

## **Comprehensive Examination Two**

RUNNING HEAD....The Revealing of Nursing Informatics: Exploring the Field.....

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## The Revealing of Nursing Informatics: Exploring the Field

The process of delineating any emerging science, field, or discipline includes the adoption of language to describe the intricacies, actions, and components inherent to the field's essential properties and scope. The term “informatics” is an example of this new language. First coined in 1957 by German computer scientist, Karl Steinbuch, as “Informatik”, followed by Phillippe Dreyfus in 1962 as “Informatique”, and further translated into “Informatics” by Walter F. Bauer, the term informatics combined the terms “information” and “automation” to name automatic information processing. The combination of “informat” with the suffix “ics” broadened the definition to address the actual science and inherent theories of information and information processing. As information technology began to be applied within various disciplines and social arenas, the term “informatics” was linked to the specific field in question, for instance, medical informatics, health informatics, business informatics, and so on. In 1980, Scholes and Barber applied this new term to the art and science of nursing, coining the term, “nursing informatics”, which they defined as “...the application of computer technology to all fields of nursing-- nursing services, nurse education, and nursing research” (p 73).

As new information and communication technologies (ICTs) emerged over the past three decades, the term nursing informatics has evolved to encompass all usage of technologies within the scope of nursing practice, education, research, and administration. This evolution sparked the emergence of a myriad of definitions of the term, nursing informatics. In 2002, Staggers and Bagley-Thompson published a thorough review of the evolution of these terms, and categorized the definitions into three themes: information technology oriented; conceptually oriented; and role oriented definitions.

A simple example of the information technology oriented definitions of nursing informatics is

represented by the interpretation proposed by Scholes and Barber in 1980. A more complex definition, using the same information technology oriented theme was proposed by key Canadian nursing informatics expert, Kathryn Hannah in 1985. Hannah defined nursing informatics as “the use of information technology in relation to any of the functions which are within the purview of nursing and which are carried out by nurses. Hence, any use of information technology by nurses in relation to the care of patients, or the educational preparation of individuals to practice in the discipline is considered nursing informatics" (p. 181).

As the use of information technology further developed in nursing, conceptually oriented definitions emerged, such as the widely applied definition by Graves and Corcoran in 1989. “Nursing informatics is a combination of computer science, information science, and nursing science designed to assist in the management and processing of nursing data, information, and knowledge, to support the practice of nursing and the delivery of nursing care” (p. 227). This development to a conceptually oriented perspective “...allowed a concentration on the purpose of technology rather than on the technology itself. This definition and emphasis on nursing data, information and knowledge was a novel change in direction in the late 1980s” (Staggers & Thompson, 2002, p 257).

The 1990's introduced a new focus on the actual users of technology in the context of nursing informatics. Role oriented definitions emerged in line with the emergence of the leadership role of the Nursing Informatics Specialist. In 1994, the American Nursing Association (ANA) refined a nursing informatics definition to encompass this new role, stating that “Nursing informatics is the specialty that integrates nursing science, computer science, and information science in identifying, collecting, processing, and managing data and information to support nursing practice, administration, education, research and the expansion of nursing knowledge" (p. 3). In Canada, Kathryn Hannah, Marion Ball, and Margaret Edwards refined a role oriented definition in the same year as the ANA. They theorized

that nursing informatics included the "... use of information technologies in relation to those functions within the purview of nursing, and that are carried out by nurses when performing their duties.

Therefore, any use of information technologies by nurses in relation to the care of their patients, the administration of health care facilities, or the educational preparation of individuals to practice the discipline is considered nursing informatics. For example, nursing informatics would include, but not be limited to, the use of artificial intelligence or decision-making systems to support the use of the nursing process; the use of a computer-based scheduling package to allocate staff in a hospital or health care organization; the use of computers for patient education; the use of computer-assisted learning in nursing education; nursing use of a hospital information system; or research related to information nurses use in making patient care decisions and how those decisions are made" (p 5).

Further, Stagers and Bagley-Thompson (2002) proposed that nursing informatics could be defined as "...a specialty that integrates nursing science, computer science, and information science to manage and communicate data, information, and knowledge in nursing practice. Nursing informatics facilitates the integration of data, information, and knowledge to support patients, nurses, and other providers in their decision making in all roles and settings. This support is accomplished through the use of information structures, information processes, and information technology" (Stagers & Thompson, 2002, p. 260).

As the impact of ICTs in health care grew, the Canadian Nurses Association initiated formal projects, policy statements and plans to guide the development of Canadian nursing informatics. "If Canada's health care system is to benefit fully from these technological developments, health care professionals, providers and institutions must be involved in monitoring and adapting information and communication technology to health needs" (Canada Health Infoway, 1999, p.20). Since the early 1990s, the Canadian Nursing Association has spearheaded several initiatives to prepare nurses to

become active and knowledgeable participants in these developments.

One such initiative, begun in 1998, was the National Nursing Informatics Project, created to begin to develop a national consensus on definition, competencies, and educational strategies and priorities in nursing informatics development. "In 1998 a national steering committee was formed to address Nursing Informatics issues and develop strategies to ensure that Registered Nurses have the competencies required to successfully carry out the responsibilities of their practice - whether that be clinical, administrative, educational or research. The first phase of the project was the development of a Discussion paper primarily authored by Hebert in 1999, and the collection of feedback on key issues related to nursing informatics competencies development from Canadian nurses.

The Canadian Nurses Association released a number of supportive documents to promote nursing informatics. In 2001, a key one was published in the September Nursing Now Bulletin, entitled: *What is Nursing Informatics and why is it so important?* This publication was a critical overview of the essential characteristics of the emerging field of nursing informatics in Canada. It also introduced a definition of nursing informatics, formulated by the National Nursing Informatics Project working group. "Nursing Informatics (NI) is the application of computer science and information science to nursing. NI promotes the generation, management and processing of relevant data in order to use information and develop knowledge that supports nursing in all practice domains" (p.1).

Over the past four decades, the field of informatics has become the focus of a large body of research, theory development and scrutiny across most disciplines. In order to address both the visible and hidden aspects and nuances of informatics in nursing, a complex review of the literature was necessary. As this review was conducted, several emergent themes became clear. Each theme contributed to a wide angle lens of the implications, barriers, benefits, processes, and danger signs that accompanied the adoption of information technologies into nursing and other disciplinary arenas. For

the purpose of this comprehensive examination, these themes have been fashioned into a conceptual framework that focuses on seven significant perspectives of informatics: antithesis, artifact, utility, technique, agency, networks, and power. All seven of these views present an unique yet interwoven body of analysis that helps to shape the experience and adoption of nursing informatics when applied to the context of nursing practice, education, research, and administration.

*Figure 1: Nursing Informatics Perspectives Conceptual Model*



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The theme Antithesis refers to ideas presented in the literature that purport that the use of computers and other information technologies in health care is a threat: in fact it is the antithesis or opposite of providing compassionate, caring and client-centered nursing care. The Artifact view refers to the notion that technology of all kinds, including the contemporary inclusion of information technologies in nursing is an inherent, almost seamless cultural phenomenon, one that is long-standing and can be

taken for granted as part of nursing evolution. Utility literature presents information technologies as simple, benign, and useful tools that nurses control and apply to their practice, research, studying, and management activities. The concept of Technique focuses on the application of information technologies in nursing aimed to boost productivity and efficiency, promote best practices and evidenced-based practice, and concretely record nursing activities electronically. A focus on Agency incorporates actor-network theory, technological agency in its' own right, and how nurses interact with ICTs in an interactive and intense, almost reciprocal way. The notion of Networks entails an examination of the application of information technologies in a collaborative way: in interactions with other people, such as colleagues, interdisciplinary team members, clients, and communities of practice and inquiry, sometimes on a global scale. Finally, the theme of Power will be investigated from a disciplinary perspective, including the consequences of prestige, influence, legitimacy, governmentality, and social access. Together, these seven themes provide a rich, sometimes discordant yet crucial analysis of the varied philosophical and active ways that information technology and informatics are enacted and applied in the nursing arena.

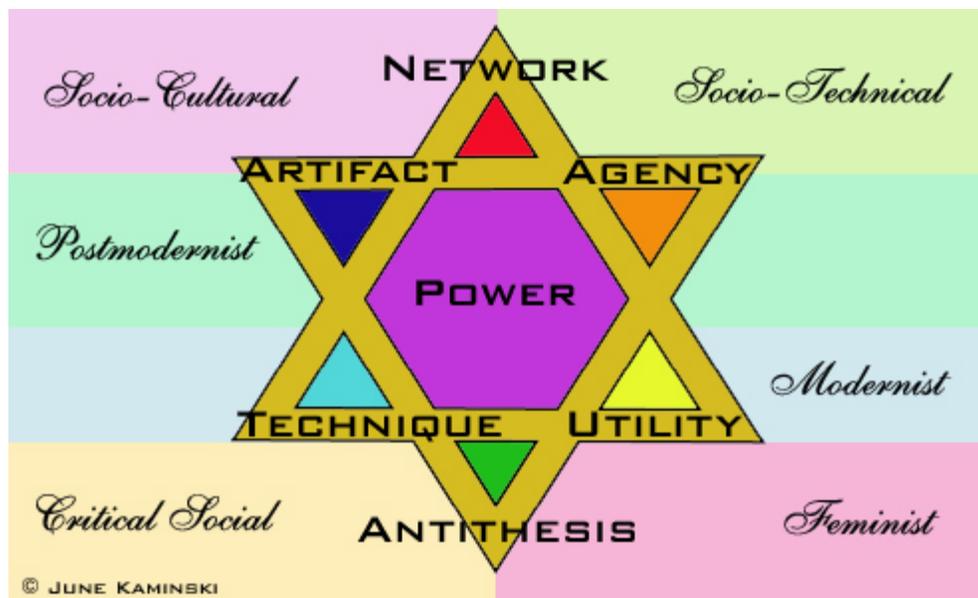


Figure 2: Conceptual Model Shaped by Philosophies

## Antithesis

To begin an analysis of nursing informatics related theory, it is logical to examine the concept of antithesis, since this dystopic notion seems to be the primary cause of resistance to information technology within nursing; it highlights the gender issues inherent in this process; and emphasizes the need for nurses to be critically involved in how technology is allowed and assumed within nursing practice (Barnard, 2000).

### *Dystopic Resistance*

Within the literature, a noticeable theme of dystopic resistance prevails, one that highlights the dehumanizing, impersonal, objectifying effects of using information technology within the provision of client health care. Often, the use of technologies are seen as paradigmatically in opposition to humanistic, holistic and client-focused care (Barnard & Sandelowski, 2001). Nurses complain that they spend far too much time interacting with technology in lieu of focusing their attention on their assigned clients (West, 2003). “Recent research on technology and registered nurses' work in acute care surfaces evidence that unchecked technological practices in acute care environments dismember and denature nursing care into assembly line tasks that depart from the healing nature of nursing care” (Marck, 2000, p. 63). Reductionist technology has spawned the development of health related technologies that order, classify, monitor, and record data and information, but miss the point in mirroring the deep and true meaning of a client's experience and recovery, or the richness of the actual nursing care provided. Thus, it seems that the resistance exhibited by nurses is grounded within a moral imperative and conscious decision to put client before machine; to put the need to care before the need to compute. “What determines experiences such as dehumanization is not technology per se but how

individual technologies are used and operate in specific user contexts, the meanings that are attributed to them, how individuals or cultural groups define what is human, and the organizational, human, political, and economical technological system (technique) that creates rationale and efficient order within nursing, health care and society” (Barnard & Sandelowski, 2001, p. 367).

In a phenomenological study with surgical nurses, Barnard (2000) found that “technology to a greater or lesser extent can interfere with a nurse's freedom to determine and accomplish individual goals, professional approaches to care and principles of nursing practice. Technology demands levels of attention, time and commitment that can be arduous for a nurse and inappropriate to the needs of patients and the clinical environment” (p. 1138). Barnard summarized this as an interference “with the will (violation) of nurses and the practice of nursing” (p. 1138). Especially in clinical areas where technologically monitored health procedures are copious, such as post-operative, critical care, and intensive care settings, the machines, monitors, and other technical apparatus can demand as much or even more attention from the nurse as the client in question does. “Machinery and equipment are designed specifically to attract attention. Devices with alarms, lights and buzzers purposefully draw nurses to the technology” (p. 1138). In essence, the nurse's ability to provide the kind of humanistic, client-focused care that is aspired for is perceived as being compromised by the demands of technology in the form of diagnostic, therapeutic, and physiological surveillance machines. “Information technology, as well as technology in general, can be seen as a threat. And we have good reasons for seeing it in this way, particularly where we use it for transforming all other possible forms of human interaction under the premises of this perspective. Within this approach, we see the originality of the perspective as the only possible one” (Capurro, 1992, p. 7).

This perception is strongly associated with resistance in nurses towards informational technology as well as less sophisticated technologies within the clinical milieu. This resistance has

multiple layers: technology is seen as a distractor that takes away from time, energy, and interaction that could be spent with the client. Technology is also often seen as an imposed directive that comes from on high – an unnegotiated result of administrative decisions that did not involve the nurses themselves, yet relies on their participation for successful implementation. “According to studies conducted at Clarian Health System during the mid 1990s, nurses provide less than one hour of direct care to their patients in a 12 hour period. The remaining time is spent managing and coordinating communication to other departments, physicians, or members of the health-care team” (Bartholomew & Curtis, 2004, p. 5).

Timmons (2003) studied the resistance exhibited by acute care nurses towards the implementation of information technology in the workplace. “The theoretical basis for this study is the social construction of technology. This is the idea that machines have meaning and in fact, they can have different meanings for different groups of people. This is interpretative flexibility of machines. For instance a care planning system could variously be interpreted as being symbolic of an up-to-date, high-tech profession, as a way of improving the care of patients, and as a bureaucratic imposition. The flexibly interpreted nature of technology influences its development” (p. 261).

Timmons considered Dowling's (1980) model of resistance which consisted of five unique resistance categories, but with some qualification. “Dowling (1980) delineates five types of resistance: a) passive resistance (failure to cooperate) b) oral defamation c) alleged inability to operate the system d) data sabotage and e) refusal to use. The real weakness of Dowling's work is that it makes no attempt to situate these phenomena in a wider context, and he suggests standard managerial responses such as improved training and communication without giving much detail about what forms they might take. As well, resistance is a more complex, multilayered phenomenon than these analyses might suggest” (Timmons, 2003, p. 259). The nurses studied by Timmons primarily demonstrated resistance by either

delaying their personal participation in the training sessions and actual utility of the new technologies or engaging in criticism of the systems. “Resistance was as much about the ideas and ways of working that the systems embodied as it was about the actual technology being used. The patterns of resistance can best be summed up by the phrase “resistive compliance” (p. 257).

Criticisms of the technology usually center around three primary concerns: a) Criticisms of the actual system such as time consumption, inconvenient access, glitches, volume of data; b) Security issues and c) Nursing issues, such as the notion that technology distracts nurses from providing quality individualized client care. When allowed the opportunity to voice their genuine perceptions of new technologies, nurses tended to be forthright and open about the perceived faults of the currently used information systems within the work milieu. “Nurses are knowledgeable reflexive actors who can give meaningful accounts of their actions in this context and the reasons for them” (Timmons, 2003, p. 260). Although it might seem like nurses had little power in the implementation of information systems in hospitals and other health care environments, their own resistance represented a presupposed power, one that is grounded in the advocacy, protection and primary obligation to ensure that high quality client care is provided.

Another factor that contributes strongly to resistance is the notion of generational cohort and technological confidence. “We're well aware that the average nurse is 44 years old. This directly impacts technology usage: Older nurses have long-established practice patterns and habits and may often view new technologies as a distraction, something that takes their attention away from the patient. One expert reports that nursing resistance alone has caused the death of numerous IT initiatives. Ironically, while we demand new technology, we actively resist it” (Bartholomew & Curtis, 2004, p. 5).

The literature supports the notion that the average middle-aged nurse has used manual methods

of data and information recording and processing for most of their working life, and often resist changing to electronic documentation since it disrupts the comfortable process that has become part of their socialized roles. “Cultural and societal factors may play a larger role in nurses' willingness to embrace the CIS than attitudes toward computers themselves. Resistance has less to do with specific functionality of the technology – screen design or the mouse, for example – than with cultural factors such as lack of time and loyalty to the historic model of paper documentation” (Kirkley & Stein, 2004, p. 216).

Although this idea that generational cohort determines comfort with technology is common across many disciplines, there are always exceptions to the common rule. Perhaps the noticeable difference between nurses born within the “Baby Boomers” generation compared with the new graduates who belong to the “Generation X” or “Millennials” age cohort is a simple reflection of the mismatch between information technology design/interface and the actual needs of nurses and their clients. “Nurses do not resist technology itself. What they resist is the addition of one more item to their workday. A significant point of resistance may come down to the nurses' fear that online charting will take more time than paper charting. The most common criticism from nurses about CIS was that the systems were time consuming” (Kirkley & Stein, 2004, p. 217). Other criticisms focus on the imposition onto nursing (female dominated, thus feminine) from the masculine domains of medicine and technology.

### *A Question of Gender*

Nursing has been a female-dominated profession throughout its entire history : even today less than 5 per cent of nurses are male. This fact has understandably influenced the investigation of how visible nursing presence, knowledge, ideas, and theories are within the landscape of health care,

including the adoption and implementation of health information systems. Often, the high female ratio in nursing has been used as an excuse to justify the exclusion of nurses from decision-making, planning, and even the adoption process in implementing information systems, yet they are expected to fulfill the goals of the implementation plan by exercising compliance and ability. “Nurses drew from ideological or referent systems that linked female/nurse to nature, nurturance, and caring, and technology to male/power and control over nature, to position nursing as female culture at odds with masculine technology. Depicted as a force for the dehumanization of both patients and nurses, technology signified Other to and even enemy of nursing. This stance reinforces gender distinctions that have traditionally worked against nursing. It also reinforces the prevailing cultural view of women as antitech, technophobic, and unskilled” (Sandelowski, 1999, p. 202). Sandelowski also pointed out that it is usually nurses who educate, enlist, conjole, and elicit compliance from clients to work with health technologies without resistance. She also describes how nurses have been linked with technology since the beginning of hospital-based health care, and are often depended on to exercise the mundane tasks associated with keeping the information system functioning as well as ensuring that all administratively or medically prescribed technological activities are completed and complied with.

It is a given that gender-related issues are a critical factor in the knowledgeable application of information technology to nursing, especially historically, yet it does not seem to be the essential reason. Resistance to change is common place in any organizational setting, including health care ones. Yet, the critical force that appears to be the biggest source of resistance is the sense that the use of technology prevents nurses from caring for their clients in the way that they morally, ethically, and professionally know they must. “For many, technology is still something nurses must work with, work around, or work hard to make compatible with, or supportive of nursing care. To this end, we have encouraged each other to develop an ethical awareness, in order to temper the effects of technology”

(Barnard & Sandelowski, 2001, p. 368). Nurses need to be involved in the development of information systems that are used in their daily practice. Only they know what will actually work in the health care setting, in the provision of holistic, professional nursing care.

### *Nurses Shaping Technology*

Despite the promise and growing evidence that the use of information technologies in health care promotes efficiency and productivity and reduces redundancy of effort, resistance towards the use of technology in health care is still an important issue. “Many health care professionals regard computing as a world far removed from the concerns that occupy them, a case of the mechanistic versus the humanistic. One factor, however, conjoins the mechanistic and humanistic worlds: information.” (Jones, 1996, p. 591). However, to actually access this information bilaterally, nurses need to have a voice in the design of the systems they use in practice. “Current technology favours a reductionist approach, meaning that nurses could be dictated to by the needs of technology rather than the information needs of their professional practice. Being constricted by reductionist technology may necessitate nurses inputting information that has limited professional value and which fails to capture the richness of patient care and nursing professionalism” (Chambers, 2002, p. 103).

Since the beginning of the profession, nurses have applied their ingenuity, resourcefulness, and professional awareness of what works to adapt technology and objects to support nursing care, usually with the intent to promote efficiency but also client comfort and healing. This resourcefulness could also be applied effectively to the adaptation of information technology within the care environment, to ensure that the technology truly does serve both clients and nurses, as well as the rest of the interdisciplinary team. “Part of the problem is that the technology that health care is presently using was not designed to support nurses in the care of patients, more effort needs to be made to change how

these data are being collected and accessed. This change should focus on the nurse's need to collect and retrieve data as quickly and easily as possible. It also should foster communication among the members of the health-care team, not hinder it” (West, 2003, p. 31).

At this point in time it is understandably difficult to involve all nurses in the development and design of health information systems, mainly because few feel confident in their ability to diagnose, experiment, and even visualize what an appropriate system would look and act like. “The lessons of restoration suggest that to counter the technological practices that presently plague many acute care environments, nurses need to develop an ecological literacy that first reinterprets and then reconstructs our relations with a technological world” (Marck, 2000, p. 63). In the future, this simple enough task will likely be easier to negotiate, since nurses who grew up while the Internet, hand-held devices and other technologies were taking hold may feel more attuned to the way technology works. A middle ground can be attained by teaming nurses with designers to brainstorm the best strategies for development, rather than expecting nurses to serve as both user and designer. This can be summed up simply by considering Kirkley and Stein's (2004) advice to “...provide the right functionality and hardware at the right place at the right time. Create functionality that realistically supports and enhances a nurse's work flow, opens channels of communication, and unlocks doors to useful information as a top priority. A well-designed intuitive interface that 'thinks like a nurse thinks' is key” (p. 220).

Thus, the resistance and dystopic view of technology that is found in the nursing and health literature becomes both understandable and worth consideration. More than a mere reaction to imposed change, the resistance evident in nursing practice is actually often founded on a strong moral imperative to safeguard the essentials of client care; to provide open, clear and accurate communication; to ensure that presence and attention is focused on the client rather than the apparatus;

and a desire to keep nursing human-focused rather than allowing it to erode into mechanistic action.

“Resistance though complex, remains not only analytically useful, but also pragmatically useful, as it is a part of the process by which an 'idealised' system is socially shaped or constructed into a working technology, part of the social fabric area where it is being used” (Timmons, 2003, p. 267).

Just as the dystopic literature in any field warns, the uncritical and unquestioned adoption of technology into any discipline or life area should be resisted. If nurses are to embrace information technology into practice, they must know beyond a shadow of a doubt that they do so to enhance quality client care, from the *client's* perspective. “In deeply disturbing ways, the speedup of nurses' work mirrors Borgmann's description of “final hyperreality” where a relentless and unreflective absorption of technology as reality predominates. With arguments that support Sandelowski's recent work, Borgmann argues that the underexamined glamour of technology shapes our gaze toward a superficial orientation in daily life, a thinner reality that does not keep more fundamentally moral practices in view” (Marck, 2000, p. 71).

It is a given that information technology will continue to be integrated and applied to nursing practice and health care in general. It does so in both visible and invisible ways and permeates nursing more and more with each passing year. It is important that nurses gain knowledge of all of the benefits and implications of this techno-saturation, and voice their concerns and visions accordingly. As Barnard and Sandelowski summarized, “We argue for the need for reconciliation of presumed tension(s) between technology and person focused care and the need to reconsider our ways of understanding the relations between technology and nursing” (2001, p. 367). We also need to be fundamentally aware of how information and other technologies shape our way of being in the health care landscape, and how our very profession is being shaped by current electronic developments. “The duality of technology, as matter and meaning, lies not in its necessary opposition to humanization but rather in its recursiveness; in its existence as both objective, material force, and as a socially

constructed and chameleon-like entity” (Barnard & Sandelowski, 2001, p. 372). This includes how technology has become a foundational part of organizational and medical culture and by default, viewed as an integral artifact of nursing.

### Artifact

Cultural artifacts or artefacts within nursing are human-made objects that reflect both professional and workplace characteristics such as values, norms, myths, sagas, symbols, rituals, ceremonies: this includes the use and placement of objects within nursing practice. In the context of this analysis, artifact refers to the notion that technology of all kinds, including the contemporary inclusion of information technologies in nursing is an inherent, almost seamless cultural phenomenon, one that is long-standing and can be taken for granted as part of nursing evolution.

### *An Intricate Dance*

Margarete Sandelowski (2000) presented a comprehensive examination of how nursing and technology have been consistently linked since the advent of the bureaucratic health care system beginning in the early 19<sup>th</sup> century. Perhaps unwittingly, nurses served as a critical force that supported the scientific and technological development of the health care system that exists today. It was the lure of modern equipment and eventually machinery, the presence of attentive and efficient nurses, and the aseptic, medical domain embodied in hospitals that shifted health care away from the home to the institution. “The hospital became the carefully established space where rituals and ceremonies were performed that centered upon the conspicuous display of new tools and equipment. Nurses made hospitals hospitable to both patients and the new machinery of care housed there” (2000, p. 1). In fact, Sandelowski purports that it was nurses who made the use of technology in health care acceptable to the public. They did this by “...educating patients about new devices, getting patients to accept and

comply with their use, and alleviating patients' fears about them” (p.2). Indeed, it was the combination of technology and nurses that lured people to go to hospitals when they became sick, placing them in the center of medical care. “The link was thus created early in this century between sympathetic care embodied in the female nurse and scientific care, embodied in medical and hospital technology.” (Sandelowski, 1999, p. 199).

This premise served the evolution of the medical profession well. In fact, as Sandelowski points out, “...for most of the history of nursing, nurses (as women) and technology (in the form of material devices, such as x-ray machines, techniques, such as surgery and organizational systems, such as hospitals and specialized units of care) have been represented as embodied extensions of physicians and as servants both to physicians and to the general public in the fight against disease” (1999, p. 199). In the early 20<sup>th</sup> century, hospital nursing was shaped as medical technology through the provision of manual labour and compliantly following doctors' orders, while physicians controlled the arena of care through their mental labour expenditures, crystallized into diagnoses and treatments. The fact that nurses were both capable and eager to apply technologies in the care of patients served the mandate of medicine well, since physicians were perceived as responsible for any healing or recovery. The nurses as almost invisible workers often shaped the technologies to work more effectively, or less obtrusively yet rarely were credited for doing so. “Physicians thought of nurses much like stethoscopes and surgical instruments, as physical or bodily extensions of physicians” (Sandelowski, 2000, p. 3).

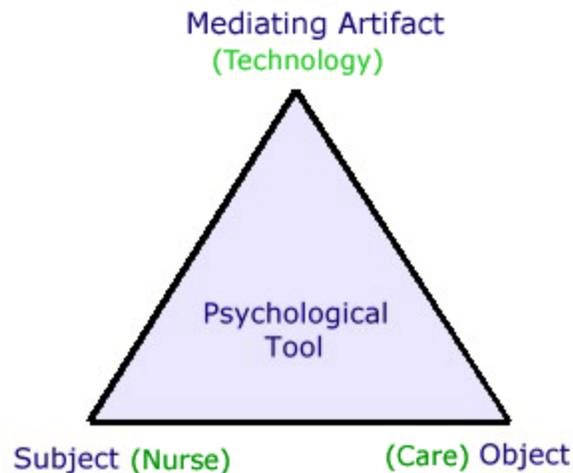
As early as the 1930's nurses began to question this premise, and recognized that technology could potentially threaten the very essence of nursing, an essence that remained elusive and unnamed. Yet, nurses of the time also recognize that technology could also support and even boost the scientific foundations of the nursing field as it struggled to begin the long process of becoming recognized as a legitimate discipline in its own right. Thus, technology has remained a key artifact of nursing culture.

“Although nurses continue to liken themselves and their work to technology to make their work visible and to advance their social positions, the metaphoric link between nurses/nursing and technology is troubling for nurses for several reasons. It reinforces the idea that nursing is nothing more than manual labor and the mindless application of medical science on orders from physicians” (Sandelowski, 1999, p. 201). It also reinforces that evolving technology has consistently been interwoven with the nursing profession in an intricate dance of ritual, ceremony, and cultural symbol. From the first thermometers, stethoscopes and physiological monitors, technologies have semiotically symbolized the nursing profession in both a social and cultural way. Now, in the 21<sup>st</sup> century, advanced information technologies as well as reproductive, medical, surgical, life-sustaining, and diagnostic technologies make up the day-to-day artifacts of the everyday hospital milieu. A nursing shift sans the utilization of some form of technology would be a very rare event in the hospital setting of today. “Technology, largely in its modes of manifestations as physical object and way of doing, has been integral to and has fundamentally (re) shaped nursing practice” (Sandelowski, 1999, p. 198).

### *Activity and Mediation*

Technologies, from simple to complex, have served as long standing artifacts within nursing culture, along with other tools, documentations, physical and organizational structures, and more recently, information systems. Technology in the form of computers and software has been shaped to improve and enhance human cognition, facilitate collaboration and communication, and support task performance. “Artefacts are thus considered to be the crucial element that binds user cognition, information processing, workload management, and task accomplishment” (Ramduny-Ellis, Dix, Rayson, Onditi, Sommerville & Ransom, 2005, p. 80). Technologies of all kinds have been applied in nursing to support, prompt and drive activity within the boundaries of health care. In fact, an adaptation of Vgotsky's mediational model triangle (1978) can be applied to convey a convincing representation

of the artifact of technology in the cultural context of nursing.



*Figure 3: Vygotsky's Mediation Model Triangle*

The subject (nurse) interacts cognitively and behaviourally (activity) with the mediating artifact (technology) motivated by the achievement of the objective or object: in this case, the provision of nursing care to clients. This activity is coupled with conscious psychological tools which support the application and evolution of nursing practice. Psychological tools are artifacts located in a socio-historical context that form an integral part of human action - in this case, the cognitive and cultural aspects in the provision of nursing care or the experiencing of nursing care within the health care context. For Vygotsky (1981), mediation with tools provided a medium to connect the external and the internal, the social and the individual. In sociocultural theory, individuals and artifacts are comprehended as aggregates embedded within sociocultural activities. Artifacts are thus understood as extensions of the individual. Nurses develop their tools (nursing care) by applying artifacts at the same time as these tools influence the community in which they are used (the health care system). According to Leontiev (1978) this occurs as a dynamic evolving relationship, as activity between subject, artifact, and object. The artifacts in question also represent (and helped to make visible) the crystallized

knowledge of nursing and medicine (Bannon and Bodker, 1991).

### *Diversity and Embeddedness*

The notion of technology, and ultimately informatics as an artifact of nursing might seem far-fetched, but it is an idea that is reflected in diverse ways in the literature. Some literature reflects semiotics as in the case of Sandelowski (1999) who viewed technology as a sign and symbol and ultimately as a cultural artifact of nursing. Others applied cognitive science, especially when looking at how people pursue activity in the workplace. “To what degree does a system embody appropriate models of work routines, management assumptions, patient care philosophies, and users conceptions of their needs? A system is never only a system, but contains cognitive models of how people work and think”(Kaplan, 2001, p. 45). Sociocultural historical notions reflected through classical activity theory by Vygotsky (1978) and later Leontiev (1978) focused on how humans interact with various physical and psychological artifacts to act upon an object within action landscapes such as health care facilities. “Health care informatics should be understood as an ecology of tasks and artifacts. Knowledge is situated in particular social and physical systems and emerges in the context of interactions with other people and the environment” (Kaplan, 2001, p. 46).

Technology has become such an embedded artifact in nursing that often the current nursing literature reflects computers and other technological equipment as mere tools, as benign objects that nurses utilize and control. “It (health-medical informatics) has been characterized as a “design discipline” similar to architecture, concerned with the design and implementation of artifacts that enable the promotion and delivery of a defined purpose, in our case health and health care. Health informatics is also a practical science in that it aims to achieve changes in the state of reality, as much as developing insights into the structure and function of reality, as is the case in theoretical sciences.”

(Moehr & Grant, 2000, p. 276).

### Utility

Another very common conception of technology, including information technology is founded in modernism: the notion that computers and machines used in nursing practice are simply tools that nurses control within their practice. This reflection is very common in the nursing literature, usually embedded within an organizational culture or management framework, to support the use of technologies in a utilitarian manner. “Technology is conceived as socially, culturally, and morally neutral – is conceived as amoral (amoral in the sense of having no value of moral consideration) – is nothing more than a resource to be used by nurses” (Barnard, 1997, p. 127). Supporters of this perspective question why information technology is not used more in nursing since it is, after all, a benign tool that can make nursing work easier, less redundant and repetitive, and more congruent with contemporary trends. “Nursing remains under the ever-pressing demand to do more with less. Yet, our profession only sparingly implements incredible technological advances that have streamlined other industries. Why haven't we capitalized on these phenomenal resources?” (Bartholomew & Curtis, 2004, p. 48).

### *Deterministic Domination*

This utility-focused view of informatics and technology in nursing can be seen as a deterministic, decidedly neutral (at least on the surface) lens to view the applications of computers and ICTs within the context of nursing care. “Nurses in all specialties are required to care for patients and develop the technical knowledge not only to manipulate machinery but interpret the world around them. Overall, the literature remains deterministic (both utopian and dystopian) and favors an uncritical

approach to technology in which the phenomenon is understood to be little more than machinery and tools. Determinism seeks to explain phenomena in terms of one principle or determining factor” (Barnard, 1997, p. 126).

“One belief influencing the reason why nurses uncritically accept and interpret technology centers on the notion that technology is a neutral object – a view that machines do not make decisions, they only solve problems” (Barnard, 1997, p. 127). This belief in technology's neutrality emphasizes the premise of human control over machines and apparatus that are simply responsive to the manipulation, preferences, decisions, and direction of the people who use them.

This view of nursing as master over technology is not a new one: it emerged as a result of the nineteenth century dominant sociological paradigm of the human right to dominate and master nature, and what humans fashion from nature, to meet their own needs and rationale. The key actions within this perspective are domination and mastery: in this case, reflected as nurses dominating and mastering information technology, and technology in general. “The neutral belief suggests there is nothing intrinsic to technology or the circumstances of its emergence which predetermines how it is used and controlled, or how the effects of technology will manifest upon individuals, groups, or the political forms around us” (Barnard, 1997, p. 127).

The modernist literature does acknowledge that in order for nurses to masterfully utilize information technology at the bedside or in the community care setting, nurses must have the dexterity, competency and knowledge to seamlessly incorporate the computer or other apparatus into their care. This notion supports the need for “high touch” nursing care combined with “high tech” abilities in order to demonstrate true caring to their clients. But this utility-based perspective downplays the influence of the technology on both nurses and clients, promoting the view that this is machinery after all – sophisticated perhaps, but nevertheless, mere tools that can support nurses in giving optimal

nursing care within the confines of the bureaucratic health system (Locsin, 1999). “Nurses are characterized as capable of transcending bias, politics, economics, disinterest, and even disenfranchisement, to influence adequately the use of technology” (Barnard, 1997, p. 128).

### *Records and Visibility*

One of the most common arguments to support this perspective of utility, is the positive effect that information technology has on nurses' ability to attend to documentation in a more timely and less redundant manner. Nursing and hospital information systems are promoted as benign, efficient software that can save time, repetitive charting, and make the nurses' documentation easily available to physicians, other nurses, and the entire interdisciplinary team at the click of a button. “Studies estimate that nurses spend as little as 15 percent of their time on direct patient care. As much as half goes to documentation. One welcome outcome expected of the many IT initiatives under way is revitalization and redefinition of the role of nurses and the nursing practice. Clinical documentation is an area where IT can have a major influence. As they help coordinate all the multifaceted activities related to patients, nurses must ensure that every aspect of diagnosis and care is carefully documented. Documentation poses a tremendous, often unmanageable, challenge and has become the root cause of many patient safety and other problems” (Ball, 2005, p. 1). It is obvious that nurses spend a lot of time recording their observations and other measured data – and that this data is critical to the smooth functioning of the modernist health care system (Jiang, Chen & Chen, 2004). Yet, despite the surface presentation of this benign technology as tool, it is also obvious that nurses must adhere to very structured guidelines in order to enter and analyze the inputted data perfectly, without error.

Of course, this need for attentiveness and accurateness is not new to nursing: even hand scribbled notes that detail vital signs and other observations are expected to be flawless and one

hundred percent accurate. Yet the idea that nurses exercise a sense of control and mastery as they effortlessly input all required data into the structured data fields of the typical nursing information system does not seem very realistic. A tension arises, which can be perceived as ambiguity. “This ambiguity is... a key issue with regard to software development, since software is not just a tool, but a specific form of reality disclosure and transformation. The question is, then: what kind of reality are we constructing when we develop software, and what are the limits and chances of such a form of reality construction?” (Capurro, 1992, p. 3).

### *Who or What is in Control?*

One question that arises is, do nurses control these benign information technology tools, or do the “tools” shape the activities, decisions, and attention of the nurses as users of technology? Much of the modernist literature encourages the tool myth by linking the effects of using information technology in nursing with both caring as previously mentioned, but also with safety and client support (Locsin, 1999; Simpson, 1994; Kling, 2000b; Smith, 2004). Technology becomes an overarching symbol of the means (as a benign tool) to serve nursing's mandate to provide meaningful caring practice, to uphold the structure and schedule of the health organization, and to do so without error or negligence. “Technology, and the data it provides, can help nursing improve care in three ways: a) by counteracting human error, b) by improving human behavior, and c) by putting nurses where they can be most effective. Technology does this in two ways: with software that translates data into information and with hardware that improves the way nurses collect that data. Technology can help cultivate caring by providing the data healthcare organizations need to understand how and why errors occur to prevent them from doing so” (Simpson, 2004, p. 303).

As outlined in the previous Artifact section of this paper, nurses have worked within a

technologically demanding environment right from the beginning. The notion of technology as neutral tool and background within nursing is a long standing one. The only difference is the configuration of the tool: contemporary information technologies are just another huge but logical step in the progressive evolution of technologies within health care and society at large. But this commonness and history do not make the notion of technology as tool any more acceptable – at least not without question. It is important that nurses consider this lens and analyze the ramifications of unquestioningly applying technology to their practice. An understanding of the influence of this modernist stance is important to nurses and other disciplines in order to make technological decisions and design new software with both awareness and deliberateness.

### *Modernist Situatedness*

The foundation for promoting this perspective of technology is essentially to enable the robust vitality of the organizational system. Thus, the technology that is selected is usually done using criteria set by the organization, not according to the needs of the users, in this case, nurses. Often, the rationale for choosing a system is based on efficiency and continuous improvement (Cowley, Daws & Ellis, 2003). The decision makers view the biggest threats to the efficiency of this system as noncompliance or error in the users, and malfunction of the system itself. The focus is on control of the system through standardization and accessibility, sometimes summarized as flexibility of the system. “By a hermeneutical design of computer programs, some possible breakdown situations can be implemented in order to help the user when something goes wrong with the normal functioning of the system. In other words, the flexibility of the system depends on its capacity for anticipating such situations, i.e., on its capacity to remain a tool” (Capurro, 1992, p. 2).

Where does this modernist organizational management approach to technology situate nurses?

The information system selected by those in the higher echelons is situated within the centre of the system to supposedly serve as benign tools and support everyday nursing practice. This model places nurses as supportive structures themselves within this mass of technological interconnectedness. Nurses do not often determine which system is used, or what functions it should support, which in essence, makes them a target of this tool perspective. So, are nurses the masters of the tools, or are they part of the tool structure themselves? Do tool and master (or mistress) become mere reflections of each other? Or, at the least, do they manifest as intertwined tools of the system?

Answers to these questions are not clearly visible in the modernist literature. Instead, this view of technology as tool is perpetuated as the solution to the ills of the modern health care system and its obvious deficiencies. “Harnessing the power of modern information and communication technologies (ICTs) to health care entails such innovative applications as electronic health records (EHRs), telemedicine, telehomecare, and Internet-based information for the health care professional and consumers alike. These applications are emerging as an enabling feature of national importance for transforming the Canadian health system in the 21<sup>st</sup> century and contributing to Canadians' health. They can significantly improve the accessibility and quality of health services for all Canadians, while increasing efficiency of the health system” (Canadian Nurses Association & Office of Health and the Information Highway, 2000, p.4).

In fact, this modernist notion is lauded as the way to achieve clinical transformation within nursing and the health care system at large. “The concept of clinical transformation is developed with new models of care delivery being supported by technology rather than driving care delivery. Clinical transformation is clinical and nonclinical process improvement supported by technology, not driven by it” (Smith, 2004, p. 92). This promise of transformation is often used as an effective way to convince nurses that information technology should be unquestioningly and seamlessly accepted into nursing

practice, often, in the way that it is currently being implemented: through top-down approaches. As nurses open to the inevitability of ICTs in nursing practice, they often accept this appeal – that technological tools can help them achieve their own disciplinary mandates. “They see ICTs as strong supports in a shift from an illness model of health care to a focus on health promotion and illness prevention. Canadian registered nurses have long advocated for this focus” (Canadian Nurses Association & Office of Health and the Information Highway, 2000, p.7).

This longstanding modernist notion of technology as tools in nursing is so common that most nurses accept it without consideration or question. This perspective has also helped to shape a more recent perspective of information technology as “technique”, one where the inclusion of informatics in the workplace can help nurses achieve best practices, embrace evidence-based practice, and truly operate in their day to day world as efficient and effective health professionals within the context of health practice.

### Technique

One of the strongest and most far-reaching current trend in health care is the application of evidence-based practice through the development of research and information technology/informatics. This trend is visible across all sectors of nursing, including practice, education, research, and administration. The rationale behind this trend is to improve client care by selecting best practice options grounded in viable research, and to expand the theoretical foundations of all health professions. The ultimate goal is to shift health care decisions, choices, and actions to a “higher”, more scientific, research and theoretically-based level.

*The Advent of Evidence Based Practice*

Information technology breakthroughs have been a key factor in the development of evidence based practice (EBP) and has supported this growing trend to promote it in nursing and other health care disciplines such as medicine (Georgiou, 2002; Johnson, 2004; Skiba, 2005). A common conceptual basis for nursing and health informatics consists of a triad of data, information, and knowledge (Graves & Corcoran, 1989; Stagers & Bagley-Thompson, 2001), where nursing data gathered manually, or using computers and other technologies are combined and categorized into meaningful information, which when reflected on and logically analyzed, become nursing knowledge. “These elements are arranged in a hierarchy, with data at the base of the model providing the basis for establishing information and leading in turn to the potential generation of knowledge. The informatics model converges closely with the principles, aims and tasks of evidence-based medicine (EBM), particularly as they relate to searching, appraising, reviewing and utilizing information and research” (Georgiou, 2002, p. 127).

This approach to knowledge development, and decision-making within practice is not a new one. The seeds of evidence-based practice were first sown in Newtonian times and further developed through the rise of positivism and scientism. “The informatics process traces its origins to the functions of taxonomy and classification as they developed in the 19<sup>th</sup> century. Early statisticians used and developed classification systems as repositories of knowledge established from data and information. They in turn developed an informatics model consisting of three essential parts arranged hierarchically, with data at the bottom, an intermediary layer of information, and topped by a knowledge layer” (Georgiou, 2002, p. 128).

The use of information technologies has perpetuated this approach to clinical decision making through various applications. The astounding collection of statistics available electronically is one such

application. The development of digital nursing languages and nomenclatures are another important supportive application. The ability to use computers for every stage of the research process, both quantitative and qualitative is another key application. Modern health care administration is strongly focused on the incorporation of all three of these developments to shape the activities, mandate, and focus of contemporary nursing.

While EBP is promoted as the definitive way to boost nursing's credibility, respectability, and uniqueness, there is also an almost invisible undercurrent of control and conformity that may threaten the essence of genuine nursing care. "There are some who criticize EBM as statistically driven rather than scientifically driven, and complain that the health service has been forcibly unified under a single quality assurance system - easily regulated by politicians, bureaucrats, and their statistical technicians" (Georgiou, 2002, p. 129). Still, much of the nursing literature, especially nursing administration literature supports this approach to planning routine care as well as advancing the nursing profession. "Data transformed into information and further transformed into knowledge assists healthcare staff in making knowledge-based decisions--choices based on the patient's total healthcare picture. Systemwide data provides a means to analyze overall process effectiveness and to spot areas needing change. This type of information management is instrumental in analyzing indicators that correlate nursing actions--such as the percentage of R.N. care hours versus all nursing care hours--with patient outcomes"(Ball, 2005, p. 1).

Information processing has been a vital part of nursing, far longer than the availability of computers and ICTs. "Information processing and communication are centrally involved in virtually all health care activities, including obtaining and recording information about patients; communication among health care professionals; accessing medical literature; selecting diagnostic procedures; interpreting laboratory results; and collecting clinical research data" (Georgiou, 2002, p. 128). ICT

advancement has made it possible to utilize technology to quicken all of these activities, to access a digitally stored pool of literature, statistics, and research data to assist in decisions, and provide a language for nurses to use to record and plan individual client care.

This advancement in access to quality data, information and knowledge can be a very valuable resource for practicing nurses, especially if they also have the time and technological support to gather, absorb, reflect on, and synthesize the information that they find within the digital collections. However, the mechanistic daily operations of the health care system leave little time for this knowledge development and application to occur. “Today, nurses are responsible for increasingly machine oriented health care dominated by administration and bureaucratic structures” (Barnard, 1997, p. 126). In theory, evidenced based practice appears to support quality client care, but in reality, it often becomes a means to further the modernist focus on quality assurance, regulation, standardization, and accreditation: essentially, the workings of the system (Buckeridge, 1999). “The generation of knowledge proceeds through a complex process of induction, deduction, and assessment, itself subject to scientific debate and further trials and experimentation. ...Moreover, the whole process cannot be divorced from the social, economic and even political influences that impact upon any decision making exercise” (Georgiou, 2002, p. 128).

### *Maintaining the Organizational Machine*

Since practicing nurses have little time to actually engage in the process of applying research, statistics, and other data to their practice, the EBP movement is often put into motion under the command of nurse leaders (Nurse Informatics Specialists, Nurse Managers, Clinical Nurse Specialists, Clinicians, and so on) through the discerning application of technology to practice directives .

“Administrators quantify technology benefits that increase productivity, streamline work processes, or

impact patient quality and safety. Technology options such as clinical documentation systems, bar coding, medication administration, computerized provider order entry (CPOE), specialty systems, inventory, charge capture, and workflow management are maturing” (Parker, 2004, p. 41) and become the ultimate rationale for applying informatics to nursing practice.

Likewise, the selection of nursing information systems is often done by administrative nurses, often through the lens of organizational operations rather than the actual needs of the nurses who use them or the clients they serve. “Nurse administrators must work directly with the CIO and nurse informatics specialist in developing and deploying systems to convert this data into useful information. The nurse administrator must help develop the IS strategic vision to ensure selection of the hardware and software needed for applications that can be used in many units or linked with other facilities. These key applications will provide fundamental systems support for nursing department operations, such as workforce, financial and quality management systems. Systems for patient classification (e.g., analyzing patient acuity level to determining level of care needed) are critical to support nursing administration functions. In financial management, linking patient classification data, staffing requirements, and evidence-based practice data to a budget methodology can help justify the nursing department's annual operating budget and expedite budget preparation” (Ball, 2005, p. 2).

Although the use of technology to support EBP can be a valuable process in providing the best care possible, it is often restricted to a justifying role for the adoption of particular rituals and practices, in the name of technique. The current trends in health care motivate nursing leaders and hospital administration to align strategic objectives with technological adoption with the end goal of remaining financially competitive (Mazzella Ebstein, 2004). “Technique refers to the formation of systems comprised of human, organizational, political, and economic structures which are aimed toward the absolute efficiency of methods and means in each field of human endeavor. Technique, not technology

has increasingly structured collective behaviour and influenced individual lives, cultures, and professional perspectives. Many aspects of nursing and health care are structured in accordance with technical demands arising from relationships that develop because of technique which emphasize a primacy of means, efficiency, and rational order. Technique does not attend to such phenomena as individual and cultural difference. The purpose of technique is to reproduce itself; it is the center of its own attention” (Barnard & Sandelowski, 2001, p. 372).

The modernist health care system demands that nurses operate within this technique driven environment, and nurses have learned to embrace this way of acting and being while providing client care. “We nurses have expressed concern over the impact of technology but have embraced technique. Yet it is technique that has made nursing technological not objects, machines, automata, or equipment” (Barnard & Sandelowski, 2001, p. 372). This focus on technique places nurses within a whirlwind of regulations and standardization that threatens their ability to care for clients in a phenomenological, individualized way. “Because of technique, there can be over emphasis on the maximization of efficiency, specialization of practice and development of conformity and sameness in product, process, and thought. Accordingly, it is technique, not technological objects per se that we must confront, as we have delegated to technique the power of decision making and have relied on technique for the development of professional status” (p. 372).

### *The Language of Nursing*

An important part of this technique approach to technologically enhanced nursing care is the development of universal nursing data languages. The most prominent of these is the International Classification of Nursing Practice (ICNP) being developed by the International Council of Nurses (ICN). “The purpose of the ICNP is to provide a tool for describing and documenting key elements

that represent clinical nursing practice” (Canadian Nurses Association, 2001, p. 2). In Canada, work on the Health Information: Nursing Components (HI:NC) represents a national initiative to quantify nursing care for computer data recording and analysis. As well, the “CIHI completed the development of a new Canadian Classification Health Interventions (CCI) that is currently being implemented in a number of provinces. The CCI was developed to be consistent with concepts and terminology in the ICNP. The classification contains a comprehensive list of diagnostic, therapeutic, support and surgical interventions, allowing for the standardized collection of health interventions, regardless of the service provider or service setting” (Canadian Nurses Association, 2001, p. 3). The intent of these languages is to ensure that nursing actions are included in the emerging electronic health records being developed at national and international levels. This is an important intent, since all too often, nursing actions become merged with the general health data of organizations, and are rendered indistinguishable as actual nursing behaviors. The danger though is that the unique qualities of nursing: the caring, the empathy, the customization of client care to suit client preferences and genuine needs may get “lost” or remain unnamed since they do not fit any of the designated data categories. Thus, the recorded data may only reflect the information needed for bureaucratic operations, rather than provide a continuum of individualized care for the client.

It is important then, for nurses to become critically aware of how and why they are using computers in nursing care, and that they become knowledgeable and skilled enough to influence the way nursing care becomes digitized. “The nation is at a tipping point in applying enabling technologies to healthcare. With the push coming from the federal government and all corners of the field, this is indeed a far-reaching revolution. The time has come for healthcare to leave the manual tools of the past in the past and turn to the enablers of the 21st century. The nursing profession is being transformed to meet the needs of the new world and will be a major player in the revolution” (Ball, 2005, p. 2). It is up

to nurses as a group to choose whether they will be major players who simply perpetuate the modernistic workings of the system, or learn to apply technology to support the provision of true client-centered and supportive care. “Technology demands levels of attention, time and commitment that can be arduous for a nurse and inappropriate to the needs of patients and the clinical environment” (Barnard, 2000, p. 1138).

The literature supports the notion that nurses often choose to resist the assimilation of information technology into nursing care on the grounds that it interferes with their ability to provide genuine, client-centered nursing care. “Nurses are among many groups who still adhere to a humanist view of technology on the nonhuman and nonnatural side of the human/nonhuman, nature/artifice divide. We still depict ourselves as the bridge spanning the divide between technology and humane health care. We have already claimed professional ownership of the space between technology and patient, and the responsibility for maintaining humane care in technological environments. Dwelling in this space, we see ourselves as the mediators between two seemingly irreconcilable and disparate forces” (Barnard & Sandelowski, 2001, p. 372).

### *Shifting the System*

For EBP to realistically manifest in nursing practice, a major shift in health care organization and focus must occur. Practicing nurses often lack the knowledge and skill to access the literature and other digital research findings to apply these to practice. As aforementioned, time, rituals and routine expectations are other factors that prevent the proper engagement necessary to genuinely apply EBP to routine nursing care. “A study by Tanner and colleagues examined nurses' readiness for evidenced-based practice, specifically, their information literacy knowledge and competency and their access to research information. The results showed a need in many respondents to:

- acknowledge awareness of a need for information
- identify and retrieve information
- evaluate information for relevance
- integrate information into practice
- and evaluate the effect of the information on the problem or issue” (Skiba, 2005, p. 310).

One key way that these skills are being fostered in future nurses is through the degree preparation afforded by baccalaureates as entry to practice and through the inclusion of nursing informatics in nursing education. “As we redesign nursing curricula or develop courses for an evidence-based practice (EBP) world, it is important to consider the essential role of informatics. Recent work by colleagues affirms that an informatics infrastructure is an essential ingredient to EBP and patient safety” (Skiba, 2005a, p. 310) where student nurses learn “...critical thinking ICT skills [in how] to define, access, manage, integrate, evaluate, create, and communicate” (p. 310).

If nurses develop the skills and abilities to access information, research, and knowledge effortlessly, as well as the time and expectation to carefully plan individualized care using the knowledge they have accessed, the true promise of EBP and nursing informatics could be more clearly realized (Johnson & Ventura 2004). Rather than serving as mere modes of modernist operational management, EBP and informatics could genuinely support nurses in providing expert yet empathetic and individualized care. “The Institute of Medicine's report “Crossing the Quality Chasm” defined 10 characteristics for redesigning health care systems in the 21<sup>st</sup> century. These characteristics included, among others, the focus on patient-centered care, patient safety as a system property, free flow of information as a source of knowledge, and decision making that is evidence-based. Evaluating quality and patient safety currently assumes the need to leverage information technology as a tool to achieve a redesigned health care system. Evidence-based practice and using informatics were identified as core competencies for health care professionals in this decade to support the principles of the Quality

Chasm report” (Johnson, 2004, p. 14).

There is an emphasis on just such an approach in nursing education, but in practice, the solution appears to lie in the development of more intelligent and responsive technologies. Expert decision support systems, voice and touch activated computer peripherals, and other user-friendly improvisations are often the focus of new technology developments in health care. “Multimodal applications that allow users to interact with computers based on voice, touch screen, pen, mouse, or keyboard improve user acceptance. Maturing health care technology and continued product enhancements lead to successful application implementation” (Parker, 2004, p. 41). A new, exciting, yet frightening branch of research relates to the development of agent technology, where computer programs are being developed to act as personal assistants to human users. This wave of technological research and development embraces another perspective of informatics where technology is regarded as an agent, a responsive phenomena that can interact and engage with humans as unique entities with innate agency.

### Agency

Human – computer interactions occur within sociocultural and sociostructural contexts, a notion that has sparked research and theory that strives to account for the social role of technology within the workplace and other arenas of society (Bandura, 2002). “Informatics is contextual by nature, entangled with the work done to gather it. There is a co-evolution of the environment and the system, the technology, work and clinicians are interwoven agents of change. Technology is physically constructed by actors working in a given social context” (Kaplan, 2001, p. 47). Some theorists view technologies as having agency (the capacity to make a difference) as they are acted upon by humans within the workplace or other social milieu. Others theorize that technologies gain agency in their own right,

which is constituted as a non-human agent within the social landscape. “Technologies, like people, are now conceived of as having agency, biographies, lives, lifecourses, histories, language, idiosyncratic quirks, inclinations, and known propensities for perverse or benign behavior” (Barnard & Sandelowski, 2001, p. 368). This type of theorizing has led to perspectives such as actor-network theory, diagnostic and therapeutic agency, and agent technology. Each of these perspectives influence the shaping of nursing informatics and have current as well as future implications for the profession of nursing and the provision of nursing care.

Human agency is often motivated by personal and collective efficiency. “By acting on their efficacy beliefs, people ply the enabling functions of electronic systems to promote their education, health, affective well-being, work-life, organizational innovativeness and productivity and to change social conditions that affect their lives. Technology influences, and is influenced by, the sociostructural nature of societies” (Bandura, 2002, p. 2). Advances in technology have catalyzed a shift from the industrial to the information age and birthed our current knowledge-based global society, at least in western capitalistic society. To adapt to this shift, human agency has accepted the need for continual self-development and self-renewal, often through the context of lifelong learning. Key to this renewal is the promise of new technologies which bring knowledge to the fingertips of any human who has access to a computer and the Internet. In this context, the characteristics of access and the promise of knowledge gives technology agency, in that it can and does make a difference in people's (including nurses) lives on a number of levels.

### *The Actor Network Arena*

The question of whether technology has agency has been the focus of social research for at least three decades. According to structuration theory, only humans have agency while technologies are

simply allocative resources that influence society only when they are incorporated in structuration processes (Giddens, 1984). Giddens theorized that only human actors had agency or transformative capacity, which was closely connected with a sense of power, manifested as an exploitation of resources. “Resources....are structured properties of social systems, drawn on and reproduced by knowledgeable agents in the course of interaction” (p.15). Thus, technologies possess structural properties which serve and are used by human agents as resources in social practices.

On the other hand, Bruno Latour (1987) coined the term 'actant' to describe the potential for agency in non-human artifacts. “While the status of material artifacts in Actor Network Theory is somewhat ambiguous, Latour's discussion of the agency of key fobs, door closers, and speed bumps (Latour, 1991) suggests a concept of agency that is not restricted to human actors” (Rose & Jones, 2005, p. 20). Latour viewed the intertwined actions that result when humans utilize technologies as a symmetrical network of actors that work together and influence each other: in essence, he seemed to view technologies and other material objects through the lens of hylozoism, where technology possesses the attributes of intentionality, will, purpose, and some sort of life of their own. “It is the extent to which humans behave 'as if' machines had autonomy and intentionality that is significant in understanding the interactions of humans and machines, rather than some objectively determined agency (even if this could be established). Moreover, as machines become more complex, their perceived autonomy increases. The mutual transformation of human and machine agency that emerges through their interplay, influences social practice through changes in the perceptions of social actors. Human agents have purposes and forms of awareness that machines do not. The two kinds of agency are not separate, but intertwined, and their consequences emergent” (Rose & Jones, 2005, p. 27).

A key tenet of actor-network theory is the acknowledgment of the importance of situated context. Nurses and technology interact within the context of bureaucratic health care, often in the

presence of their clients or other health professionals. These interactions culminate in “emergent networks that make work practices function smoothly” (Kaplan, 2001, p. 47) within “...dynamic, emergent processes, [where] causality is multi-directional” (p. 48). “In contemporary social studies of science and technology, the actor-network view of humans and nonhumans as analytically (as opposed to morally) similar, and its emphasis on acts, not actors, contrasts with dualistic and deterministic accounts of technology as alien to human beings and as stable causes of effects. Technologies, like people, simultaneously act, but are also 'acted upon'” (Barnard & Sandelowski, 2001, p. 369) where “...machines, tools, procedures, and protocols are agents of use and are physically and philosophically independent of human action and choice” (Barnard, 1997, p. 127).

This particular perspective of informatics presents technology as a critical actor within the social context of the health system, an actor that “cannot be understood without examining contextual factors relevant to the particular society, such as gender, class, economics, culture or race. Within this context, a series of historical actors with an investment in the system make choices about the function, form, or use of a particular technology, and these choices themselves reflect the social context” (Fairman & D'Antonio, 1999, p. 180). “When machines act they can be seen as tools (where they act directly under the control of humans to amplify their capacity to make a difference), as proxies (where they replace humans and act in their stead), or as automata (where they take over some (usually minor) part of human decision making as well as the power to act). Modern organizational computer systems can serve all three functions” (Rose & Jones, 2005, p. 28).

### *Diagnostic and Therapeutic Agency*

Technologies in nursing are often used for either diagnostic or therapeutic purposes. If one looks at these activities through the lens of agency, these instruments prove to be more than mere tools

or objects that promote efficiency and reduce human error. They become both actor in the form of helping the nurse gather diagnostic data, such as a client's vital signs, and symbols that represent the work that nurses perform in practice. “The potential and power of a technological device to shape an interaction is not pregiven but is realised in practice, e.g. A stethoscope is an instrument of diagnosis, an extension of the ear, a symbol of science, and a bid to a higher social status” (Barnard & Sandelowski, 2001, p. 369). It is in the pathic and caring use of such instruments, that nursing engages the client within the network formed by nurse and technology (in this case, the stethoscope). Through the agency of the stethoscope, deep invisible activity (pulse, respiration rate and rhythm, bowel sounds, and so on) within the client are revealed, measured, and recorded.

More sophisticated technologies go even further. “Technologies foster personhood and further humane caring. Xrays, etc. offer visual objectification of the body and often sustained patient's subjectivity by helping them to legitimate their suffering. By offering these patients, who had nothing to show for their pain, visual proof of its cause, visual technologies conferred them the power of the visible in a culture that increasingly defines the real as the seen” (Barnard & Sandelowski, 2001, p. 370). Even in end of life situations, technology can be viewed as exhibiting therapeutic agency. “Resuscitation technology served as a cultural ritual facilitating the passage from life to death. By providing an opportunity to prepare for impending death, the technology naturalized and dignified death” (Barnard & Sandelowski, 2001, p. 371).

As new technologies such as tele-nursing and virtual assessment emerge, the arena for actor network encounters between nurses and technology widens and becomes more complex. Although physical connection is absent, the nurse is able to visualize and communicate with the client, and suggest diagnostic and therapeutic activities through the means of sophisticated ICTs. “The resurrection of the fleshy body in nursing, the simultaneous transformation of the body into

information, and the new turn in medicine and nursing toward encountering patients in virtual environments of care challenge nurses once again to address the tension between touch-body and technology-information as paradigms for nursing care and the paradox of visibility that advances in technologically - enhanced visibility pose for nursing” (Sandelowski, 2002, p. 63). Instead of communicating directly through their bodies and utilizing the common practices of touch, proximity and human contact to engage with the client, the nurse must transpose their presence, empathy and professionalism through the circuitry and visual displays of the ICT machine. The nurse is still present in a manner of speaking in this situation, and perceived as situated within the health care interaction by the client, albeit through electronic means.

The emerging field of agent technology however, poses a much different configuration – one where technology acts in the role of proxy, where intelligent technological action occurs in lieu of human activity.

### *The Promise and Consequences of Agent Technology*

One of the most contemporary, dynamic, promising and yet somewhat alarming developments in information technology is the advent of agent technology. “An agent is a computer system capable of flexible autonomous action in a dynamic, unpredictable and open environment” (Luck, McBurney & Preist, 2003, p. 8). Agent technology is considered the foundation for next generation technology.

“As the computing landscape moves from a focus on the individual, stand alone computer system to a situation in which the real power of computers is realised through distributed, open and dynamic systems, we are faced with new technological challenges and new opportunities. The characteristics of dynamic and open environments in which, for example, heterogeneous systems must interact, span organizational boundaries, and operate effectively within rapidly changing circumstances

and with dramatically increasing quantities of available information, suggest that improvements on the traditional computing models and paradigms are required. In particular, the need for some degree of autonomy, to enable components to respond dynamically to changing circumstances while trying to achieve over-arching objectives, is seen by many as fundamental” (Luck et al, 2003, p. 9).

Autonomy is one characteristic that needs to be considered carefully when designing agent technologies. Chalupsky, Gil, Knoblock, Lerman, Oh, Pynadath, Russ. & Tambe (2001) described a sophisticated group of agent technologies they created called the Electric Elves, that services the Intelligence Systems Division in their workplace, which consisted of “a system of about 15 agents, including nine proxies for nine people, plus two different matchmakers, one flight tracker and one scheduler running continuously” (p.1). “In the process of building the applications... we addressed a number of key technology problems that arise in any agent-based system applied to human organizations. In particular we described how to use Markov Decision Processes to determine the appropriate degree of autonomy for the agents, how to use knowledge-based matchmaking to assign tasks within an organization, how to apply machine learning techniques to ensure robust access to the data sources, how to combine knowledge-based and statistical matchmaking techniques to derive knowledge about the participants both within and outside an organization, and how to apply multi-agent teamwork coordination to dynamically assemble teams” (p. 10).

The Electric Elf proxy agent acted like a personal assistant, always aware of the assigned human's location using a Global Positioning System (GPS), their calendar and other information sources. The agent could perform routine duties such as scheduling meetings, give reminders about appointments and events, communicate with other humans on the user's behalf by email, wireless messaging or faxes, and so on. “When a proxy agent notices that someone is not attending a scheduled meeting or that they are located too far away to make it to a scheduled meeting in time, then their agent

sends them a request using a wireless device asking if they want to cancel the meeting, delay the meeting, or have the meeting proceed without them. If a user responds, their decision is then communicated to the other participants of the scheduled meeting. If they are unable to respond, the agent must make a decision autonomously” (Chalupsky et al, 2001, p. 2).

Chalupsky et al. (2001) described the agents as “...autonomous, heterogeneous, and distributed over a variety of platforms and research groups. Yet, these diverse agents must work together to accomplish the complex tasks required by Electric Elves. By interfacing with Teamcore proxies, existing agents become team-ready and thus able to rapidly assemble themselves into a team to solve a given problem” (p.7). Although this type of sophisticated technology is still a fantasy in health care, it already exists and will likely be part of the health care landscape within the next few years. Their efficiency, ability to attend to redundant tasks, and the various ways they can support organizational functioning will make them too valuable to ignore for long. “Our agents go beyond simply automating tasks that were previously performed by humans. Because hardware and processing power is cheap, our agents can perform a level of monitoring that would be impractical for human assistants, ensuring that activities within an organization runs smoothly and that events are planned and coordinated to maximize the productivity of the individuals in the organization” (p. 10). Agent technology “...enable the aggregation of different functionalities that have previously been distinct (such as planning, learning, coordination, etc. ) in a conceptually embodied and situated whole” (Luck et al. 2003, p. 9).

This radical new wave of information technology demands new ways of thinking of technology in the context of nursing. Since agents are “autonomous entities capable of exercising choice over their actions and interactions” (Luck et al. 2003, p. 17), the complexities of applying agent technology to nursing poses both promise and threat. Promise in the fact that these technologies could potentially perform many of the mundane duties that keep nurses occupied in operational procedures that maintain

the organizational system but detract from potential time spent in meaningful exchanges with clients. But they also pose a threat in other ways: their ability to exercise choice and interact could be relied on as a reliable decision making source that could deter nurses from providing individualized care. They also could present the threat of potentially replacing humans in the workplace. Agent technology in nursing could provide many benefits, but as with all technologies, nurses would need to be involved in their design, in the choice of their assigned applications, and retain control of any actions that directly impact on providing individualized client care.

Nurses and technologies interact to form actor networks within the workplace arena. New technologies are also used to facilitate networks between nurses and other health care professionals. These networks manifest as virtual nursing and interdisciplinary work teams, interest groups, communities of practice, and other collaborative configurations.

### Network

Primary health care is a key focus of the current Canadian health care system, a model that depends on networks of people working together to achieve high quality, empowering, 24 hours a day, 7 days a week, client-focused care. These human networks include all members of the interdisciplinary team including nurses, various work groups and social networks, all centered on or at least referent to the clients of the system, the Canadian public. "Sociology draws attention to health care as a nexus of interlocking institutions, including networks, functions, and structures of health care delivery systems, professions, and public governance as well as organizational and professional structures, institutions and roles" (Kaplan, Flatley-Brennan, Dowling, Friedman & Peel, 2001, p. 238). ICTs are beginning to serve as a critical foundation for making these human networks dynamic and viable.

Networks can perhaps best be viewed through a socio-technical or socio-cultural lens, since

social and human-to-human interaction are the key processes involved in any network activity. As well ICTs should also be conceived as socio-technical networks, since they are more than simple tools. “A key idea of social informatics is that information technology is a socio-technical network. ICT in practice is socially shaped. In the highly intertwined model, tech-in-use and a social world are not seen as separate – they co-constitute each other” (Kling, 2000a, p. 248).

The application of networks in health care requires careful design and awareness of the users of the system. System designers, as well as nurses who serve as guardians and guides of the system need to recognize the life-worlds and work-worlds of the users: in this context, of the health team and the clients they serve. As well, the social context (a matrix of people, service, organization, location, history, and so on) of the ICT use in network activity must be considered since they play “... a significant role in influencing the ways that people use information and technologies” (Kling, 2000a, p. 254).

Networks within health care can manifest in several different configurations, including client focused networks such as in telenursing, e-health, and client support networks; work related networks including virtual work and virtual social networks; and learning and research networks as in communities of practice. These trends are still in their infancy in most nursing work environments (and personal lives) but they are predicted to be a strong trend in the future. “As the Net generation grows in influence, the trend will be toward networks, not hierarchies, toward open collaboration rather than authority; toward consensus rather than arbitrary edict. The communication support provided by networks and information systems will also alter patterns of social interaction within a health care organization. This technology provides a medium for greater accessibility to shared information and support for rich interpersonal exchange and collaboration across departmental boundaries” (Richards, 2000, p. 10).

*Virtual Work Networks*

In essence, all organizations consist of networks: systems of people configured into nodes or work teams, occupations, specialties, and hierarchical layers linked by relationships, and all generally focused on a central goal or target. In the case of health care, the central goal is the provision of health care to a network of clients from all walks of life. In recent years, virtual networks within the workplace have become common in many businesses and industries and are a growing phenomena in health care. Seamless work networks require active participation by all of the actors within the health care system, as well as a strong socio-technical infrastructure (Kling, 2000b). The networks intertwine so that "...the technology in use and the social world are not seen as separate, they coconstitute each other (p. 220).

Unfortunately, most current virtual work networks are initiated by administration within health care organizations, usually for the purpose of information dissemination and some employee input. "Electronic bulletin boards, calendar filings and email enable rapid communication of nursing administrators with staff, nursing managers and support departments (Ball, 2005, p. 2). Although relationships are a core element of a dynamic virtual work network, most intranet communication and activity remains top-down and often does not require or expect any response from the recipients. This is logical considering that most health organizations are bureaucratic in nature, where the emphasis is more on order and structure rather than interconnectedness. But trusting relationships are necessary for true virtual networking to occur in the workplace. "Social informatics research investigates intriguing new social phenomena that emerge when people use information technology such as the ways in which people develop trust in virtual teams" (Kling, 2000b, p. 229). Lack of trust in these networks highlight issues of surveillance of communications and network use by administration; confidentiality and privacy issues; and the lack of social support for open two-way or multiple-way interaction. Often a

change in leadership and administrative practices are needed: a shift from a bureaucratic model to a more collaborative, equitable mode of interaction across the entire network of players.

### *Virtual Social Networks*

Virtual social networks are another form of professional network that have expanded phenomenally since the advent of the Internet and other ICTs. “Electronic media do more than just expand access to vast bodies of information. They also serve as a convenient vehicle for building virtual social networks for creating shared knowledge through collaborative learning and problem solving. Cross pollination of ideas through worldwide connectivity can boost creativity synergistically in the co-construction of knowledge” (Bandura, 2002, p. 4). Basically, nursing-related virtual social networks provide a cyberspace for nurses to make contacts, share information and ideas, and build a sense of community. Social technologies are used to provide a dynamic virtual environment, and often provide communicative capabilities through posting tools like blogs, forums, and wikis; email for sharing ideas on a smaller scale; collaborative areas for interaction, creating and building digital artefacts or planning projects; navigation tools for moving through the virtual network landscape; and profiles to provide a space for each member to disclose personal information with others. Nurses who have to engage in shift-work often find that virtual social networks can provide a sense of connection with other professionals that is available around the clock. Since time is often a factor in any social interchange, virtual communication often offers an alternative for practicing nurses who can access information and interchange at any time of day. With active participation, the interchanges and shared information/ideas of the network can culminate into valuable social and cultural capital, available to all members. Often, nursing virtual social networks are created for the purpose of exchanging ideas on practice issues and best practices; to become more knowledgeable about new trends, research, and innovations in health care; or to participate in advocacy, activist, and educational initiatives.

Of course, nurses must have both technological and social access to reap any benefits from virtual social networks. Technological access includes actual available ICT equipment including “...computers of adequate speed and equipped with appropriate software for a given activity” (Kling, 1998, p.1) which serve as technologies of interaction within the network context. Social access “...refers to know-how, a mix of professional knowledge, economic resources, and technical skills, to use technologies in ways that enhance professional practices and social life” (p.1) and support the development of complex social network relationships with peers within a virtual landscape. Time and life commitments are also important considerations, since participation in virtual social networks does require that time be applied to the process, a commodity that is often at a premium in a nurse's life. “Expert knowledge sharing includes both proactive and reactive processes. Receiving information on an ongoing basis requires proactively participating in listservs, which requires effective time management for e-mail” (Johnson, 2004, p. 16).

Lamb and Kling (2002) described a multidimensional view of professional participants in virtual social networks that distinguished them as social actors with four central characteristics: affiliations, environments, interactions and identities. Affiliations referred to dynamic, multi-level, multi-valent, and multi-network social actor relationships shaped by networks of organizational affiliations. Environments were also dynamic and were contingent on ICT quality and pliability. Interactions referred to actions taken to communicate in legitimate ways, with ICTs included as part of the interaction process. As well, people perform socially embedded (role-based), highly specified actions within the network. Finally, identities focused on social actor identities that had an ICT use component and manifested as multi-level identities in the virtual environment. Social actors use ICTS to construct identities and to control perceptions in others. Sawhney and Lee (2000) described how social actors who create unique virtual social networks using ICTs interact with and “discover the new

liberties of action of an emerging communication technology” (p.1) and together with other social actors create a space for people to shape a network focused on a common subject or affiliation. Similar technologies are becoming commonly used in the actual provision of nursing care, in the form of telenursing and e-health networks.

### *Telenursing Networks*

Telenursing is the branch of telehealth that involves actual nursing and client interaction through the medium of information technology. Before the advent of computers, similar activity sometimes occurred using telephones (which still occurs, i.e. the BC NurseLine) or even two-way radio. “Telehealth is the provision of health care or health information using telecommunications technology to provide care or information over long or short distances. It may include consultation, assessment, diagnosis, treatment, transfer of health data, client education and professional development. Telehealth may use familiar technology such as telephone, e-mail, or personal digital assistants, or more complex technology such as remote control surgical instrumentation” (CRNBC, 2005, p. 1).

Telenursing first evolved to provide expert service to people living in remote areas, but it is becoming more common in urban regions as well. New technologies have added a visual component to the interactions that augments the historic audio exchange. Nurses can actually view healing wounds, can access physiological monitoring equipment to measure physical indicators such as vital signs and provide routine assessment and follow-up care without the client having to travel to the health care agency for an appointment. “Telehealth, considered the use of home-monitoring systems by nurses, may be designed to provide home healthcare nursing services to monitor chronic diseases, such as diabetes. A video monitoring system may be used in conjunction with the monitoring devices at both

ends of the system, permitting video and voice interaction between nurse and patient and adding a personal touch” (Moody, 2005, p. 157).

A decidedly modernist approach is often used in the literature to promote and discuss the benefits of telenursing, especially by organizational leadership researchers, but also by governing nursing organizations such as the College of Registered Nurses of British Columbia (CRNBC). “Telehealth is innovative and rapidly changing to provide more information, quicker communication and instant access within health care. Nurses' in all practice settings can use telehealth to deliver care, provide education, monitor clients' progress, access client records, obtain information and foster communication and collaboration among themselves, other health professionals and clients. Telehealth can be used to replace or complement some components of face-to-face health care. It has the potential to increase accessibility, particularly for clients in rural, remote, or under-served locations. Telehealth may be used to provide more timely, effective and efficient care, and enable the client to remain closer to home. Nurses use telehealth when it can enhance, augment, or otherwise improve care and services for clients” (CRNBC, 2005, p. 1).

It does seem logical that some clients would find value in telenursing services, especially if the alternative would require repetitive travel, expense, or isolation from home and significant others. However, nurses need to be aware of the less visible potential effects of providing nursing care “...on screen, instead of behind the screens” (Sandelowski, 2002, p. 64). Nurses need to question if the absence of physical presence and shared physical space detracts from caring and establishing reciprocity with clients. “Nurses have an interest in determining how tele-technologies can be used to maximize health benefits and to enhance the felt presence of the nurse, but they also have an interest in understanding how these technologies can undermine the presence of the nurse. Tele-health practices not only call for nurses to reconceptualize presence, place, and bodies in nursing, but also to explore

how these practices threaten to displace nursing” (p. 65). There is a danger that both nurses and clients can enter a sort of shadow land as they dissolve into the virtual interface. It is imperative for any nurse who engages in telenursing to be aware of this, and to ensure that network exchanges with their clients reflect dynamic, personable caring and attentiveness, even when the interactions occur via ICT mediums. In telenursing, it is the nurse who is responsible and accountable for ensuring that the client is never perceived as a “...hypertexted, hyperreal representation on screen in the form of a rhythm strip; black-and-white or colorized image; or numeric, graphic, digital, schematic, or other visual display” (p. 66).

It is theoretically possible, if the technology used is sophisticated enough to provide clear, crisp visuals, real-time relay, exceptional audio, and accurate physiological measurement, that an astute and technologically literate nurse could create a similar sense of caring, presence, and individualized attention with the client, using telenursing ICTs. Still, virtual environments for nursing care could challenge the nurse's ability to perceive the digitalized presentation of the client as an individual, and provide individualized care. “For nurses especially, they trouble the distinction between human being/body and information network, and between body work and information work. Yet they offer nurses an opportunity to move toward an informatics of the body and a more embodied informatics in nursing; that is, toward an orientation to nursing education, practice, and research that celebrates the body work of nursing and reunites it with the information work of nursing” (Sandelowski, 2002, p. 67).

While engaging with the virtual representation of a client, the nurse must strive to envision and experience the client's three dimensional body and being in order to accurately advise, assess, diagnose, and interact fully and dynamically. This perceiving must occur within the a virtual network environment, where both body-sense and body-awareness are combined with digital information.

“Nurses must see body and information work as constituting each other, and the body as a source of

knowledge and power for nursing. Because nurses occupy a distinctive place in the health care arena, they have a distinctive contribution to make to theorizing the body in the virtual environments of care now emerging” (Sandelowski, 2002, p. 68). Not only the body, but also the person's inner being must be acknowledged and somehow included.

What are the psychological and emotional effects of being examined and assessed via a video camera? Is the sense of intimacy and privacy common in caring client-nurse interchanges lost in the virtual translation? These are questions that nurses must consider before engaging in telenursing network interactions and activities. The ideal scenario would be that nurses and ICT designers could work together to create more sophisticated ICTs that could meet the needs of the clients better. “Although they seem far removed from each other, both media designers and nurses share a common interest in presence: in how to create it, how to use it effectively, and how it works to generate its effects. At the heart of all efforts to enhance media is the creation of the illusion that technologically mediated experiences, such as tele-health encounters and virtual reality, are not mediated at all; that is, to create the perception of presence. The design intentions behind distance technologies are to overcome the effects of distance and electronic mediation; that is, to simulate lifelike and full-bodied encounters in proximate space that close the distance between people and allow users to feel as if they were,...reaching out to touch someone” (Sandelowski, 2002, p. 65).

### *E-health Networks*

Another critically important wave of network evolution is the public use of the Internet for networking with health care providers and other members of the public, now called E-health. Essentially, E-health is a client-centered World Wide Web-based network where clients and health care providers collaborate through ICT mediums to research, seek, manage, deliver, refer, arrange, and consult with others about health related information and concerns (Moody, 2005; Conte, 1999). “The

spread of powerful computers among a large and rapidly increasing segment of the population, and their interconnection through the Internet and millions of powerful servers, has brought an entirely new and largely unexpected quality to health and health informatics, and is effecting changes that we are only beginning to fathom. Essentially, it provided a vehicle to tie the general population in a new way into the system of health provision, health maintenance and health care. According to many assessments, health care is among the foremost reasons for resorting to the Internet” (Moehr & Grant, 2000, p. 278).

Although E-health developed from the telehealth network movement, it is a unique phenomena in two ways: networks and resources devoted to E-health have developed on the Internet at an amazing rate over the past decade or so, and the emphasis is genuinely client focused. “It differs from telehealth or telemedicine in that e-health is Internet-based and includes a range of services, nursing or healthcare, health education, and medication prescription or refills via e-prescribing. In conjunction, telemonitoring devices may be used, via a Universal Serial Bus (USB) port on the patient's computer, to collect additional physiologic data (e.g blood pressure, pulse, temperature, weight, spirometry, blood glucose, and oxygen saturation levels)” (Moody, 2005, p. 157).

The phenomenal growth of E-health can not generally be credited to the health care system or its employed social actors. Rather, clients driven by the need and urge to become informed health consumers and participants have catalyzed this new style of networking, clients who have learned to utilize ICTs in the form of the Internet to meet their health concern needs. Although statistics show that women are underrepresented in Internet usage, women tend to access the Internet more than men to seek health related information and networking (Henwood, Wyatt, Hart & Smith, 2003). “The notion of informed choice is inductive of the greater agency and sense of empowerment said to be experienced by such patients. The dominant discourse here is said to be one of rights, where patients

have the right to information and are treated as individuals, not treatment opportunities” (p. 591).

Informed, reflective clients in the health care system have encountered some degree of alarm and reluctance from members of the health team, since the notion requires a change in the dynamics of provider-patient or provider-client interactions. “It is clear that the informed patient will not emerge naturally or easily within existing structures and relationships. Constraints exist within both practitioner and patient communities and within the space occupied by both in the medical encounter” (Henwood et al, 2003, p. 605). E-health networks that support interactions between knowledgeable clients who have assumed a position of control and choice in their own health care and reciprocal health professionals depend upon a shift in perspective on the part of health care providers, especially in medicine and nursing. A health care landscape that is conducive to a partnership level of interaction is critical, while the onus of control rests with the client (Moehr & Grant, 2000). “These trends are also leading informatics, as an information-intensive industry, to become a major pillar of health care. Because the person is the only element in common across institutional, organizational, and national boundaries, we come full circle, to the need to re-design systems around the person, that is, to patient centered informatics. IT facilitates the transmission of health care information without regard to location; it contributes to the trend toward boundary-less delivery of both health information and health care” (Kaplan, Flatley-Brennan, Dowling, Friedman & Peel, 2001, p. 240).

Nurses can be primary actors in the virtual arena of E-health, serving as health advisors, Internet guides to help clients select reliable information resources, support group liaisons, web information providers, and so on. Nurses need to be involved in the design and implementation of E-health portals and programs that provide the best possible E-health experience for health care clients. Designers of such programs should be directed to “...build tools to enable individuals to become involved in their cure no matter where they are. Such tools may include programs for monitoring one's own health and

health behaviours, tools for accessing quality information, and tools for communicating with others in like circumstances or with health professionals” (Kaplan et al, 2001, p. 239).

It is becoming obvious, that many clients want health care that is “highly personalized, customized, targeted, with tailored information and ultimately care delivery and case management” (Kaplan & Flatley Brennan, 2001, p. 311). This has led to the evolution of many client managed E-health initiatives that serve as self-help or support group networks. Initiators of these networks embrace the role of significant provider as well as user of health information, providing advice and a virtual environment that invites interaction with others who are focused on the same health issues and questions (Henwood et al, 2003). The levels of affiliation and interaction that develops within some of these networks are truly inspirational to health care providers who wish to engage in E-health networks with clients. Nurses can become visible social agents within these networks, interacting with informed, reflective public agents who have the desire and capabilities to make the health care choices that suit their own life world and personal values.

### *Communities of Practice*

Communities of Practice (COP) are another example of professional networks that can interact using ICTs including the Internet to collaborate on a variety of projects or initiatives, often for the sake of research or education (which are sometimes called Communities of Learning or learning communities). These networks can be viewed through the lens of social cognitive theory to reveal the enactment of collective agency. “People's shared belief in their combined power to achieve desired results is a key ingredient of collective agency. Perceived collective efficiency raises people's vision of what they wish to achieve, enhances motivational commitment to their missions, strengthens resilience to adversity, and enhances performance accomplishments” (Bandura, 2002, p. 3).

Shortliffe, Barnett, Cimino, Greenes, Huff, and Patel described the Intermed project, which served as a model for informatics-related COP networking, which depended on Internet-based ICTs as a virtual meeting space for the community. Collectively, the social agents of this incubated “...the idea of an electronically mediated, research collaboration, a collaboratory. A national collaboratory is a center without walls, in which the nation's researchers can perform their research without regard to geographic location – interacting with colleagues, accessing instrumentation, sharing data, and computational resources and accessing information in digital libraries. The Intermed project seeks to demonstrate the viability of the collaboratory concept in the context of medical informatics research” (1996, p. 1).

Although COPs are relatively new in nursing, the literature does support the benefits of such initiatives, by describing the value to nursing through “...the “doing” of community within the context of shared projects, obligations, and goals” (Page & Scott, 2001, p. 528). In fact, COPs are acknowledged as a prime vehicle for achieving the goal of informatics integration into nursing education. “Creative faculty development strategies that capitalize on the concept of faculty as a community of practice are required to incorporate informatics competencies into nursing curricula” (Barton, 2005, p. 323). Although COPs are usually devoted to rather formal, critical issues and foci, there is a tendency to also encourage open, creative thinking and affective interaction within the socio-technical arena. “We develop the concept of “learning communities” to meet the need for democratic, inclusive, and on-going innovation ... We conceptualize 'learning communities” as dialogic and “playful” spaces within which members can draw creatively on their differences while constructing shared knowledge” (Page & Scott, 2001, p. 528). The virtual social space of COPs ideally invites collaborative inquiry, a sharing of learning or research goals as well as process, within a holistic, action-oriented network.

Wenger, McDermott and Snyder (2002) identified seven key principles for COP cultivation: design for evolution, open a dialogue between inside and outside perspectives, invite different levels of participation, develop both public and private community spaces, focus on value, combine familiarity and excitement, and create a rhythm for the community. Wenger also identified four general categories of COP, all of which fit well within nursing ideals and intents: helping communities, best-practice communities, knowledge-stewarding communities, and innovation communities. COP need to be actively created and sustained, which requires well developed relational links and abilities between the social actors, both human and technical.

The issues of inclusion/exclusion and social access (or the lack thereof) are potential critical consequences of any health oriented network. Clients and health professionals alike could be disadvantaged if other modes of interaction are not available. “The information society might be conceptualized as a powerful technoeconomic network that is creating a new social reality. Drawing on the work of Latour, Star has described the way heterogeneous interests can be pulled together into 'mini-empires' enrolling both human and non-human actors into new techno-social networks. Once stabilized, these networks begin to shape our social landscape, grounding each and every social action and movement. Within these networks, new sets of physical-social conventions are established, which being stable for non-members, also creates new forms of marginality” (Page & Scott, 2001, p. 549).

### Power

A final glance at the lens of power is important for nursing, to examine the dynamics of disciplinary and individual power in the context of utilizing information technology within nursing. A particular focus on the power that nurses exhibit in the context of using technologies within the health care system is important, as is a look at client power. The nursing literature is just beginning to provide

a look at informatics through this particular lens which is actually a part of all of the previous perspectives addressed, from antithesis to networks. “As a society, we barely comprehend the true effects of our increasing involvement with computers. Technology does not function in a vacuum but within a social matrix, interacting with individuals in an organization. The use of computer capabilities can indeed affect the social and political dynamics in an organization by frequently rearranging communication patterns and the distribution of power” (Richards, 2001, p. 11).

Much of the contemporary nursing literature supports a noticeably strong modernist philosophy of nursing power, especially in relation to the integration of technologies into nursing practice. The maxim that “knowledge is power” and that the skillful use of computers and other ICTs is the heart of this power is a common thread through much of this literature (Ball, 2005; Canadian Nurses Association & Office of Health and the Information Highway, 2000; Richards, 2001; Buckeridge, 1999). “The computer literate nurse will have knowledge, and as a result, power and influence. Society has accepted computers as standard elements, and as such, computers will continue to shape nurses’ psychological, social, economic, and political existence in innumerable ways. Nursing, in order to interface with other spheres of society, must be computer literate. In short, society has accepted computer technology as a means to enhance life; so must nursing” (Richards, 2001, p.9).

### *Technologically Enhanced Disciplinary Power*

Nursing is a field that has striven to establish itself as a legitimate discipline in the eyes of other health profession groups and disciplines, and by society in general. Theory development and research have been the main activities embraced in this mission, coupled with the application and integration of technology into the nursing landscape. With the emergence of information technology, the inclusion of computers and eventually ICTs in nursing has become a way to boost prestige and influence within the

health care system. “Our association with technological knowledge and skill has been a source of increased prestige and power for nursing” (Barnard & Sandelowski, 2001, p. 372). This lure of disciplinary power remains a common enticement to convince nurses that they should unquestioningly participate fully in the computerization of health care in all of its forms.

This enticement is not exclusive to nursing though, since nurses as a group are often also responsible for convincing clients that they too should embrace the wonders of technology in their own health care. “Transformed by our associations with the economics of healthcare delivery and the legalities of membership within professional associations, we are positioned to see and hear patients through prior written traces. Only in this way can 'continuity' of care be demonstrated. Our technologies of accountability demand this. The link between a disciplined gaze (what the nurse sees) and disciplined conduct (telling and showing what has been seen) establishes the conditions for legitimating nursing's knowledge as a discipline” (Purkis, 1999, p. 154).

Nursing informatics as a field, emerged from the overarching discipline of health informatics and alongside the expanding field of medical informatics. Nursing informatics researchers and theorists acknowledge these bonds with health and medical informatics but are also very careful to emphasize the importance and distinction of nursing informatics from all other similar fields. “Practitioners are interested in enrolling forms of technology that enable them to make visible their unique contribution to the care delivery enterprise. Latour's writings on 'technology' as durability offer methods for describing socio-technical processes that contribute to the appearance of domination. Challenging the prevailing view that order results from powerful domination, Latour argues that domination is an effect of contingent processes” (Purkis, 1999, p. 147).

This tendency to focus on technology as a means for discipline articulation is not new. Sandelowski (2000) described how nurses have fashioned their care around similar technologies since

the 1950s when physiological monitors became common within hospitals and clinics. “With the advent of machine monitoring in clinical nursing practice, nursing observation was transformed from a largely embodied relation with patients and devices to an increasingly hermeneutic relation with devices. Nursing became less corporeal and more hyperreal. Whereas nurses had once observed their patients in the world of the tool, they were now monitoring their patients in the world of the screen. Knowing patients increasingly meant keeping them under technological surveillance. This kind of knowing introduced a new kind of ‘hands off’ care, which contrasted sharply with traditional hands-on contact with the physical body” (Sandelowski, 2000, p. 155).

The world of the screen is fast becoming a constant reality within health care through the mediums of telenursing, e-health, hospital and nursing information systems, and advanced physiological monitoring. There is an alarming need for nurses to reflect and incubate ways to counteract the potential distancing and rupturing of relations with clients that can accompany the use of information technologies in nursing care. “It is argued that in health care systems where the mismatch between treatment options and resources for care steadily grows, the nursing discipline must develop ecological literacy for a technological world” (Marck, 2000, p. 62). Nurses need to ponder on how these inevitable technologies can be included in nursing care in ways that actually allow more embodied time and presence with clients. The promise has been given over and over in the literature – that the use of computerized information systems will free both time and energy so that nurses can perform their in-person nursing care in a more present, more reciprocal and attentive way: to be with the client. Yet, that promise has not been realized, nor will it be as long as a modernist drive for doing more with less remains a reality in health care.

*Discovery of Hidden Governmentality*

As previously mentioned, primary health care has been recognized as the best possible model for fashioning the present and future Canadian health care system. Self-care and health promotion are both critical and contingent to the success of this movement. One of the primary roles of nurses is that of health educator, devoted to guiding clients in how to take their health into their own hands, by following regimes of healthy living. “Registered nurses will become information brokers and educators to support consumers using ICTs” (Canadian Nurses Association & Office of Health and the Information Highway, 2000, p.12). This trend can be seen through a positive lens, since people do enjoy much more dynamic lives when their bodies are well nourished, fit, and free from disease. But it can also be looked at through the lens of power as a form of surveillance, perpetuated to control and normalize the health of clients. “Surveillance in these contexts is an intervention of social control, as opposed to benign clinical assessment. According to Foucault, surveillance disciplines, such as the criminal justice system and medicine, acquire and maintain power by virtue of their authority to look. According to Foucault, contemporary measures of power are ensured not by right, or law, or punishment, but rather by, normalization, control and technique” (Sandelowski, 2000, p. 157).

The growing arena of E-health is grounded in this movement of health promotion and self-care, supported by a large array of Internet based resources and bodies of information. Nurses are responsible for ensuring that ethical information and choice are included in the E-health context, and any other situation where information technology is a part of nursing care. The “Internet eHealth Code of Ethics (by Internet Healthcare Coalition and the ehealth faEthics Summit) – meant to be international, inclusive, and comprehensive with the goal to ensure that all people worldwide can confidently, without risk, realize the full benefits of the Internet to improve their health. [The code is] founded on eight principles: candor, honesty, quality, informed consent, privacy, professionalism,

responsible partnering, and accountability” (Kaplan & Flatley Brennan, 2001, p. 311). If people are going to embrace self-care and seek out information for themselves, nurses must be there to support their choices, not just provide rote health information based on diagnoses and generalizations. Kaplan and Flatley Brennan (2001) identified three areas that nurses could focus on to support client choice and individualized care - a) determining what constitutes a “patient's view” of information; b) deliver targeted, personalized, just in time information and c) assess what affective messages are carried by the technology, either explicitly or implicitly, [how they] situate care in the context of a patient's life (p. 313).

National electronic health records (EHRs) are another technological development that has received enormous support, funding, and time investment across the globe. “The arrival of near-ubiquitous electronic networks has finally made it practical to realise the goal of true person-centric information technology systems. The holy grail of health informatics, a true lifelong electronic health record, is becoming a reality” (Harrison & Booth, 2003, p. 223). Various groups including the Canadian Nurses Association continue to work on developing the nursing data classifications to be included in the projected national Electronic Health Record.

The EHR is lauded as the perfect way to ensure continuity of care since every health care system encounter can be digitally recorded and added to the record. In one database file, a person's entire medical and health history can be accessed and inspected by authorized health professionals across the nation, and even internationally in some instances. “An ICT-supported health care system will seamlessly link all points of care for the consumer, often across geographic borders. Homes, health care providers, community clinics, long term care facilities, acute care hospitals, telehealth service providers, etc. will all be linked electronically. With permission, providers at all points of care will be able to access a consumer's EHR” (Canadian Nurses Association & Office of Health and the

Information Highway, 2000, p.11). The ideal context for this new development in health informatics is that the person, the client, will have control of their own EHR. “Recent work in the emerging field of network or digital identity suggests a new approach to the design of informatics systems, in which the individual becomes the guardian of their own personal data, and is assisted in controlling access to it by an infrastructure that is aware of roles, such as 'doctor' and relationships such as 'doctor-patient’” (Harrison & Booth, 2003, p. 223).

The literature insists that EHRs are a positive development that will put the client in control of their own health information, which supposedly will give them more access and control. “Consumer involvement: secure personal health records, maintained by the patient and his or her physician, insurer, or others, give the patient unrecented access and control. This not only means a better-informed consumer, but also directs consumer involvement regarding care decisions”(Moody, 2005, p. 158). Considering how difficult it is for people to keep organized health records through out their life time, this new way to formally witness a person's life health does seem like a positive endeavor. However, it too could act as a very serious artifact of surveillance. “The challenge here is that prevailing understanding of who pushes who around (and with what) in an effort to control and organize, must be re-examined” (Purkis, 1999, p. 149). Nurses must always be aware that “Technology is not neutral. It has effects. And these effects are, for Latour, transformational such that the removal of a non-human actor will not 'solve' the problem” (p. 149). A permanent record of a person's health history could become a dangerous artifact, especially if there are entries that reflect habits, behaviours or diseases that are considered socially derogatory or unacceptable. In an extreme view, this pool of personal information could be a sentence to social ostracization, exclusion, denial of privileges, and other forms of oppression or punishment. Nurses must be part of the dialogue, planning, and shaping of these emerging EHR and adopt the role of client advocate to protect personal information, rights, and choice.

Beyond participation in the planning and decision-making in informatics initiatives, nurses can help the public best by becoming as technologically astute as possible. This expertise and awareness needs to be coupled with a critical social lens to view both the benefits and dangers of nursing through technological means. Once nurses become comfortable with various technologies, they can shape them, refine them, and apply them in new and different ways – just as they have always adapted earlier equipment and technologies.

It is predicted that as today's young people enter nursing and become the norm in practice that they will also bring insights and abilities that will help to reinforce client-centered care coupled with a natural affinity with technologies. “Digital media is increasingly a reflection of our worldview, disciplines, commercial interest, and knowledge repository. Because this form of media is interactive and malleable, it is a vehicle for unprecedented change throughout our social attitudes and structure. A massive communications revolution (paradigm shift) is under way, one that will have profound effects upon the art and science of nursing. Currently, nurses, as a group are unsophisticated in informatics potential. This lack of computer skill in a majority of practicing nurses will be a major drawback in meeting the high technology challenges of our present professional domain. Such a deficiency is juxtaposed against the fact that young nurses entering the profession have grown up surrounded by technology, assimilating it as easily as the air they breathe. These new graduates will bring with them new, powerful tools for inquiry, analysis and self expression. They will begin to question the implicit values contained in information we have historically championed and cherished within our profession. It is through the use of digital media that our forthcoming nurses will cultivate and superimpose their culture on society” (Richards, 2001, p.6). This prediction holds promise, but nursing can not just wait for inevitable replacement by more technologically savvy young nurses. Nurses need to gain the insight to look at all of the different perspectives discussed to view the realities of applying information technology to nursing, and apply critical awareness and strategies to how they shape client care.

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