relationships between wholes and their environments and that these links can be observed and understood. What distinguishes the different scientific disciplinary approaches are the issues of what counts, for the scientist, as a part or a whole, a relationship or a causal connection and the specific bases on which these can be known and reasoned about. This is clearly delineated in Table 1 of the Greenhalgh et al. paper.

Now, saying that we see the world in terms of entities and the relationships between them and have to be logical in our arguments about them seems to be stating the very obvious. The problem arises when we consider the price of this reductionism. From a scientific perspective, the structures and processes surrounding an EPR must have inscribed in them a clinical logic of causes and effects, risks and benefits. But this is not the only relevant logic. There is also the logic of management which considers efficiencies and effectiveness and the logic of care which is concerned with responsibility, mutuality and trust. And there are other logics, i.e. perspectives from which sense must be made and maintained. As we will see, there are well developed frameworks with their own, individual disciplinary roots which serve particular perspectives but, by admitting only their local logic, they are difficult to bring into any useful alignment and coherence. Individually they are not expressively adequate to address the multi-faceted complexity which lies behind the apparently simple concept of the EPR.

A consequence of the fact that the driving rhetoric of the EPR centres on a visible and concrete thing is that this, naturally, becomes the object of systematisation, design and construction and from the managerial and political perspectives, its deployment becomes the symbol of completion and the fruition of policy<sup>3</sup>. In contrast, what emerged in the DDHER project was that the shared record is much more constructively seen as the outcome, and beneficial side effect, of the way other clinical messaging and transaction services were supported and delivered. The project further observed that, to be sustainable, the use and governance of the shared record must be an outcome of the use and governance of this surrounding constellation of messaging and transaction services which provide the infrastructure for care. Finally, we observed that the record should not be considered as container for “information as stuff” to be owned and protected but as a publication space which responds to the need to inform and support the intentions, processes and relationships, i.e. “conversations” of care.

The change precipitated by the DDEHR work concerned shared concepts and language which proved an essential component of the engagement of the community of users in the processes of definition and development. The

---

<sup>2</sup> Mario Bunge Vol 7

<sup>3</sup> Sacramental in Gregory Bateson’s sense

engagement was beginning to bare fruit when the initiation of the National Programme overtook it. Perhaps now it is time to re-examine some of these ideas as part of the “interdisciplinary debate on priorities for EPR research and policy” which Greenhalgh and her co-authors call for.

### **The EHR Demonstrator**

This Durham and Darlington EHR prototype was based on a clinical scenario in coronary care. At its core was a sequence of clinical messages concerning a particular patient. Examples of these are summarised in figure 1.

#### **Simulator Messages and transactions**

- Registrations
- Prescription 1
- Consent registration
- GP Publication
- GP eczema
- Referral to Cardiologist
- Radiology Referral
- Lab Orders
- Cardio Appointment
- Radiology Appointment
- Lab Results
- ECG Result
- CXR Result
- Ambulance Call
- Ambulance Results
- A&E Triage
- A&E Orders
- A&E Radiology
- A&E Rad Results
- A&E Lab Results
- Hospital Discharge
- Referral for Exercise Test

Figure 1

Each message was implemented through an XML schema and a publication rule which defined what data would be extracted from the message, where it would be recorded and how a root publication server would be notified. The specific configuration of these rules were the consequence of joint acts of publication and consent by a clinician and a patient as a part of the pathway definitions of the clinical situation.

The project had developed a set of architectural models of both physical systems and the processes that they supported and also of the intentional aspects of the roles and conversations that were being enacted and instrumented. (More of this in the second part of the paper). As far as the demonstrator is concerned, one of the results was the ability to define the set of systems and information services that would support a local community of care and its health economy. And this community was represented as a member of a federation of communities rather than as part of an integrated, monolithic whole. This is represented in the right hand pane of the EHR demonstrator dash-board shown in figure 2. The other panes in this prototype application contain the list of messages in the system (the time line) and the current message being processed in the simulation sequence.

As messages were played through the demonstrator, their passage through the network between servers and applications was visualised on the system map and the consequences on the content of the EHR, in the browser window represented in Figure 3, was updated. At each stage, as the events unfolded, the prototype shared record could be evaluated for clinical relevance and completeness.

This rapid prototype was constructed in a few weeks by a single programmer under the guidance of the clinical and technical directors of the project. When the technical team saw it their reaction was that they had thought they were involved

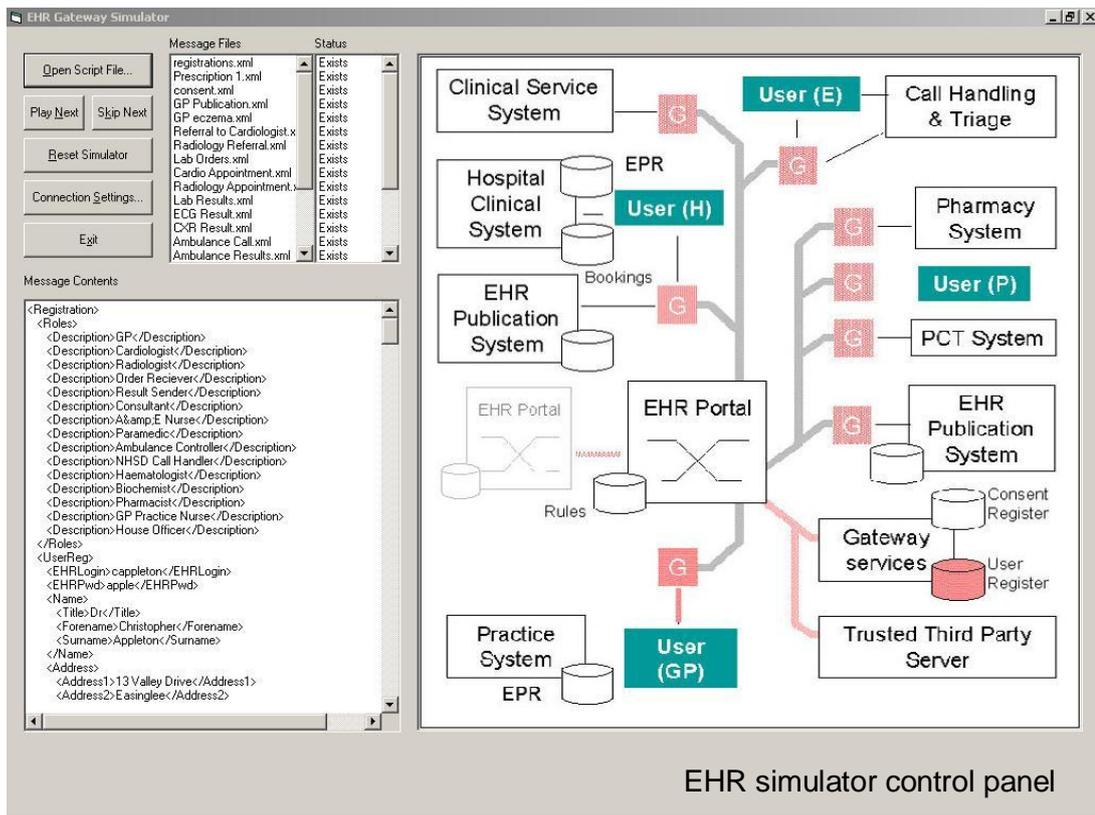


Figure 2

**Problems**

Label	Status	Date Created	Last Modified
Eczema	Ongoing	26/09/2002 14:16:42	26/09/2002 14:16:42
Angina	Ongoing	26/09/2002 14:16:41	26/09/2002 14:16:56

**Allergies & Sensitivities**

Description	Date Recorded	Added By
Shellfish	21/10/1980	[User Icon]

Please note that it is possible the patient has sensitivities that are not recorded in the EHR.

**Current Medication**

Drug Description	Presc./Issue Date	Expiry Date	Status	Added By
Metformin 500mg	04/05/1996	00:00:00	Prescribed	[User Icon]
GTN spray 400mg	02/03/2004	00:00:00	Prescribed	[User Icon]
Aspirin 75mg	03/03/2004	28/03/2004	Prescribed	[User Icon]
Lisinopril 5 mg	08/09/2004 11:45:00	28/10/2004	Dispensed	[User Icon]
Mixtard bd.	08/09/2004 11:45:00	00:00:00	Dispensed	[User Icon]
Simvastatin 10mg	08/09/2004 11:45:00	28/10/2004	Dispensed	[User Icon]

Please note that it is possible that medications exist for this patient which are not known to the EHR or are incorrectly recorded as expired.

Figure 3

in a database project and that the issues were data selection, coding and cleansing –processes that had proved extremely troublesome and had not succeeded. Now,

they said, they realised that the problem was really one of message and transaction management. The clinical representatives who evaluated the content against the requirements of the clinical scenario judged that the live, evolving record was adequate and appropriate and that a high reliance could be put on the quality of the data because it had come from real transactions rather than been collected for the purposes of a recording system. They then commenced discussions on the design of clinical messages and whether this or that item of data could or should be included. It was also clear in these discussions that this shared record was not seen as a substitute for either primary or acute records, with their local and specific contexts and purposes, but as a valuable supporting and integrating tool. The project did not have the resources to examine the practical consequences of the support of secondary uses although these issues were considered at the architectural level.

These results were, of course preliminary and only indicative; it was clear that many issues still required resolution. However, language and attitudes in the local engaged community had changed and this included clinical users, service and strategic management and the technical developers from the systems supplier. The discourse of security, access control and ownership, which had dominated much of the discussions on data sharing up to that point, changed to one of governance responsibilities and needs to inform safely and appropriately. All of the content of the “record” had already been shared because it came from the content of structured messages that had already been sent and received. The contexts of each item of data had been preserved because it could be traced back to the message context, sender and role in which it originated.

### **The EHR Clinical scenario**

The clinical scenario was embodied in a simple audio-visual presentation using stills, rich pictures and a voice-over. It was designed to provoke engagement and discussion. After each short section questions were raised and discussions undertaken in a series of small focus group/workshop sessions which eventually involved some hundreds of members of the health care community of Durham and Darlington from all disciplines and roles. The process was facilitated by a researcher who had had no part in the design of the material and who was careful to project a neutral stance: this was not to be experienced as a selling exercise.

A considerable body of data was collected and analysed from these discussions and the evaluation report is available at [{link to the evaluation report here}](#). It provides evidence of shared learning and co-construction of meaning in a context where the constraints, such as what was technically possible and clinically and organisationally appropriate, could be explored and agreed even across disciplinary and organisational boundaries.

As indicated above, this work did not come to fruition and is not offered as a blueprint or plan but as a provocation to thought. In the next section we will outline the theoretical framework (meta-discourse if you like) which informed its design and delivery.

## Architectural discourse

The commitments of the different “meta-discourses” examined in Greenhalgh et al. are not arbitrary, they are adopted by the different disciplinary groups in order to do particular jobs. The requirements to provide the theoretical and methodological underpinning for the construction of technological systems is quite different compared with those needed to critique such systems or to explain the social and political processes that they engender.

The evidence that non of these approaches, in isolation, provides comprehensive or even very constructive answers, is clear. As Greenhalgh et al observe that the idea that there might be another theory, at this same level of operation and abstraction, which would be complete and adequate, is not convincing. This is not Physics, so the idea that there might be a “grand unification theory” is simply another unconvincing reductionism. We are left with only one avenue: if any theoretical progress is to be made it must lie in the relationships and interactions between at least some of these different stances and the metaphysical commitments that they make. Since, as we have observed, the purpose of the commitments of a meta-discourse is to do a job we must ask the question: what exactly is the job that needs to be done here?

The jobs selected so far in EPR research seem to be of the following sort:

- Show how to design a record system that is clinically efficient and effective and prove that it is or is not.
- Explain why things keep going wrong (and who is to blame).
- Emancipate the workers or service users and redistribute power...

As we see in TABLE 1 of (Greenhalgh et al.) these ideas are associated with the axiology or value system of the research and represents the forms academic capital takes in different disciplinary settings. One thing is clear, however: what counts as truth and value is subtly or sometimes blatantly, different for each of them and this means that constructive communication is only possible after a painful and threatening process of mutual sense making. Because such a process is about creating new values and truths rather than reinforcing the old, institutionalised ones, it is destructive of academic capital and rarely happens. It does not count as scientific work and can not easily be published in the established journals. The prospects for a constructive academic debate look bleak.

Returning to the Durham and Darlington EHR project for a moment, and with a lot of hindsight, we can see it as an important stage in a process of accommodation between systems engineering, hard and soft science perspectives and an evolving set of pragma and praxa of intervention. If we were now to articulate what emerged as the task of the project we would express it in the following terms:

To nurture and inform a process of sense making and co-construction in a health care community and its suppliers about the informational challenges of care coordination and delivery. To define and offer infrastructural resources and services through which the outcomes of these deliberations could be implemented, evolve and be governed and to

define further infrastructural mechanisms and services that support the federation of groups of care communities into a national environment which overcomes the problems of the mobility of patients across boundaries and over time while maintaining declared (and changing) standards and priorities of care and of efficiency.

If we are to be convincing in the argument that this is not simply more rhetoric but that its meaning can be made precise, practical, and verifiable, we must not only present the *prima facie* evidence of the prototype and the demonstrator and the responses they provoked but we must also construct an adequate meta-discourse that provides a philosophical and theoretical grounding for them, the processes which produced them and in which they were embedded<sup>4</sup>. This discourse includes, but is not limited to, the scientific stance in a pursuit of truth but also includes aesthetic, ethical, and engineering values and, on this basis, we would claim that it is an architectural discourse. Because it is presented here generically, it is offered as an architectural discourse for socio-technical systems of which systems of clinical and social care are an important and particularly challenging class. A consequence of this approach is that the protagonist is no longer simply the scientific researcher but also designer, implementer, client, user, sponsor, external agent, supplier etc. and, as we will see in the final part of this paper, how these roles are distributed, together with the consequent allocations of powers and responsibilities associated with them, becomes a key issue of practice in participation, co-construction and governance.

### **Existing architectural discourses**

In the positivist practice of information systems design and management, there has developed the clear conception of a set of projections, views or conceptual frames within which a proposed system is specified. Each of these has a set of procedures, a logic and a calculus for analysis and composition. Conventionally the design process starts with the mapping or re-engineering of business processes in a definition of the proposed system. The language here is exclusively functional. Since the generation of data is an example of a function, the construction of data models, taxonomies and coding schemes, is also part of this process. Systems engineers have borrowed and bowdlerised the term “ontology” for a process which selects precisely those concepts that will count in an implementation. What is not in the ontology does not exist in the information system and, by implication, is not considered to be of significance in its domain of operation and interest.

In the second projection, functions are allocated to capabilities. What will be done by users at user interfaces and what will be performed by software algorithms is refined and a representation of the system called a deployment model is generated. It defines *where* all of the things specified in the functional projection or object model will happen and which systems resource will deliver them.

Finally, there is the issue of capacity, *how much* and *how quickly* the system will deliver its functionality. This capacity view is the third and final projection of the

---

<sup>4</sup> This is equivalent to the demand of the apocryphal French academic: “That’s all very well in practice, but where is your *theory*?”

system as defined by current rational design methodologies. All the concepts in this systems discourse are concrete and measurable, i.e. extensional; they are amenable to a scientific realist stance. More significantly, what counts in the situation has already been determined by the technologies and product specifications inscribed in a “solution language” which is brought to the process by the “solution provider” or, in the case of the NPfIT, constructed by the parties in a procurement process which was largely outside the purview of any care community itself.

When, as was the case in the NPfIT programme, the information and communications systems engineering paradigm is configured into a managerialist perspective it provides a basis and mechanisms for the imposition of a Fordist-Taylorist logic of production and control. The factory, where work is performed, is conceived of as a machine, the worker is automated to become a component of that machine and the objective of design is to make the desirable (i.e. profitable and efficient from a management perspective) inevitable and the undesirable, impossible.

The dilemma of the positivist systems engineering convention is that it rapidly becomes expressively inadequate when faced with the complex realities even of commerce and that this expressive inadequacy becomes acute and unsupportable when the “enterprise” that is being informatised is one of care rather than manufacture or commerce. Insisting that what is being supported is “clinical work” does not solve this problem and, when the desirable to be ensured is wellbeing and the undesirable, to be made impossible, is neglect and abuse, a world defined exclusively in terms of behaviour (i.e. extensions) loses its humanity.

There is a second equally mature if not quite so well formalised architectural discourse which deals precisely (and almost exclusively) with the thing that is missing in the discourse of information systems. This is the discourse of jurisprudence which is concerned with intentions. It comprises:

- A projection of roles and the conversational relationships between them. In this projection issues of conflict and synergy of interest in the composition of roles are reasoned about and the distributions of significance, mutuality and initiative are examined.
- An instrumental projection which identifies the abstract resources which will signify and record the traces of acts of creation, exchange and discharge of responsibilities.
- Act-flows as the sequences of interpretations that may be applied to a purposeful sequences of conversational, role based actions.

One way of explaining what goes on in this architectural discourse is to consider a cluedo question: “what makes the candlestick a murder weapon?” It is not merely the fact that Colonel Mustard bludgeoned Dr Black with it in the library, he might have been mad at the time or acting in self defence. What makes it an instrument of murder is an interpretation that his intentions were murderous by the jury in the context of a set of norms, laws and institutional practices – a court.

Now, many of the important issues in the delivery of care concern intentions: the way we interpret actions. Many of the things that doctors do to patients (particularly surgeons) have the characteristics of attacks when, in fact, they are acts of care so, if the architectural discourse concerning the informatisation and, by unavoidable association, the governance of systems of care is to be expressively adequate, then it is at least the case that the extensional and the intentional have to be brought into alignment in a coherent architectural discourse.

At this point we can make two observations:

1. Professional conversations between lawyers and information technologists are rare and seldom very productive at any fundamental level: there are all the usual inter-disciplinary barriers of experience, concepts, language and values.
2. The process of reasoning about the relationship between “act-flows” and work-flows (or actions) is, in fact, highly developed. It is called semiotics and is closely related to, or part of, what are referred to as the interpretive disciplines of social science in Greenhalgh et al.

So, in combining the projections of jurisprudence and of information systems and observing that semiotic processes provide the theoretical basis for understanding how behaviours acquire meanings and how meanings evolve in communities of shared language and interest, we can take a final step in the process of defining an architectural discourse of the socio-technical. This involves revisiting the process of systematisation itself and provides a further clarification of the relationships between the different academic disciplinary views.

### **The process of systematisation**

We start with the notion of a relationship between rhetoric – what was, for Plato, non philosophical and is for us, non-scientific discourse – and the mapping of the terms in that discourse onto things in the world which may be natural or constructed. This is, by definition, not science, the *effect* that is caused is an *affect* and we may call it art and craft or aesthetic. We do not dismiss it: there can be no leadership without rhetoric and leadership is an important element in all processes of organisational change and development. To be able to make a claim to be systematic, however, we must at least select certain concepts out of our discourse and apply them with consistency. This corresponds to qualitative science. Linnaeus, for example, systematises in terms of species and genus, and transforms the art and craft of the herbalist to the qualitative science of the botanist. We now know what counts as a buttercup and what counts as a daisy and, with this knowledge, we can in fact count and calculate. If it is the result of these calculations – a statistical analysis, for example – that is mapped onto the world, we have quantitative science.

The formalism that supports our quantitative science is that of the count itself, it is completely generic. If we select a formalism that relates to the specific conceptualisation of a domain and map its algebraic or logical structure back onto the world as an hypothesis to be tested by experiments, together with the instruments and procedures to pursue these tests, we have empirical science. Our

archetype here is Galileo with the hypothesis, expressible in a formula, that the acceleration due to gravity is constant together with small spheres and inclined planes as instruments of verification.

Finally when calculations are made on the basis of model specific formalisms and they are mapped back onto the world we have engineering. For example, we make calculations of static and dynamic stress, strain and resonance on a proposed mechanical structure as part of the design process and make the engineering assertion that the bridge will survive and be serviceable.

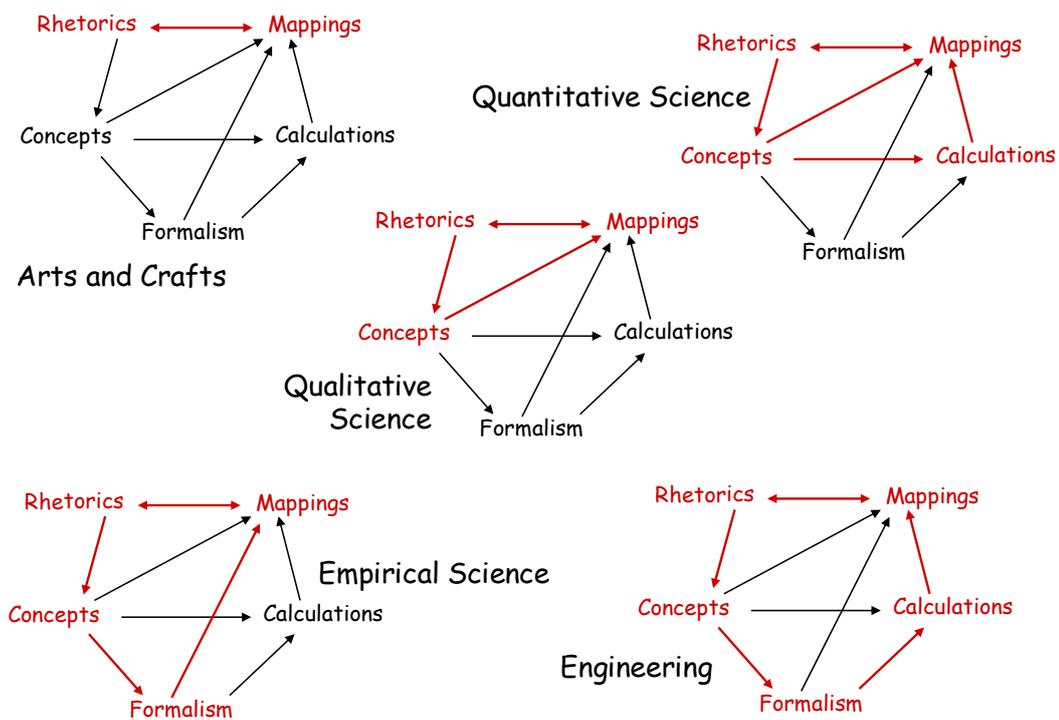


Figure 4

These ideas about systematic discourse are represented in the diagrams of Figure 4 which is, interestingly, an Escher-like example of itself. It is a conceptual model of systematisation processes which includes conceptualisation. It uses the simple formalism of a directed graph to specify the relationships between parts and the structure of a whole and provides an interesting rhetoric: all the different forms of humanities, sciences and engineering have a place in the architectural discourse of the socio-technical. It is, of course, nothing new, being simply another representation of Western, post enlightenment, modern thought about what has come to count, for us, as science.

We make one further (axiomatic) assertion that each of the projections or conceptual frames we have described as a part of the architectural discourse is the subject of the manifold of systematisation processes represented in Figure 4. and that this generates the conceptual map represented in Figure 5 in which the act and behaviour projections have been brought together into a single projection representing a set of agreed conventions and meanings or norms (our business processes).

Some aspects of the processes by which socio-technical systems come to be designed can now be seen in terms of trajectories within this discursive space which may result in the temporary splitting of the behaviour projection back into distinct act-flow work-flow representations to create new possibilities for meanings and interpretations through their modification, evolution and mutual remapping.

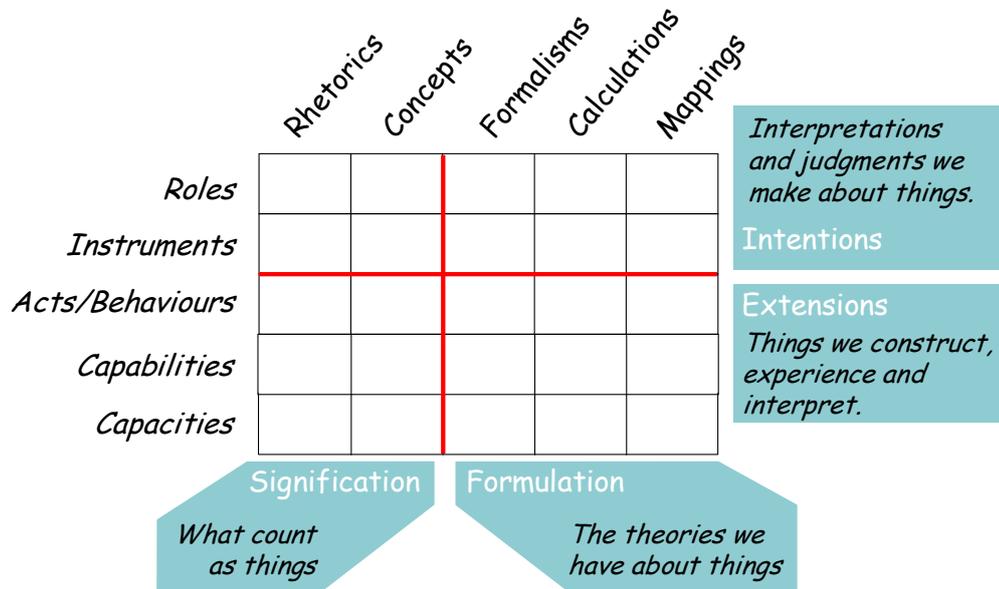


Figure 5

Two significant lines can be drawn on this map. The first is a horizontal one. Below this line we have extensions, that is to say all the concepts are concrete real-world things. Above the line we have intentional concepts, ideas and interpretations in people's heads. The second line that can be drawn is a vertical one. To the left we have processes of signification which decide what counts in the situation for those who are participating and have an interest. To the right of this line we have processes of formulation which develop the theories and logics of what is being signified.

### Co-production

One of the factors associated with current systems procurement practice is the use of the horizontal line as a demarcation of responsibilities. Systems providers work strictly below this line and assume that all work above the line has been completed. The input they receive as "requirements" is expected to be systematic and logical, free of conflict and contradictions. If this is not the case then the assumption is that management will exercise the power to resolve what is a defective situation. Our extension and reformulation of the architectural discourse of the socio-technical provides an alternative approach. If they are to be effective in making sense of, and delivering the aspirations of, political rhetoric signification activities, to the left of the line, must be participative, deliberative and co-productive both above and below the horizontal line; this is to say, what counts as both intentions and extensions must be open for negotiation in a

potentially transformative and innovatory processes, in the case of an EPR, of reshaping the coordination of clinical care. This may turn out to involve the re-mapping of old roles or the creation of new ones. It may involve the re-instrumentalisation of existing relationships by, for example, replacing paper with electronic means. This is doing familiar things in new ways. Alternatively, it may involve doing new things (i.e. new conversations and relationships) possibly with familiar resources. It is important that participants can maintain their bearings and understand what sort (or order) of change is being proposed and explored. The conceptual framework of the architectural discourse of the socio-technical provides a tool for this purpose. To the left of the line, in signification processes, technicians, designers, users, sponsors all must be empowered to be participants to make their contributions in the process and not divided into expert versus client relationships. To the right of the line, technical roles inform, support and respond to the emerging significations with analysis and design which is then re-submitted for sense making and signification in the evolution of a shared vision of a socio-technical system which is doing real specificatory and design work.

It is this sort of thing that happens, by accident or design, in the “small is beautiful” approach identified in some of the studies examined by Greenhalgh et al. But “small is beautiful” does not scale, by definition. If a systematic approach must take the care community as the “whole”, the unit of design and application, then it must also recognise that the environment (of a care community) is a population of other similar communities. Consideration must be given to the relationships that need to exist between them. This is the “we are not alone” principle which must be applied at all levels of architectural design of networked scalable systems. It is the antidote to the integrationist approach which produces the outcome that “large is inevitable” and, as a consequence, brittle, unmanageable and ultimately unfit for purpose.

Some examples of the practical use of the architectural discourse in health care settings might help here. Some years ago the concept of “nurse-practitioner” was introduced. At the time it sounded paradoxical and contradictory: nurses and practitioners were different people with different responsibilities and these very differences were fundamental to their professional identities. In order to make sense of the new term – in fact to give it meaning – a number of issues needed to be sorted out. For example, what conversations and relationships did the nurse-practitioner have with the other existing clinical roles? Was this role instrumentalised by the whole pharmacopoeia or by a sub-set? Where did the nurse-practitioner practice? What would the proportions of nurse verses doctor practitioners be in different contexts? All of these questions are situated in one or other of the projections and the architectural discourse framework not only serves to generate them but also indicates mutual relationships and consequences, progress and completion. “Nurse-practitioner” had to be defined as a socio-technical construct across all the projections and systematisation processes of the architectural discourse. The rhetoric of the “polyclinic” is another example of sense making of the socio-technical. Is it a hospital or a practice? What is its clinical coverage, scale and capacity? Which clinical and care

conversations and relationships does it support? As a vision of a proposed health care institution, it also was required to be defined as a socio-technical system.

In cases such as these, a term is used to connote or indicate a cluster of ideas as a proposal, a policy, an invention or discovery. For this to become an innovation (i.e. a social and physical reality) it must itself be systematised and incorporated into the wider socio-technical system in an agreed framework of practice and governance. In the case of the electronic patient record, we can not assume that this is merely a change of medium: from brown envelopes and shelves to databases and workstations. There are multiple existing records which have evolved to instrumentalise distinct clinical relationships and conversations. Primary records and acute records are different because they serve different purposes and hold different meanings. The task is not to substitute many records with one but to understand how the many distinct clinical roles and conversations need to interact so as to co-construct the required conversations and transactions of coordination and provide the information and communications services and capacities through which they can be put into practice.

### **The idea of infrastructure**

As part of informing the processes of sense making and co-production in the Durham and Darlington EHR project we have explained why the introduction of the principle of federation was needed. There is a second technical idea that which was required as part of the intervention and this was an elaboration of the concept of infrastructure. These together represent global requirements which do not naturally emerge from the consideration of local needs but which must be introduced into the co-productive process if its products are to be transferable and scalable.

Much has been written, forgotten and reinvented, about the notion of infrastructure and of infrastructural service. Here, first of all, we focus on the aspect of power and control. We will use the example of the telephone. In the early days of its development, after the public had got over the bizarre idea of talking, or rather shouting, at an electro-mechanical device, there was much concern about what precisely you could or could not say on the telephone. In modern terms, this was treating the telephone as an application, a system and tool that has all aspects of its use explicitly inscribed in its design. It took quite a while for society to realise that the telephone, as an infrastructural service, represented a demarcation of responsibility. The duty of the service provider was to deploy the capacity to create connections on demand and to deliver the traffic and this was associated with the right to meter and charge for use – a service relationship. What the subscriber said, the use that was made of the service, was his or her responsibility only. There is more to the concept of infrastructure than this demarcation of rights and responsibilities. Sharing and reuse, for example, are essential features which deliver both the economies and network benefits of infrastructuralisation. We should note that, in the case of infrastructure for the support of public service, this reuse has a special significance because it must operate across successive policies. It is the nature of public service to have to respond to a constant barrage of politically initiated change – the generation of

these changes is, after all, is the purpose of politicians and of the political process. Investment in public service infrastructure, like a Civil Service, must be independent of, as well as adaptable and responsive to, these changes. These investments should not take the form of applications designed to implement what happens to be the current policy and which will require reimplementations for the next.

In this approach, changing priorities and the other dimensions of evolution and development of the service are the domain of governance and it is a requirement on infrastructure that it provides service to support governance rather than mechanisms to enforce policy. Further, the overall complexity of the environment has been reduced by the demarcation between structure and infrastructure and this can be recursively applied, that is to say, each layer of infrastructure is supported by its infrastructure until we come down to basic shared physical resources.

### **Concluding remarks**

The Durham and Darlington EHR project represented a serious attempt to deliver an intervention that articulated the complexity of the co-ordination of clinical care in terms of the five projections of a socio-technical system and to engage the different disciplines in a community of care in co-productive sense making work about them. This involved offering certain technical concepts for adoption and appropriation and, as a consequence of this approach, the constraints of the narrow language of systems supply were relaxed, new terms came into use in the community which was a sign of their sense making and learning. “Acts of publication” rather than access control, “federation” rather than integration and “infrastructural services” rather than applications were some of the more notable examples. In describing the underlying theory behind this intervention, we have attempted to articulate a meta-discourse which is not “meta” in relation to any one of the specific scientific genres examined by Greenhalgh et al. but is “meta” in relation to several of them to provide the theoretical underpinning for their alignment and combination in a learning and development process.

If we were to attempt to summarise, under the headings provided by Greenhalgh et al., the philosophical basis of the proposed (neo?) socio-technical approach, we might suggest the following, or, rather, put down some markers in the ground and indicators of directions for the discussion:

**Ontology:** We assume an explicitly psychophysical dualist approach, The socio-technical world is comprised of intentions and extensions and the semiotic relationships that are co-constructed between them. This has its roots in Thomistic intentionality (and thence back to Plato). This commitment is not on the basis that we believe it represents some ultimate truth but because it represents the habitual way we, in our society, think: it is our culture and does the job<sup>5</sup>. As G.K. Chesterton has it: “the Thomist philosophy is nearer than most

---

<sup>5</sup> The “job” here is to be clear about the difference between phenomena such as loving care as opposed to abuse or between surgery and mutilation, thus providing the basis for the “logics of care”.

philosophies to the mind of the man in the street” and our health care system and other public services should, therefore, have this naturalistic metaphysic inscribed in it rather than attempts at revision.

This (conventional) ontological commitment is further underpinned by Badiou’s removal of ontology (in a new, stricter sense of the term) from metaphysics and his situating it in the mathematics of Cantoran set theory, providing a formal, theoretical foundation for the processes of sense making, innovation and the production of truth. (Cf. *Number and Numbers, Logics of worlds*)

**Epistemology:** Here we (more or less) subscribe to the “epistemic reflexivity” of Pierre Bourdieu (Cf. *Logic of Practice*) relating his “second step back” to the notion of cybernetic orders and deuterio-learning in Gregory Bateson. (Cf. *Steps to an ecology of mind*)

**Role:** The processes of change, innovation and development generate three sets of roles: the executive-manager at the first order, the innovator-entrepreneur at the second order and the “philosopher-therapist” (aka gardener ) at the third (deutero sic.) order. The purpose of action research or intervention at the level of this third order is to nurture, encourage and facilitate constructive, informed and appropriate transitions between the first order management of risk in the delivery of plans and second order action of sense making, languaging and innovating, among the stake holders and co-producers of socio-technical systems.

**Methodology:** Our commitment is to mimesis – showing not telling; windowing and mirroring. There are two aspects to the methodology of a third order intervention: Firstly ethnographic approaches provide grounding in the real world experience of participating co-producers which is offered as affirmation and also as provocation to mutual sense making and engagement. Secondly, the ensuing explorations and discussions of possibilities and proposals (significations) are reflected back to the co-producers but reorganised and re-structured through the prism of the architectural projections. The appropriation and elaboration of this material by them and supported by formulation and design proposals from different technical perspectives, evolves into the specification of the shared vision.

**Axiology:** Innovation and growth in socio-technical systems can only be the outcome of co-production. Such “systems” i.e. shared visions, inevitably go feral on implementation and deployment, they become part of the hyper-complexity of the real. The continuing and unending processes of sense-making and re-systematisation i.e. governance, must also be participative and co-productive if it is to be ultimately sustainable. The result is (must be) at best agonistic and at worst, conflictual. When, however, it becomes an imposition of power, it also becomes self-defeating.

Eight years after the Durham and Darlington EHR project, much has changed but non of the change represents a simplification of the challenges of supporting caring and developmental services with information and communication technologies and infrastructure. In the NHS, significant progress has been made in the deployment of infrastructural capacity and capabilities. The technologies, products and services have been deployed are precisely those that we considered in 2002, the ones that were, and still are, available. The problem is not to invent

new ones but to develop new thinking and language about how they are shaped, appropriated and governed. And this problem is becoming more urgent now that the immediate discussion is no longer confined to the contexts of clinical care but must also engage with social care and education.