Socio-Technical Structures,
the Scope of Informatics and Hodges' model

Peter Jones

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Abstract

This chapter explores the potential of a conceptual framework – Hodges' model – as a socio-technical structure of relevance to nursing informatics theory and practice. The model can be applied universally by virtue of its **structure** and the content which it encompasses. In apprehending this submission readers will be able to **draw**, **describe** and **explain** the scope of Hodges' model within contemporary health care contexts and the wider global issues presented by the 21st century that influence and shape nursing informatics. Critically, the reader will also gain insight into how socio-technical structures can facilitate cross fertilization of clinical and informatics theory and practice; drawing attention to *information* as a concept that provides a bridge between socio-technical disciplines. The paper will review the socio-technical literature and venture definitions of socio-technical structures related to Hodges' model and advocate the need for sociopolitical-technical structures. Finally, the paper asks and responds to the tension within *nursing* in terms of objective (physical) and subjective (emotional) health and the subsequent tensions to be found within *nursing informatics*?

Introduction

Data is a plural noun. Technology has plural - compound uses. The word *technology* is somewhat unique among the family of '-ologies'. The word is applied as a noun, adjective and used in everyday conversation and media to an extent that no other -ology can match. The word refers of course, not only to the study of the technical, but a phenomenon: a ubiquitous, pervasive presence in our lives. The extent to which we take technology for granted, is evident in our missing this other meaning. How often do we refer to: *This biology is playing up* (which may well be the case!)? *Geology never lasts very long! Sociology just adds to the noise*. Maths and English [all languages] are similar in not only referring to the study of a subject area, but being applied in day-to-day life – essential forms of literacy. Depending on definitions *technology* is of course an adjunct to literacy and expression, from the caves of Lascaux to to virtual reality communities. It is only 'now' that *technology* is considered as the latest – the third *ology* - to become ubiquitous.

Technology presents challenges by virtue of its ability to liberate or constrain. While this can confuse and disorientate us, technology also offers opportunities for discovery and integration. Viewed through the compound eye of Hodges' model (see below), technology can liberate by creating fractures of the model's axes allowing leakage, seepage of meaning. We can look upon the seepage as soap that assists conceptual hygiene, as we make sense of technology across several knowledge domains. This affords us the opportunity to break the constraints of time, distance, culture (with translation) and intra-interdisciplinary theory and practice. If however, technology is poorly managed and implemented it can again in terms of Hodges' model constrain the movement of information and meaning to just one or two knowledge domains? When allied with language, technology paradoxically supports categorisation which negatively can depersonalise and alienate human actors. Alternately, though positive effects are witnessed in the social networking phenomena with its tags and labels.

From a socio-technical perspective technologies ability to fracture is not catastrophic, but is a circumstance that carries an ecological impact. It helps us to conjoin what are usually disparate disciplines of theory, practice and policy and also highlights the need for a philosophy of technology. Elsewhere, I discuss how Michel Serres, the French philosopher, employs the ancient god *Hermes* as a trope for explain technology and communication. Hermes is well suited to this task being the philosopher of plural spaces. H2cm constitutes a plural - pantological space (Jones, 2008). Perhaps this plurality explains the extended significance of technology in our language and professional practice. Historically,

our culture is built on layers of technology, fire, the wheel, agricultural tools and weapons to the rapid lifecycle rate experienced today.

This chapter begins with a brief introduction to Hodges' model, followed by definitions of socio-technical structure; then several key sources in the socio-technical literature are introduced leading to the formulation of socio-technical structures within Hodges' model followed by closing discussion. If a paper is afforded one gross assumption, then at this point let me suggest that nurses and the majority of other health and social care practitioners are either suspicious of ICT due to previous experiences at work, or they are pragmatic in their expectations. Pragmatic in that they recognise the inevitability that in the 21st century informatics will figure in their working lives, just as it does in their personal lives. This paper seeks to highlight how nursing informatics can be informed by models of nursing and how the clinical field can contribute to informatics, a connection utilising Hodges' model and the concept of *information*.

Hodges' Model: A Cognitive Periplus for Life-Long Learning

Developed in the UK during the early 1980s, Hodges' model is a conceptual framework that is person-centred and situation based. In structure it combines two axes to create four care (knowledge) domains (figures 1 and 2). Academics and practitioners in many fields create models that help support theory and practice (Wilber, 2000). Models act as a memory jogger and guide. In health care generic models can encourage holistic practice directing the user to consider the patient as a whole person and not merely as a diagnosis derived from physical investigations? Exposure of h2cm is limited to a small (yet growing) cadre of practitioners; several published articles (Hinchcliffe, 1989; Adams, 1987; Jones 2004a, b). In addition to a website (Jones, 1998) a blog and podcast were published in 2006. The most recent paper relates h2cm and work of the French philosopher Michel Serres to social informatics (Jones, 2008).

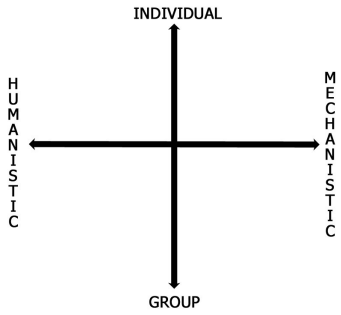


Figure 1.

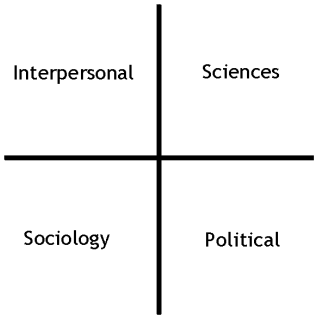


Figure 2.

The best way to explain h2cm is to review the questions Hodges originally posed. To begin, who are the recipients of care? Well, first and foremost individuals of all ages, races and creed, but also groups of people, families, communities and populations. Then Hodges asked: what types of activities - tasks, duties, and treatments - do nurses carry out? They must always act professionally, but frequently according to strict rules and policies, their actions often dictated by specific treatments including drugs, investigations, and minor surgery. Nurses do many things by routine according to precise procedures, rather like the stereotypical matron with machine-like efficiency? If these actions are classed as mechanistic, they contrast with times when healthcare workers give of themselves to reassure, comfort, develop rapport and engage therapeutically. This is opposite to mechanistic tasks and is described as humanistic; what the public usually think of as the *caring* nurse. In use this framework prompts the user to consider four major subject headings or care domains of knowledge. Namely, what knowledge is needed to care for individuals - groups and undertake humanistic - mechanistic activities? Through these questions Hodges' derived the model depicted above.

Initial study of h2cm on the website has related Hodges' model to the multicontextual nature of health, informatics, consilience (Wilson, 1998), interdisciplinarity, and visualization. H2cm says nothing about the study of knowledge, but a great deal about the nature of knowledge is implied in figures 1 and 2. This prompted two web pages devoted to the structural and theoretical assumptions of h2cm (Jones, 2000a, b.). Although the axes of h2cm are dichotomous, they also represent continua. This duality is important as an individual's mental health status is situated on a continuum spanning *excellent* to *extremely unwell*. There are various states in-between affected by an individual's beliefs, response to

stress, coping strategies, epigenetic and other influences. H2cm was created to meet four educational and service-side objectives:

1. To produce a curriculum development tool.
2. Help ensure holistic assessment and evaluation.
3. To support reflective practice.
4. To reduce the theory-practice gap.

Since h2cm's formulation these objectives have grown in relevance. The 1980s may seem remote, but these problems are far from archaic as expansion of points 1-4 reveals. Student life is preparation for life-long learning. Curricula are under constant pressure. Despite decades of policy declarations, truly holistic care (combining physical, mental and pastoral care) remains elusive. The concept and practice of reflection swings like a metronome, one second seemingly de rigour, the next moment the subject of web based polls. H2cm can be used in interviews, outlining discussion and actions to pursue, an agenda - agreed and shared at the end of a session. The model is equally at home on paper, blackboard, flipchart and interactive whiteboard. Finally, technology is often seen as a way to make knowledge available to all practitioners; the means to bridge theory-practice gap through activities such as e-learning, governance and knowledge management.

The model's expressive power arises from its structure; a conceptual space created by diagrammatic representation of four pivotal concepts – *individual*, *group*, *humanistic* and *mechanistic*. This construct leads to a conceptual framework with generic and specific, broad and detailed capacities. The conceptual dynamics of the model can be represented as a horse and litter. The horse and its direction of travel constitutes the situation – context. Hodges' model is the litter, a framework which can carry our ideas, concepts, problems, issues AND solutions. The challenge follows then from the fact that health and social care is multi-contextual, multiaxial. One horse and litter is simply not enough. The horse needs to travel in several directions at once.

What Hodges' model encourages and provides in one context is vicarious travel. The axes within h2cm create a cognitive space; a third axis projecting through the page can represent history; be that an educational, health or other 'career'. It is ironic, that an act of partition can simultaneously represent reductionism and holism. Reductionism has a pivotal role to play, which h2cm acknowledges in the sciences domain. What h2cm can do is prompt the expert (single domain) practitioner that there are three other pages to reflect and write upon. In total with the addition of faith h2cm could also be said to represent the spiritual domain.

Definitions: What do we mean by 'socio-technical' and 'socio-technical structure'?

Nursing informatics can be considered as a socio-technical structure. The multi-axial nature of health has been recognised for millennia from the fundamental dichotomy of life-death to more recent pre-occupations of supply-demand, person-centred services, and public-private. There are more specific axes instantiated in terminology systems such as SNOMED CT; for example, *diseases, drugs, function, procedure* and *event* (Melton, et al.; 2006). Relating this to h2cm, a dichotomy such as subjective - objective can be defined as spanning and linking all four care domains. This may seem so general as to be useless as a meaningful definition, but a definition of *socio-technical structure* should demarcate the space it inhabits whether physical or conceptual.

Defining these terms is difficult and what follows will not find agreement with all. … For all that globalisation says about the world today, our appreciation of the world remains less than wholly. The world is constantly partitioned: North-South - East-West. C.P. Snow's seminal book *Two Cultures* (1959) noted the fracture within the pursuit of knowledge; with the existence of two camps the *sciences* and the *humanities* that were divorced and non-communicative. This dichotomy is symptomatic of a profound tendency for human beings to polarise, as evinced in the psychological literature through Tomkins' *Polarity theory (*Stone & Schaffner; 1997). As all students quickly realise, a key part of learning entails unpacking polarities, dichotomies and axes. It could be argued that our capacity to dichotomize in situations assures the creation of socio-technical structures even if this *ticket to enlightenment* is only 'half-used'. After the finale many ticket stubs litter the ground. In informatics the need to tackle the skills divide provoked the quest for hybrid managers; senior personnel gifted with management acumen and information skills to deliver (socio-technical) change in the new organisation (Earl & Skyrme, 1990). The objective and subjective are clearly germane to health as Sullivan (2003) argues:

If medicine is now to aim for patient-centred outcomes, it needs a new object of study. Outcomes research is as yet undecided if this will be the patient's health or the patient's life. Each step in this direction brings medicine closer to pursuing "what really matters to patients" and also brings greater scientific, ethical and social complexity. Subjective health is more meaningful to patients than objective health measures … p.1602

If I ask you the reader to place, first the *social* on Hodges' model followed by the *technical*, you quickly realise looking at the structure of Hodges' model that it provides an immediate high level template and prescription for assessment, planning, intervention and evaluation. The *social* obviously belongs to the humanistic left-hand side of the model, while the *technical* is to the right – the mechanistic. Hodges' model can provide a conceptual and propositional (Jones, 2008) bridge from the socio-technical to health and social care as shown in figure 3.

Figure 3 "Socio–technical" in h2cm east-west

Socio-			technical
	intrapersonal	sciences	
	sociology	political	

Our definitions – working or otherwise - must be cognisant of history. The *socio-technical* movement began in the late 1940s, giving rise to the Tavistock Institute (Mumford, 1983). After the Second World War, science and the earliest modern computers had proved themselves, but in the search for increased production and commercial advantage it became apparent that technical solutions alone do not guarantee success. If attempts to apply technology are not managed properly with the impact considered holistically, then technical solutions can become part of the problem. At the Tavistock Institute a series of field studies provided the first major contributions to the theory of socio-technical design with research in the British coal industry (Mumford, 1983).

Definitions: 'Socio-technical'

From the outset it is important to differentiate between *socio-technical* as applied within the informatics contexts of information systems design, software development plus project management; and definitions that operate in organisational management. So, for the purposes of this paper *socio-technical* is defined as the combination of two types of knowledge (objective and subjective) comprised of people, artefacts, a retinue of concepts and inconstant fields of human practice notably management, finance and organisation. Whether consciously acknowledged or not, this combination may be coherent or incoherent, depending upon the structures (see below) used to integrate and manage conceptually proximate and disparate parts.

'Socio-technical structure'

Building on the definition of socio-technical, the structural aspect is a hybrid, an in-situ analogue-digital creation made up of physical (devices/infrastructure), concepts, human and political ingredients based on various theoretical conceptual schemas and methodologies. Socio-technical structures are multiple and composite in that they span human-machine-organisational boundaries: subject to mathematics and nebulosity. They are transient, their existence and timescales ranging across the human-machine interface, database, available network configuration, hardware and software life-cycle management, organisational and governmental longevity. Socio-technical structures are curricula for change, especially in the form of Masters in Informatics and MBA courses. The clinical-education partnership necessarily entails socio-technical structures from the research councils - Economic and Social Research Council (ESRC), Engineering and Physical Sciences Research Council (EPSRC), the JANET-NHS partnership through to group and one-to-one e-supervision. Education and training (lifelong learning and business change) act as a transport system for ideas that test the business, social, finance and infotech ideologies of the day. Socio-technical structures must also be defined economically, key drivers of creativity and innovation. The result is an amalgam comprised of humanistic and mechanistic systems, software (infrastructure), policy and social groupings. The NHS boasts a prime example (although with development ongoing the talk is whispered despite the strides in progress) in the National Programme for Information Technology, Connecting for Health.

'Socio-political-technical'

In formulating h2cm, Hodges' inclusion of the political domain is pivotal. In any intra-interpersonal - social scenario, politics holds sway. Not necessarily in that formal legal, party political sense, but an informal socially conveyed politics encompassing for example; power relations, gender, choice, consent and autonomy. Globally - creativity, innovation and leadership (design) are no longer relatives *twice removed* from enterprise whether social, technical or socio-technical. Hodges' model can represent through its structure the need for rules in the organisation of the many. For at least two decades the debate about technology shaping society versus society shaping technology has been ongoing (Bijker, et al.; 1987): informal and formal politics in action.

Background: Existing socio-technical structures and methods

This section scratches the pages of the socio-technical literature by introducing two seminal contributions and briefly references other sources. The two authors discussed are Mumford (1983) in the socio-technical sense and Giddens (1984) who is more generic socially and organisational oriented. Enid Mumford created ETHICS, a systems design methodology: *Effective Technical and Human Implementation of Computer-based Systems*. The need for ETHICS is to help manage change with three objectives. First, ETHICS stresses that the future users of computer systems, whether directly or indirectly involved should play a major part in designing these systems. User involvement is closely related to subsequent job satisfaction and efficiency gains and hence the realization of benefits. The users of systems are credited as experts; if this knowledge and experience is recognized and utilized then job satisfaction gains are likely as the users are active agents in the change process and not passive. There is an interesting correspondence here with the continuing emphasis on patients and carers being acknowledged as experts in their care assessment, management and evaluation.

The second objective focuses on the human – behavioural response to change. It is important that specific job satisfaction objectives are factored into the design from the outset and not left to chance, lost amid technical specifications and objectives. In this way potential negative change impacting the quality of work life can be anticipated and avoided or at least ameliorated. Technology has frequently been associated with deskilling and of course the loss of traditional jobs. The prospect of technical, management led change can cause consternation in the user community. If alienated employees may be absent, seek alternate employment, and overall be less productive.

ETHICS is not restricted to the computer system; the third objective highlights the need for a new computer system to be 'surrounded by a compatible, well functioning organizational system' (Mumford, 1983). Design must be viewed globally as a whole. The technical design is just one part of a very complex design process that must also incorporate the details of human-machine interaction; what would be called gap analysis, the differences in existing processes and proposed new processes and procedures. In addition, as per objectives one and two, individual jobs and workgroup activities must be reviewed; how are existing roles and relationships altered and newly defined? What new management arrangements are needed, since (middle) management is rarely untouched?

Giddens' structuration theory seeks to integrate structure and agency. Giddens defines structuration as "the structuring of social relations across time and space, in virtue of the duality of structure" (*Constitution*, p. 376). The duality arises from Giddens' emphasis on social action as being comprised of human agents and social structures:

The basic domain of study of the social sciences, according to the theory of structuration, is neither the experience of the individual actor, nor the existence of any form of social totality, but social practices ordered across space and time. Human social activities, like some self-reproducing items in nature, are recursive. That is to say, they are not brought into being by social actors but continually recreated by them via the very means whereby they express themselves as actors. In and through their activities agents reproduce the conditions that make these activities possible. (Constitution, p. 2).

This definition allows Giddens to traverse the human individual experience through to the macro level structures of institutions and organisations. A focus purely centred on the technical ignores people as knowledgeable agents; people must not be lost amid objectivism. The links between the thought of Mumford and Giddens are clear. The items that follow are mentioned briefly, they are more specific with a technical bias focusing on IT services, customer services and project management. The complexity of software and hence software development has led to the production and ongoing refinement of tools and frameworks to assure safe, fit for purpose, reliable and efficient code on the one hand and the effective

management of a project on the other, such that risk reduction ensures project success as in the deployment of a new (or updated) information system.

Atkinson's (2001) Soft Information Systems and Technologies Methodology (SISTeM) provides a contingency approach to integrated decision making and development. SISTeM draws upon actor network theory, enabling integrated networks of humans and non-humans. Launched in 1996 PRINCE2 - PRojects IN Controlled Environments is a process-based method for effective project management. PRINCE2 is an Open Source international de facto standard used extensively by the UK Government in the public and a skill also sought in the private sector. The history of PRINCE can be traced back to 1975. According to Wikipedia *Structured Systems Analysis and Design Method* (SSADM) is a systems approach to the analysis and design of information systems. In SSADM information systems design is derived through a waterfall method and is seen as a rigorous document-led approach.

PRINCE2 and SSADM are being challenged by more socially-iterative methods of what is called Rapid Application Development (RAD) and Agile Software Development (Thomas, et al.; 2007). *IT Infrastructure Library* (ITIL) refers to a series of five volumes that describe a lifecycle framework for IT Service Management: the volumes include Service Strategy, Service Design, Service Transition, Service Operation and Continual Service Improvement. ITIL can be adapted to various business settings (e.g. telecommunications, help-desk, information system customer services) the framework defines how Service Management is applied within an organisation and is associated with the international standard - ISO 20000. There are many other tools including the *SocioTechnical Framework* (links to this and other methods follows the references).

Socio-technical structures of h2cm and nursing informatics: The 4Ps

The previous discussion and citations highlight that existing socio-technical structures are employed to help realise effective information systems. The idealised objectives are systems that can facilitate fluid organisational change through the efficient utilisation (dissemination, reuse and refinement) of skills and knowledge. Essentially, this same motivation applies to h2cm, but in a caring context. The fusion of h2cm and the socio-technical depends upon either:

1. Users bring their existing socio-technical structures (as above) and deploy them through h2cm, confirming a high-level role for Hodges' model or;
2. Researchers study Hodges' model and the extent to which it can support socio-technical perspectives within customary information systems environments. Novel formulations between informatics disciplines or other areas tainted (as are most) by informatics (office applications) may be revealed by this more powerful socio-technical light.

Figure 4 below extends figure 3 through the 4Ps: PROCESS; PURPOSE; POLICY and PRACTICE each is associated with a knowledge domain.

Figure 4 Hodges' model and the 4P's

PURPOSE	PROCESS
PRACTICE	POLICY

PURPOSE

To be at cross-purposes is a sorry state; it variously denotes disarray, uncertainty, disorganisation and confusion. The NHS finds itself at cross-purposes; the commonly cited anecdote that 'NHS' really stands for *National Ill-Health Service* bears repeating here. Given our propensity to polarise, the profusion of dichotomies in health care and the regular cycles of re-organisation, it is strange that these two world's of disease and health promotion still wear the same uniform. This state of affairs has not gone unnoticed amid health-social care structural and policy review. PURPOSE lies at the heart of socio-technical structures as a fusion of people (as individuals and groups), skills, knowledge, function and form. Key social structures are obviously embedded in the humanistic domains.

For the individual, motivation is a primary psychological factor. Having a sense of PURPOSE is essential in terms of response to a given situation and any subsequent problems solving. Purpose matters

from the level of technical with local project planning and management to National engagement in informatics programmes. Whilst organisations are primarily group centred (production, payroll, sickness) planning and change must be framed in individual terms. Despite the replacement of the in-tray with the inbox, the messages for the many may be lost on the one. People are sense making machines. They need to be fed with a sense of purpose. Not programmed. Nursing should not be purely task-oriented; nursing is about people not (just) PROCESS. While we often speak of care pathways and patient journeys (nursing) informatics entails multiple pathways for individual practitioners; all require socio-technical structures to aid travel to information resources, user interface navigation, user engagement as in Agile software development.

PRACTICE

If clinically, informatics is seen as little more than a management abacus, then the user's sense of purpose will be reduced to that of a *bean counter*. The much vaunted aim of personalised care then becomes nothing more than numbers on paper related to serious untoward incidents, the number of complaints and similar data. Tasks have been viewed pejoratively in the past within nursing, but *tasks are* an essential consequence of time and currency of description. Tasks can readily be quantified and they are a vital part of the totality of care and informatics. In software development approaches such as *computation, coordination, configuration* [CCC] (El-Hassen and Fiadeiro; 2007) and *models, views and controllers* [MVC] (Thomas, et al., 2007) just what is it that needs coordinating and configuring? For staff to be motivated and have a sense of purpose, qualitative considerations must be brought into play. Care is always situated; priorities, education and training, the environment and technology and much more all affect PRACTICE. In making these distinctions this is not to divorce PURPOSE and PRACTICE from the SCIENTIFIC and POLITICAL domains. The 4Ps are interdependent. They can support or hinder the learning organisation. Effective socio-technical structures must create and respond to change; producing improvement through data-to-knowledge transformation that delivers meaning at all levels. Meaning is nothing if not disseminated. There is an acute issue in nursing, that of ensuring that user engagement:

- actually takes place and is actively pursued by project leads and developers;
- is recognised and valued by nursing managers;
- provision is made by senior managers to allow clinical users time-out to engage with backfill of posts if needed;

It is at this crucial juncture that the political dependencies in socio-technical structures become apparent. For evidence based care to be embedded in clinical practice, the benefits of access to geographic datasets and census data must not be restricted to higher level management-commissioner reporting. Wards and other services should be aware of their ongoing service profiles and trends: who is walking through the door and who (being well or undiagnosed) is not? Nurses also need socio-technical structures that support them in asking questions about their individual case-workloads.

PROCESS

Whether sequential or parallel, PROCESSES are first and foremost grounded in the SCIENCES domain. Although PROCESS may have something to say about delivery of narrative, it seems reasonable to declare that what narrative is to the SOCIOLOGICAL domain, so PROCESS is to the SCIENTIFIC? In socio-technical structures however, health care is about PEOPLE and PROCESS. The debacle in November 2007 with the merger of HM Revenue and Customs and loss of the personal data of millions of UK citizens is a stark reminder of the dependencies between PROCESS and PEOPLE. The advent of the nursing process, with its 4-6 iterative stages (assessment; diagnosis; planning; implementation and evaluation) saw some nurses concerned that patients were literally being 'processed'.

PROCESS in informatics now has a socio-technical home in clinical practice through role based access and control [RBAC] (El-Hassen and Fiadeiro; 2007), as deployed in the UK's National Programme for Information Technology. Now *roles* take on an extended socio-technical meaning within the organisation. Roles are also of import in gap analysis, a key activity completed in the preparation, roll-out and review of new systems. What are the existing processes? Are there any 'show-stoppers', new processes that do not support vital tasks, for example, specific reporting requirements or referral pathway events?

A beginner's guide to IT might include a description of *what computers do best*. Computers excel in their number crunching abilities. It is their capacity to transform processes that makes them so powerful. Central to socio-technical structures is their nature and permanence. Are they static or dynamic? Like web

site content, file structures, databases, ontology's and interfaces, our socio-technical structures should be capable of transformation according to the context-situation. As far as granularity is concerned Hodges' model wants it all ways. We need stepping stones in order to navigate our situated-problem spaces. For all its structural symmetry Hodges' model can provide matching or non-matching sets of stones. If necessary we can break step; tentative in how we proceed. Or, take a giant leap into the unknown. Our steps can be disjoint, chaotic even; varying in scale from conceptual nuggets, to community and continental dimensions that are needed to take in the care dimensions of interpersonal space, global health and community-urban informatics.

POLICY

Figure 3 showed socio-technical as a vertical bisection of h2cm. Is there a horizontal form as per figure 5?

Figure 5 "Socio–technical" in h2cm: north-south

technical

interpersonal	sciences
sociology	political

socio-

In the same way that the individual precedes the group as the focus within Hodges' model, so too for the *technical* which can also be said to occupy the INTRA-INTERPERSONAL and SCIENCES domains. Distributed social networks are a product of devices and other technologies that are designed and used by individual users. It follows then that the *socio* component spans the SOCIOLOGY and POLITICAL domains. This is why the construct of socio-political-technical previously mentioned is needed. PROCESS is found in the SCIENCES, but is enacted (or not!) in the humanistic domains. A further justification of the need to add politics to our socio-technical definitions could rest solely on standards: and information standards in particular. Technical standards provide the intelligent glue that holds the structures together and releases them appropriately. Standards of course are imbued within professional practice. Information standards are critical in assuring the quality of data and safety of the public. When standards are truly effective they are transparent.

Health policy is critical given the time frames within which it must operate across personal, local, national and international boundaries. It is also *specialised* as a discipline and *special* in that it responds to and is also a driver for PROCESS, PURPOSE and PRACTICE. POLICY is important in our socio-technical structure for two reasons:

1. Policy frequently suffers one of two extremes, being either:
   a) Not factored into the scheme of things as in "*joined up policy*", or alternately
   b) The policy is expressed in 'blunderbuss form' to the detriment of the other Ps.
2. Now ICT can help ensure that policy can deliver and be translated and transformed across the domains and hence the other Ps.

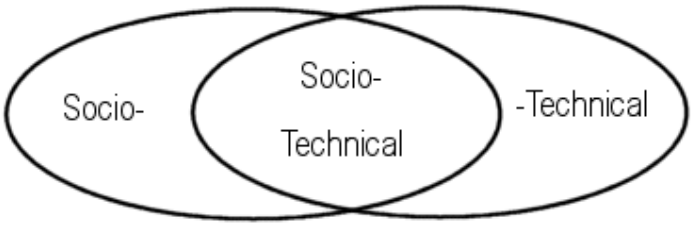
While both points need to be qualified #2 can be readily appreciated as the four Ps create expectations on both sides of the socio-technical framework. Informatics is commonly posited as the way to enhance education, public involvement in service management and health education. Delivery often falls short, hence the need to include, listen and integrate the 4Ps. A frequent difficulty is translating policy into practice. Hodges' model identifies three possible routes, each with its unique pros and cons. Direct from the political domain, computer mediated from SCIENCES (technology) through individual experience (INTRAPERSONAL) to the SOCIOLOGICAL domain and actual PRACTICE.

So, to conclude the 4Ps we tend to think of the parts-whole debate as intimately connected with reductionist SCIENCES – PROCESSES. In grasping the 4Ps, perhaps there is a need to consider mereology, the study of whole-part relations, across all the h2cm knowledge domains? Perhaps, a key to fully apprehending socio-technical structures is to treat them as organic and study their morphology (Bortoft, 1996)? We need new ways of seeing. Before there is a vision we need to envision.

A world of two halves or four quarters and enforced relations

Figures 3, 4 and 5 maintain the two distinct socio-technical camps. A more accurate (and rather obvious) depiction is that of a subset combining both social and technical factors as in figure 6.

Figure 6 Socio-technical as Venn diagram

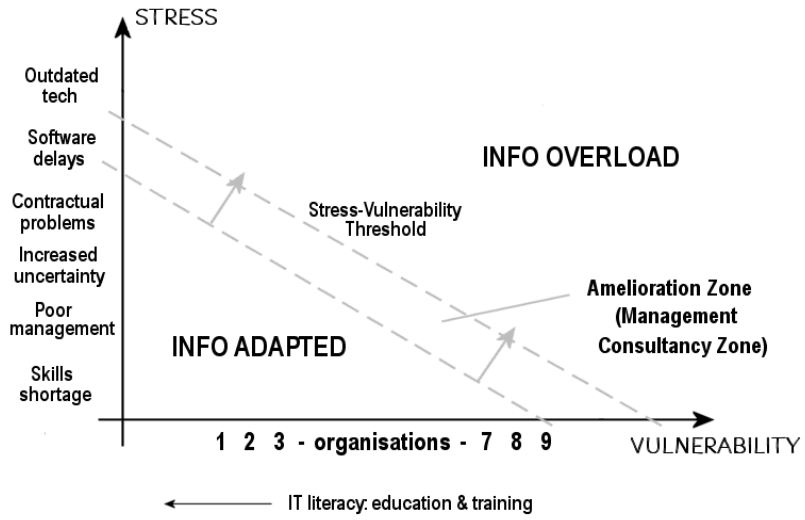


To contemplate the socio-technical is to contemplate a world of knowledge, experience and thought that is so obviously divided. I have adopted the convention of the hyphen, inspired by the work of Serres (1995), plus the nexus of Hodges' model and because small things can denote large. Let us ask *the* question then: how hard does that hyphen have to work? Is the union forced and the two worlds produce seismic waves; or is the union one of ready accommodation with a regulated need to re-focus eased by artifice on both sides? Perhaps, the hyphen is not as passive as may first appear? It makes it possible insofar as Hodges model is concerned to use our imagination and travel between the *social* and the *technical*. At times it does appear we are dealing purely with a sociological agenda, at other times technical. The hyphen becomes a switch either analogue or digital seeing the technical from an analogue perspective and vice-versa; facilitating inclusion as recognised above in the socio-political-technical.

The hyphen can act like the lunar terminator (the dividing margin between night and day), waxing and waning according to context. Lunar observers recognise that the terminator is where shadows are to be found, providing contrast more detail. The full moon [TECHNICAL] brings illumination for focused action, but the glare (of Wilson's 'white heat') can be blinding. The new moon [SOCIAL] promotes a need for collective safety, reflection and planning; while the half moon relates to the socio-technical in balance is a time for connection, creativity and fusion. It may seem strange that an object of myth can feature within informatics. In truth myth must have a place in the *socio*-technical. Just as circuit boards are the substrate for technology; so myth is the substrate for society and history. People rarely see the last quarter they are usually asleep dreaming. Our vision though is still subject to the vagaries of the weather. Above the clouds the source of the moon's illumination is a constant: whole.

One of the problems in melding together and conceptually sustaining s-t structures is a lack of unifying concepts. *Information* is I believe the concept of choice. If *information* is not the logical choice, then it is surely *the* holistic candidate? Informatics might provide the basis for a foundation that is not only flexible, multi or non-contextual, but that can not only operate at the required levels of description, but across them: for example: machine code – public mental health strategy; information strategy - information prescription; ontology – patient advice. Nursing informatics practitioners readily embrace the vocabulary and techniques of the informatics world. They can also utilise and champion tools developed in health care that can provide the bracing to reinforce the integrity, resilience, longevity and functionality of our socio-technical structures. A case in point is the *stress vulnerability model* of Zubin & Spring (1977), which helps to explain an individual's response to stress with reference to level of stress exposure and the person's degree of vulnerability. This model can also be used to characterise information use and information overload (as per figure 7) plus the effects of training.

Figure 7 Stress-Vulnerability model



Closing Discussion

The market, policy makers and enthusiasts have sold informatics on the back of promised benefits. In these most commercial of times, we must ask what of value Hodges' model adds to the socio-technical debate? As the nursing literature reveals concept analysis has long been a tool of nurse theorists. Hodges' model can stimulate and augment conceptual analysis, encouraging exploration and identification of concepts and thereby highlight ill-defined or much needed conceptual cross-members to marry the social (political) and technical realms. It is no accident that *scaffolding* is a common metaphor and technique in education, engineering, cognitive science and software development. Safety first principles dictate that due care and diligence is taken as we leverage existing structures and when necessary build new ones. For all informatics practitioners and participants the issue is not just the existence and creation of socio-technical structures, but access and utilisation and how this is measured.

As befits the socio-technical and media drenched world we live in, it seems that everyone is busy *moving forward*. Nursing as a profession must constantly aspire to make a difference and effect positive change. In the decades ahead (nursing) informatics can help leverage positive change in tackling health inequalities, and addressing the ongoing revision of the new health agenda of health promotion and education. To do so though nursing informatics must also recognise its limits; it must seek out or help create new structures through partnerships with other informatics disciplines; community, social care, urban, citizen for example. Although 2x2 matrices are ubiquitous as a structuring device for concepts, ideas and much more, they are also much maligned: a *ready reckoner for gross assumptions*. Upon first encounter Hodges' model may be considered merely as a brainstorming tool. H2cm can act as a framework for weaving; a template for a socio-technical tapestry. The framework provides a lattice upon which vital conceptual connections can be displayed explicitly on its public face, or privately when the handicraft is viewed from the back – the (propositional) infrastructure.

Although founded upon two axes, the juxtaposition, and mutual bisection of these axes I interpret as a call to embrace complexity. Images are an essential tool, especially for learning. A snapshot can facilitate understanding and provide new insights and evidence to answer questions. If needed, a further extension of socio-technical can be made by way of our increasing reliance on visual literacy as a means to compress information and convey meaning across disparate and potentially perilous divides. Photographs solved the question of horses and the contact of their hooves on the ground when galloping. We can look at h2cm as a (work) horse; each leg represents a knowledge domain. Although purposed to locomote, each limb has a unique role to play overall in balance, momentum, speed, direction: synergy. The concept of redundancy is central in information science, so too for socio-technical structures. The horse-h2cm analogy becomes salutary. Should our horse lose the use of a leg: then someone needs to call the vet? The horse's head is nodding to the age-old proverb. It could prove very bad news - if as we leap - we fail to take in holistic perspectives. Whatever the direction of travel, socio-technical structures and actions based upon them are essential to *moving forward:* safely…

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Socio-technical websites:
http://www.sociotechnical.org/ (British Computer Society Sociotechnical Specialist Group)
http://www.prince2.com/what-is-prince2.asp (PRINCE2)
http://www.itil.org.uk/ (ITIL)
http://wisdom.usc.edu/stf/ (Sociotechnical Framework)

Figures

Figure 1 Health Career Model Axes
Figure 2 Health Career Model Care Domains
Figure 3 Socio – Technical in h2cm: east:west
Figure 4 Hodges' model and the 4Ps
Figure 5 Venn Diagram Social s-t Tech
Figure 6 S-V model – info processing version
Figure 7 Socio-technical in h2cm: north-south

Acknowledgements