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A GROUNDED STUDY OF INFORMATION SYSTEMS IN ANAESTHESIA

Abstract

This paper presents an exploratory study of the appropriation of information systems (AIS) in anaesthesia. Using a grounded theory approach, we identify three key concepts and the basic social process of appropriation to construct a theoretical model that explains why certain systems are chosen, what technologies are considered and how they are appropriated. This study attempts to offer theoretical contributions to the field of anaesthesia and represents the first grounded theory investigation with an IS perspective conducted in this area.

Keywords: Appropriation, Grounded Theory, Anaesthesia, Information Systems

1 INTRODUCTION

As the responsibilities of the anaesthetist increased from drug administration to the full professional care of patients before, during and after surgery, sophisticated computer monitoring systems were introduced to provide early warning of changing conditions within the patient (Calverley, 1989). Monitoring tools such as pulse oxymetry and anaesthetic workstations, consisting of integrated software, shaped the roles and expected capabilities of the anaesthetist, and significantly improved patient outcome (Byrick & Cohen, 1995; Greenwood, 2005). Now, advanced monitoring technology is used in anaesthesia more than any other area of medicine (Smith et al., 2003).

In a survey of adaptive and intelligent systems among sub-specialties of medicine, Abbod et al. (2002) found that surgery and anaesthesia had 25 instances of such systems, second only to radiology (27). The most frequently used information systems in anaesthesia are Anaesthetic Information Systems (AIS), a class of computer-based monitoring that captures and stores data from patient monitors to create electronic anaesthetic records (Feldman, 2004). Studies on AIS have included Feldman's (2004) survey on whether these systems elicit fear of malpractice exposure, and Gardner and Peachy's (2002) recommendation of a standard XML schema for created records.

While records are created by these AIS, they are not necessarily used afterwards. For example, major hospitals in Queensland, Australia, have collected AIS data for seven years but it is only now that Information System (IS) researchers are examining these data-sets. Within anaesthesia, there exists opportunities for IS researchers to apply various techniques and methods to gain insight into the technology component of the anaesthetists' practice. Little attention has been invested in the consideration of why anaesthesia has a high propensity toward technology, what systems they pay particular attention to, and, how they go about incorporating these systems into their practice.

Using a Grounded Theory (GT) approach (Glaser & Strauss, 1967; Glaser, 1978, 1992), our intent is to develop a theoretical model that depicts the process of technology incorporation in anaesthetic practice from an IS perspective. We chose the Glaserian approach to GT because we were seeking emergent patterns within the data collected from practitioners. The central discovery is the concept of *appropriation* (Ollman, 1971) - the anaesthetists' activity of recognizing, adapting and incorporating technologies such as AIS¹. Appropriation forms the core concern of our theoretical model. We depict the process of appropriation through three constructs or concepts: *knowledge-driven medicine* (the why), *complementary systems* (the what) and *clinical culture* (the how).

Our specific contributions with this paper are to:

- Create a theoretical model with grounded constructs mapping the process of appropriation specific and relevant to the anaesthetic domain; and
- Chronicle a Grounded Theory design that is true to the *Glaserian* (Glaser, 1992) approach².

The remainder of this paper is structured as follows. Firstly, we detail our initial broad research questions formulated prior to entering the field. Second, we present the grounded theory method and the research design including some example data and the process of analysis. Then we present our

¹ Note: In IS research, information systems appropriation is a concept that is used in Adaptive Structuration Theory by (DeSanctis & Poole, 1994) for group decision support systems and in Orlikowski's (1991) Structural model of technology. This study uses appropriation in the original sense perceived by Marx and refined by Ollman (1971) as the subject-object relationship. It is interesting to note that the findings emerging from this study appear to differ from those reported by Orlikowski (1991 and DeSanctis & Poole (1994).

² Note: It is generally acknowledged that the two major types of Grounded Theory are Glaserian and Straussian. For an extended discussion on these different approaches, see Creswell (2002).

theoretical model and study findings derived from the GT analysis, before summarizing the study contributions and potential future investigations.

2 RESEARCH QUESTIONS

A Grounded Theory study commences with non-specific, broad initial questions designed to lend focus to the phenomenon under investigation (Glaser, 1992). Our research motivation stemmed from our background in knowledge management and IS, which led to our two initial queries:

- How do anaesthetists manage knowledge in the pursuit of their clinical practice?
- How do information systems play a role in this regard?

By using these broad queries we extracted pertinent issues from respondents and slowly fashioned questions around more narrowing objectives. Our GT research design is described in the next section. Here we outline the method, explain how data collection and analysis occurred, and describe the activities used to narrow objectives and elicit the study findings.

3 GROUNDED THEORY

The objective of Grounded Theory is not to test pre-conceived hypotheses or an existing theoretical framework, but instead to generate constructs and hypotheses of the phenomena under examination. It is inductive and data-driven, with the researcher entering the field with ‘abstract wonderment’ – through simultaneous data collection and analysis – discovers patterns, and concepts underlying the phenomena. Data are intimately considered through the process of *memoing* (mind-maps, notes, diagrams, etc) where the researcher constantly compares incidents and starts to connect emerging concepts. This recursive activity employs *theoretical sampling* whereby further data collection builds around the occurring findings and narrowing scope of the study, until *theoretical saturation* is reached where no new data changes the emergent constructs. At this point, the researcher can build a substantive theory or hypotheses that explain the observed phenomena by selecting the core category or the *basic social process* (BSP) that integrates concepts and establishes relationships. Figure 1 depicts this process.

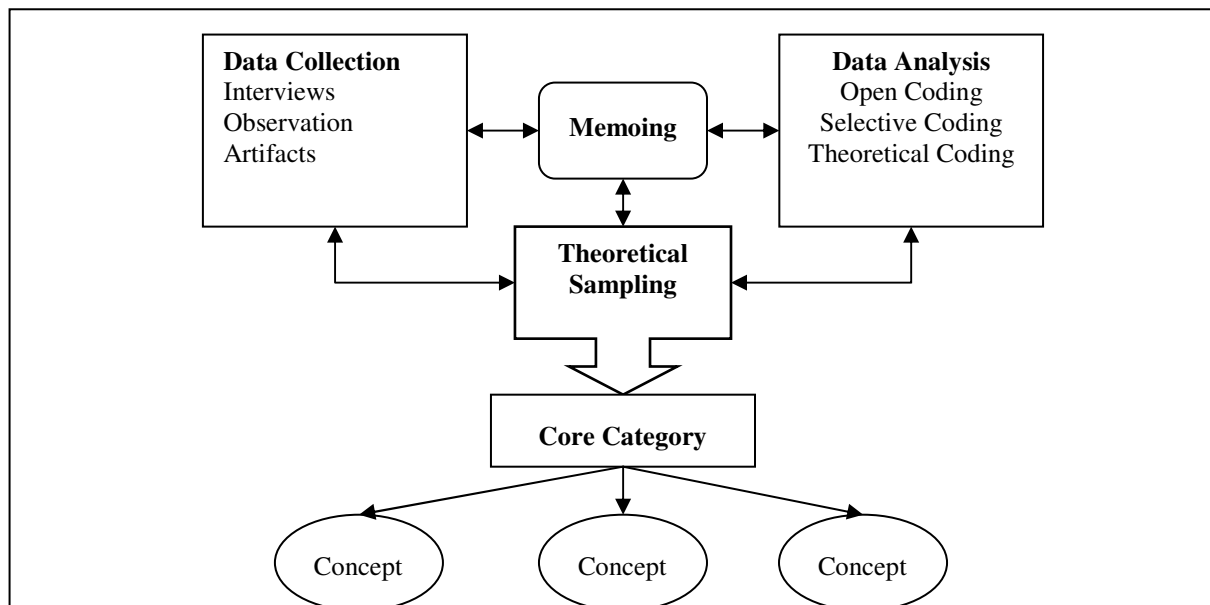


Figure 1. Grounded Theory research model.

In this research paradigm, a literature review is left until *after* theory generation (Glaser, 1998). However, that is not to say literature is completely ignored – rather, as literature is discovered it is compared as data to be woven into concepts and modifies the theory in conjunction with field evidence. Everything that occurs in the research scene can be used to modify the substantive theory to increase its power and completeness – GT is driven by the mantra that “all is data” (Glaser, 2001, p. 145). A substantive theory is developed by comparing consciously selected groups. We now describe our data collection phase.

3.1 Data Collection

Data collection began in late 2006. It began with a symposium on knowledge management in medicine that included a senior anaesthetist who had a strong background in the adoption and deployment of IS. Through this contact, we acquired access to a broad network of anaesthetists with differing backgrounds and varying experience. Table 1 below lists their locations and brief details about their backgrounds.

Location	Participant	Graduated Medicine
Royal Brisbane Hospital (RBH)	Medical Director of Incident Reporting	Early 1980's
	Research Director	Early 1980's
	Researcher and IT Developer	Early 1980's
	Research Director and Medical Specialist	Early 1980's
	Senior Anaesthetist 1	Early 1980's
	Researcher	Early 1990's
	Senior Anaesthetist 2	Early 2000's
Princess Alexandra Hospital (PA)	Head of Department of Anaesthesia	Early 1980's
	Third Year Registrar and IT developer	Graduated medicine in early 1990's
	Second Year Registrar 1	Graduated medicine in 2000's
	Second Year Registrar 2	Graduated medicine in 2000's

Table 1. Study participants and brief details

Eleven respondents in total participated in qualitative interviews, either one-to-one or in groups. Some respondents were interviewed multiple times as coding brought about interesting issues. Sessions lasted 1-2 hours and interviews were semi-structured and open-ended, allowing for rich depictions and experiences. From these, pertinent issues were extracted through coding from which theoretical sampling provided a narrowing path toward the use of information systems used in anaesthetic knowledge processes. Table 2 shows a sample of questions pursued.

Research Stage	Questions
Initial Questions	What has your experience with information systems in your line of work been?
	How were you taught to deal with uncertainty in your line of work?
	What led you to choose anaesthesia as a specialty?
Focused Interview Questions	What benefits do you feel information systems have had on your anaesthetic routine?
	At the time of your training did you have significant contact with information systems? What role did they play in your training and how were you taught to use them?

	What was/is your reaction to new systems being incorporated into your work? Are you able to intuitively use the systems or do you feel they are difficult to learn?
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Table 2. Line of questioning

As theoretical sampling progressed with the emergence of codes and locating relevant respondents to the theory in development, interview questions became more specific, centring on developing concepts until finally a core category emerged. The next section describes the data analysis and coding process.

3.2 Data Analysis

Coding in grounded theory has three stages: *open coding*, *selective coding* and *theoretical coding*. Data analysis begins immediately and operates in conjunction with continued data accretion, unifying the comparative patterns of the GT researcher and allowing theoretical sampling to unfold. Open coding is the first stage in which the data - transcripts and observations - are fractured into incidents that are analyzed line-by-line. Conceptualization proceeds and initial codes are developed, either using in-vivo words or themes derived from the language of the participants (Glaser, 1978). Major *concepts* (or constructs) are identified along with their social properties. Theoretical coding is implemented to relate concepts to their properties, and concepts to other concepts, establishing a holistic mapping of the perceived phenomena. Memos are used to capture concepts and establish links and relationships among the concepts, and to determine how the study should progress. Table 3 shows an example of a theoretical memo, and the resultant follow-ups.

Memo (18-01-2007)	
Anaesthesiology and IS	Anaesthetists are high users of technology, but many of them ‘take it for granted’ in a way. It is remarkable how many anaesthetists we have interviewed who have studied or are studying information technology, so it’s this prevalence of activity – in conjunction with the amount of advanced systems in their practice – which makes it surprising that not many IS studies have attempted to explore this aspect of the field.
Follow-ups	<ul style="list-style-type: none"> • Begin structuring questions around this idea of technology use; • Try and canvass a broad sample of anaesthetists from differing eras; • Further explore this notion of technology use.

Table 3. Example of a theoretical memo, January 2007.

We recorded 40 memos in total and this accumulated memo bank was harvested for three salient concepts that depicted the technology related activities in depth. These three concepts were *knowledge-directed medicine*, *complementary systems* and *clinical culture*. Table 4 depicts an audit trail of these three concepts. They are comprised of their embodying *social properties* and the supporting informant data from which the properties and constructs were crafted.

Concept	Social Properties	Example of Informant Data
Knowledge-directed medicine	Integrating knowledge	“In anaesthesia, we need an electronic way to type up requests... knowledge tools for the capture, management, sharing and reuse of information”
	Managing uncertainty	“Clinicians generally handle uncertainty very well, because they are trained to do so”
	Knowledge	“We must have the ability to manipulate data

	dissemination	electronically...what techniques can we use to display data better than mere conventional snapshots?"
Complementary Systems	Encapsulating experience	"In current medical systems, the problem is the inability to incorporate experience and physician judgment into the system...we need a system that can incorporate experience and background knowledge for future training"
	Attuned to instinct	"Monitoring gives me that extra time for quicker decisions. I don't have to wait until the patient changes colour before I act..."
	Enhance decision-making	"We need belief-based systems that can support and strengthen decision-making"
Clinical Culture	Reflective practice	"[In terms of systems] anaesthesia usually sees systems in other domains such as critical care or ER, see that they work well, and think that 'yes, they might be useful to us'..."
	Recursive interaction	"We have our own professional body that is very much representative...they make policies and are very reflective of what we want"
	Improving patient outlook	"We need to consider patient values...people who believe they will recover better do recover better."

Table 4. *Audit trail of concept development*

During analysis, we originally elicited a fourth concept, labelled *medical complexity*, which represented the aspect of the anaesthetic practice that dealt with the numerical component of their work such as base rates, sample sizes and data inconsistency. On further theoretical sampling and coding, we gradually felt that this concept lacked real significance for the study. As stated in the following theoretical memo:

Memo (16-12-2007)	
Medical Complexity	We received the comment from a senior anaesthetist that "clinicians generally handle uncertainty very well because they are trained to do so", which initially led us to believe it was a significant finding, but on further analysis and reflection, complexity is not so much a reason why they incorporate technologies but merely one aspect of this practice these systems help to manage.
Follow-ups	<ul style="list-style-type: none"> Integrate medical complexity into another concept as a social property.

Table 5. *Example of a theoretical memo, December 2007.*

The final stage of analysis is selective coding in which a core category for the theoretical model is chosen. The core category has "the prime function of integrating the theory" (Glaser, 1978, p. 93), essentially providing the main theme of the model that interrelates the other concepts. For our model, we discovered the main theme to be the basic social process of *appropriation*. This core category captures the essence of the technology incorporation phenomena and is explained by the three concepts developed in Table 4 above. In the next section, we present the findings from our approach—a theoretical model that captures the process of appropriation and its relationship to the three concepts of knowledge-directed medicine, complementary systems and clinical culture.

4 FINDINGS

In constructing our theoretical model, we use three important elements as suggested by Whetton (1989) to relate the concepts to the core construct – namely, the *why*, the *what*, and the *how*. These three elements are represented by knowledge-directed medicine, complementary systems and clinical culture respectively.

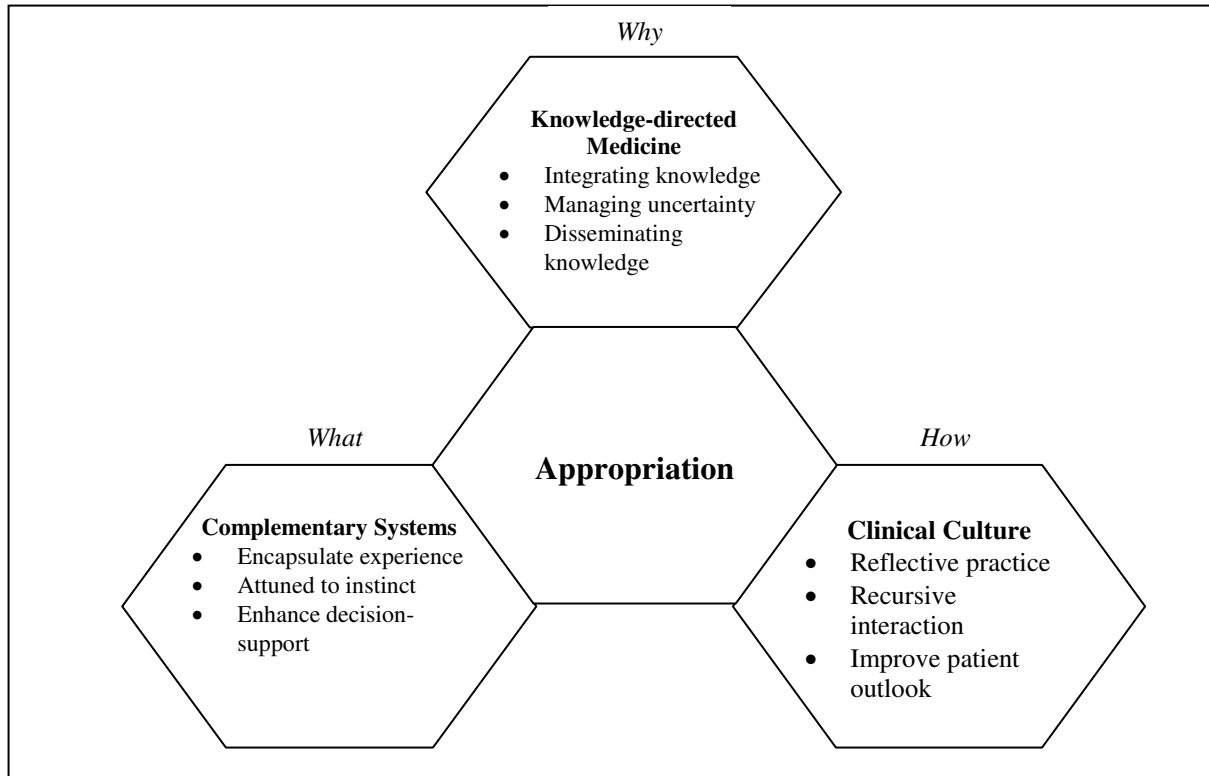


Figure 2. Theoretical model of appropriation in anaesthesiology

The core construct appropriation interrelates the three concepts through a process-based approach. As depicted in our model in Figure 2, the three constructs are unified through the concept of appropriation. *Why* anaesthetists appropriate systems is to strengthen their knowledge-based decision-making. This leads to *what* systems they appropriate, namely complementary systems that match the mental models that they have developed in professional training and experience. These systems aren't a substitute for the cognitive skills and mental models of the clinician but enact as a tool that mediates their interaction with patient physiology and provides computer-based support. The clinical culture of the anaesthetist represents *how* they appropriate such technologies as AIS. Anaesthesiology is both a work group and an institutional structure, working independently of the larger organizational system while being a part of it. Hospitals as the organizational context do not make the decision to instantiate technologies into this sub-domain, but rather the anaesthetists themselves – through a process of community decision-making – come to an agreement on a technology and agree to appropriate it.

The three constructs and associated social properties are discussed further as follows.

4.1 Knowledge-directed Medicine

Why do anaesthetists appropriate technologies such as AIS? Firstly, it can be seen that these systems provide the property of *integrating knowledge*. This practice of integration extends beyond just the operating room and into the routines of the anaesthetist, as reported by one respondent:

"In my practice, my tools would be mainly my computer continuously, to be able to access patients' results, tests, booking information, even online courses, like Up-To-Date, a system we've got that is a collection of EBM reviews, to be able to look at that continuously, so I would use my computer...I'd say at least 10 times an hour. So I use my computer more than other people would. (Senior Anaesthetist 2, RBH)"

By recording and storing data, computer systems lessen the workload of the anaesthetist and retain information for future perusal. Technologies such as AIS also work to help *manage complexity*. As we stated in our analysis, complexity refers to the numerical and algorithmic aspects of the anaesthetic work practice and these involve the numerous base rates and sample sizes and blood and oxygen, temperature readings exhibited by the patient. Complexity occurs when any one factor might change in the patient and a decision needs to be made as to what action must be taken. This in turn relates to the property of *dissemination of knowledge* or the way in which these systems present data that can assist the decision processes of the anaesthetist. The sum provision of these technologies was best described by one informant:

"The inputs to [our] instinct have become automatic - looking at colour of the patient, [listening to] the sounds of the machines, a lot of those inputs are instinctive and then they feed into your ability to work out [any] uncertainty...we have a system to work from the machine, to tube, to patient, so a systematic approach to find out what [any] uncertainty is (Senior Anaesthetist 2, RBH)."

Knowledge-directed medicine embodies the accumulation of facts, models and data that are presented by the AIS, giving the anaesthetist real-time outputs that allow for knowledge-based decisions. The clinician's 'instinct' is still involved, but the factual information displayed allows for a more streamlined judgment. They appropriate these systems to aid in what one respondent termed the "fixation problem" – the clinician becomes fixated on one problem when it in fact might be another. By having the AIS present, they can examine the data and base decisions on a more informed process to either change treatment or ask for another anaesthetist for support. As one respondent said:

"Prior to these machines, the only way you could tell if something is wrong is when the patient starts to turn blue. Monitoring gives me that extra time...[for] quicker decisions...I don't have to wait until the patient changes colour before I can act...[the monitors] give a better indication of what is going on (Head of Department of Anaesthesia, PA)."

It is reported that out of all the errors that occurred in the provision of anaesthesia when the anaesthetist are faced with unexpected incidents, 25% are indeed diagnostic or knowledge-based (Runciman et al., 1993). Thorough technology such as AIS, data displays organize the information such that it matches the 'cognitive interpretation' performed by the clinician to enable better speed and higher accuracy in decision-making (Blike & Surgenor, 1999).

4.2 Complementary Systems

What technologies do anaesthetist appropriate? From our evidence, anaesthetists look to employ technology that is congruent with their routines and work task and are complementary to the *mental model* of the anaesthetist. By mental model we refer to the cognitive processes that have been developed through training and experience – the measures of blood levels, oxygen flow, temperature and other such factors that an anaesthetist must constantly weigh up internally as they place a patient into a suspended state. The social property of *encapsulate experience* was a frequent code in the data, mentioned by several respondents. It was mostly in reference to training – senior anaesthetists suggested that there need to be simulators and computer-based learning tools that somehow encapsulate background knowledge and experiential practice to better inform registrars on the anaesthetic pathway. In the literature, the anaesthetic specialty has been likened to the aviation

industry, with both being high-risk domains dependent on well arranged and cutting edge work spaces (Fletcher et al., 2002). This thought was shared by one respondent:

“Anaesthetic training is like training to be a pilot...you clock up countless hours of simulation, get your ticket, and you can be assigned to 200 passengers without having ever flown with passengers before (Senior Anaesthetist 1, RBH)”

In anaesthesia, the practice can be highly volatile with scenarios changing from periods of stability to immediate danger. But the technology enables that extra second of warning, *attuned to the instinct* of the anaesthetist. When discussing the warning pitches on the monitors, several anaesthetists reported the ability to decipher between what needs attention and what doesn't. One respondent reported:

“You can know what's happening without even looking at the machine...you can ring someone in another theatre and say ‘I think you need to go’, because you can hear the pitch of their machine and know what's happening in their theatres. So it's an instinct that you can hear it in the background and know there's a problem (Senior Anaesthetist 2, RBH)”

These machines are not subservient then, but are a genuine complementary tool that functions in unison with the needs of the anaesthetist. As one respondent mentioned: *“Going into anaesthesia doesn't mean moving into technology...the technology component gradually works its way into the work as you gain more experience.”* The systems they appropriate then are not tools that substitute decision-making but are tools that work to *enhance decision-making* and fine-tune their mental model of the patients' physiology. As we were assured by the participants, training sessions sometimes ran with the monitors being switched off or through the simulation of a power-loss, testing the ability to cope and handle situations devoid of computer support. The systems appropriated are congruent with anaesthetic mental models. These are tools that are defined by anaesthetic practice, mirroring their routines and giving added benefits such as warning pitches to alert any changes, but are not a defining aspect of the occupation.

4.3 Clinical Culture

Clinical culture represents *how* anaesthetists appropriate the systems that they have perceived. From our observations anaesthetists have a unique culture of appropriation. When we speak of anaesthetic culture, we refer to their professional culture or *occupational subculture*, a term described by Trice (1993) - although they belong to the larger organization of health care, they function as a workgroup with independent standards and guidelines. In anaesthesia the duty of care to the public influences much of the technology incorporation; however, the social property of *reflective practice* plays a major part in technology being appropriated for group practice. As they deal with individual patients case-by-case, anaesthetists draw upon the shared cultural values and standards of the workgroup while employing technology in a way suited for each patient. This property works similarly to Giddens' (1979) *reflexivity*, whereby a human agent accounts for their own conduct and behaviour by rationalizing their actions against the backdrop of the physical context. This reflective practice was summed up by one respondent:

“A lot of the [implementation of these machines] was driven by the end user. We'd say ‘we need this for patient safety. What you've got is not an overarching group that says ‘this is what you must do’, we're a collection of individuals professionals who see someone else with something or see another part of the hospital with something and say that will be useful. ... There are some things that people bring up and say it's going to be a standard, but it's usually already widespread in the anaesthetic workplace before it gets to that stage anyway (Senior Anaesthetist 1, RBH)”

Recursive interaction is a social property that signifies the reflexivity between anaesthetists as practitioners and anaesthetists as a workgroup. Where reflective practice refers to individual activity, recursiveness accounts for the collective occupational subculture. Anaesthetists establish an

institutional system in their department or region with their own standards and requirements, along with the hospital and regional values. Through this institutional system, the anaesthetists can appropriate technologies against both the rationalization of action of an individual and the rationalization of the group. A respondent mentioned the Australian College of Anaesthetists (ACA) as one such example of a group structure:

“The ACA is the main professional body that sets standards, but is very much a representative body. Officers are unpaid; [they] stood for election and the professional standards body changes continually, with a duration cycle of approximately 10 years. It is reflective of the people that are actually members of that culture, not just a collection of people who got into power and are imposing their ideas. They make policies, but they are very much reflective of what we would want (Senior Anaesthetist 1, RBH).”

It is through this recursive system that appropriations can be made and justified to reason. With the final property of *improving patient outlook*, patient values are used to justify technologies in terms of expected public benefits. The social structure of anaesthetic clinical culture promotes beliefs and values of technologies such as AIS, encouraging feedback and flexible usage of the systems while setting precedents for practitioners to remain current and retain standards.

Another example of a structure that maintains this standard is Continuing Medical Education (CME), or ongoing professional development. Goudar and Kotur (2003) define CME as “any and all the ways in which doctors learn after formal completion of their training” (p. 27). As we learned from our respondents, CME is a mandatory component of anaesthesiology, with requirements for anaesthetists to engage in related activities and a points system in place to reinforce this. This structure integrates the concepts of clinical learning and clinical culture by instilling beliefs and values of appropriated AIS and ensuring these are retained throughout their post-graduate career.

In summarizing how these three concepts relate within the anaesthetic appropriation process: technologies are appropriated because of the way in which they support the mental model of the anaesthetist’s occupation; appropriated technologies are representative of the anaesthetic practice and are used if they match or support the cognitive model that anaesthetists have developed through training; and these technologies are appropriated through the recursively built nature of the anaesthetic sub-domain in which institutional structures are composed of by practitioners themselves.

4.4 Comparisons with other notions of appropriation

This process of technology appropriation in anaesthesia reflects the concept of appropriation as discussed by Ollman (1971) in relation to Marx. There is the quality of the subject-object relationship: anaesthetists first realize these technologies, perhaps in other areas such as critical care as noted by our respondents, then begin to constructively use and build by incorporation into their work practice. Appropriated technology in the medical domain can additionally be seen as either the consolidation of power or the empowerment of the worker, as discussed by Barley (1986) and Poole and DeSanctis (1989).

In IS research, appropriation is a significant concept within the theoretical lens of Adaptive Structuration Theory (Poole & DeSanctis, 1989; DeSanctis & Poole, 1994). This perspective purports that an appropriated technology brings new structure to the group incorporating it while in turn being influenced by the group social structure, as defined by the extent to which the group retains the spirit of the structural feature set built into the technology. Adaptive Structuration Theory (AST) first examined appropriation in the context of Group Decision Support Systems, multi-user technology that facilitates communication among a social system.

Orlikowski and Robey (1991) and Orlikowski (1992) founded another major perspective of technology appropriation with the *structural model of technology*. In this theory, information systems are seen as having a ‘duality’ - at once being the product of social interaction within structural

and cultural contexts and simultaneously an object that provides rules and resources that mediate interaction, thereby recreating and reshaping the context into which the information system is placed.

It is interesting to note that the conception of appropriation in our theoretical model is different from both AST and Orlikowski's model. There are two reasons. Firstly, AIS are an instance of single-user technology, not group technology. They are not designed to facilitate communication but to integrate knowledge and store data. These systems exhibit a different manner of duality, not really influencing or being influenced by anaesthetists, but are incorporated as systems that are true to end-user specifications or complementary to the anaesthetist's mental model of a patient's physiology while in a suspended state.

Secondly and most importantly, AST and the structural model were generated within business contexts where organizations placed technologies into employee routines, leaving users to modify or rejected the 'structural features' or 'spirit' of these technologies by consensus. As we showed in our findings, anaesthesia as a sub-domain of medicine works differently. They are a community of practice within the larger body of a hospital and create a system of appropriation very much reflective of their needs. This finding will lead to the next stage of our Grounded Theory approach. We can compare our theory to the theories of DeSanctis and Poole and Orlikowski to enhance the rigor of our study and demonstrate a new aspect of appropriation in the IS domain.

5 SUMMARY

We have presented a study that explored the concept of technology appropriation in anaesthesia. This is the first study to date to have attempted a data-driven, theoretical explanation of this phenomenon and employed a Grounded Theory research design. The scope of this paper is the grounded theoretical model developed that depicts the process of appropriation using three concepts relevant to the practitioners. Our reported findings explained this process and interrelated the concepts. While *this study uses the area of anaesthesia as the domain of study, we believe that both the approach and findings may be applied to other domains involving complex, high-risks tasks where successful executions rely on appropriate access to multitudes of information sources, but the role of information systems or technologies have not been previously investigated.*

In terms of future research, we aim to continue the refinement of the theoretical model to the substantive field. The major research avenue to be pursued in this regard will be to compare our derived concept of appropriation to the constructs of appropriation and the duality of technology as fashioned by DeSanctis and Poole (1994) and Orlikowski and Robey (1991) and Orlikowski (1992). As noted in our findings, our appropriation process differs from these other theories as anaesthetists exhibit a practice different to contexts such as the business domain. By doing a comparative study, it will enhance the rigor of the Grounded Theory approach and strengthen our theoretical model.

References

- Abbod, M.F., Linkens, D.A., Mahfouf, M., and Dounias, G. (2002). Survey on the Use of Smart and Adaptive Engineering Systems in Medicine. *Artificial Intelligence in Medicine*, 26, 179-209.
- Barley, S. (1986). Technology as an Occasion for Structuring. *Administrative Science Quarterly*, 31, 78-108.
- Blike, G. and Surgenor, S. (1999). A Graphical Object Display Improves Anesthesiologists' Performance on a Simulated Diagnostic Task. *Journal of Clinical Monitoring and Computing*, 15, 37-44.
- Byrick, R. and Cohen, M. (1995). Technology Assessment of Anaesthesia Monitors: Problems and Future Directions. *Can J Anaesth*, 42 (3), 234-9.
- Calverley, R. (1989). Anesthesia as a Specialty: Past, Present and Future. In *Clinical Anesthesia* (Barash, P., Cullen, B. and Stoelting, R., eds.), pp. 3-34, J.P. Lippincott Company, Philadelphia.

- Creswell, J. (2002). *Educational Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research*. Merrill Prentice Hall, New Jersey.
- DeSanctis, G. & Poole, M.S. (1994). Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory. *Organization Science*, 5 (2), 121-47.
- Fletcher, G., McGeorge, P., Flin, R., Glavin, R. and Maran, N. (2002). The Role of Non-Technical Skills in Anaesthesia: A Review of Current Literature. *British Journal of Anaesthesia*, 88 (3), 418-29.
- Gardner, M. and Peachey, T. (2002). A Standard XML Schema for Computerised Anaesthetic Records. *Anaesthesia*, 57, 1174-82.
- Giddens, A. (1979). *Central Problems in Social Theory: Action, Structure and Contradiction in Social Analysis*. Macmillan, London.
- Glaser, B.G. and Strauss, A. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Sociology Press, Mill Valley.
- Glaser, B.G. (1978). *Theoretical Sensitivity: Advances in the Methodology of Grounded Theory*. Sociology Press, Mill Valley.
- Glaser, B.G. (1992). *Basics of Grounded Theory Analysis: Emergence vs. Forcing*. Sociology Press, Mill Valley.
- Glaser, B.G. (1998). *Doing Grounded Theory - Issues and Discussions*. Sociology Press: Mill Valley.
- Goudar, S. and Kotur, P. (2003). Trends in Medical Education. *Indian Journal of Anaesthesia*, 47 (1), 25-29.
- Greenwood, J. (2005). Generic Machine Checks. *Anaesthesia*, 60, 1248-49.
- Ollman, B. (1971). *Alienation: Marx's Conception of Man in Capitalist Society*. Cambridge: Cambridge University Press.
- Orlikowski, W. and Robey, D. (1991). Information Technology and the Structuring of Organizations. *Information Systems Research*, 2 (2), 143-69.
- Orlikowski, W.J. (1992). The Duality of Technology: Rethinking the Concept of Technology in Organizations. *Organization Science*, 3 (3), 398-427.
- Poole, M.S. and DeSanctis, G. (1989). Use of Group Decision Support Systems as an Appropriation Process. In Vol.IV: Emerging Technologies and Applications Track, Proceedings of the Twenty-Second Annual Hawaii International Conference on System Sciences, 1989, 149-57.
- Runciman, W., Sellen, A., Webb, R.K., et al. (1993). Errors, Incidents and Accidents in Anaesthetic Practice. *Anaesth Intensive Care*, 21, 506-19.
- Smith, A., Mort, M., Goodwin, D. and Pope, C. (2003). Making Monitoring Work: Human-machine Interaction and Patient Safety in Anaesthesia. *Anaesthesia*, 58, 1070-78.
- Trice, H.M. (1993). *Occupational Subcultures in the Workplace*. Ithaca: ILR Press.