

Realizing Technology Impact:
A dialectical theory of technology initiated routine
disruption and renewal

By

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Abstract

Today, organizational leaders increasingly leverage technology as a restructuring force to achieve greater efficiency and competitive positioning. This technology shapes the environmental conditions within which organizations operate and through the need to align with such conditions, affects organizational characteristics and behaviours. This study generates new insights into the common problem of unexpected group behaviour in response to technology initiated change by exploring the disruption and renewal of an organizational routine. This research bridges aspects of organizational routines, dialectic change theory, and information systems literature to contribute new understandings about the micro-processes that generate the divergent performance variation events often seen as contributing to the unpredictability associated with technology initiated organizational change.

Through an in-depth qualitative analysis of a health information system introduction at a large research hospital located in Ottawa, Canada, we demonstrate how a dialectic modalities lens provides new insights into agent driven organizational routine repair and renewal. We then show how two dimensions of dialectics (performative<->ostensive and performative<->environmental) act independently to produce varying levels of dialectic tension that motivate variation and change in the performance of an organizational routine. This work adapts the emerging work on dialectics of organizational change to conceive of dialectic change as a generator of variation and change within organizational routines and suggests that dialectic tension is a key driver of organizational routine change. To account for this, we introduce a new concept and model – “Dialectic Modalities of Routine Change” – to describe the four combinations of dialectic tension that can occur in the performance and enactment of a routine.

It is our position that greater understanding and focus on routine disruption and renewal will ultimately assist managers in improving practice and can provide a deeper theoretical understanding of organizational change processes. Moreover, this study’s collected narrative approach to identifying a routine in practice opens new opportunities to explore enacted routine structure in sensitive environments often difficult to access for sufficient levels of observation. Finally, this research also makes important contributions to routines theory through the theoretical exploration of micro-foundational dynamics of routine change.

Keywords: Organizational Routines, IT Usage, Organizational Change, Technochange

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Chapter 1: Introduction

Information technology investment has served as a major restructuring force for both industries (Brynjolfsson & Saunders, 2010; Kim, Lin, & Simpson, 2015; Lin & Chuang, 2013; Locke & Wellhausen, 2014) and the internal work practices used to accomplish work within organizations (Lyytinen & Newman, 2008; Orlikowski, 1992; Thompson, 2012). Indeed, technology shapes the environmental conditions within which organizations operate and because of the need to align with such conditions, affects organizational characteristics and behaviours (Tushman & Anderson, 1986). As organizational leaders leverage this restructuring force to achieve greater efficiency and competitive positioning, worldwide IT spending by organizations continues to increase. A recent study estimates that worldwide IT spending will reach \$3.5 trillion by the end of 2017 (Gartner, 2015), which is a significant increase from the \$1.2 trillion spent in 2008 (Nakata, Zhu, & Kraimer, 2008). Moreover, another recent study of IT products and services revenue estimates the increase to be 3.5%, with Professional Services, Healthcare, and Banking industries leading the way in spending (5.4%, 5.3%, and 5.0% of total spent, respectively) (IDC, 2017). Looking at how this spending is allocated in organizations, a recent survey of over 900 CIOs across 29 countries indicated that over one-quarter of all IT budgets were allocated to what was described as supporting business change (Deloitte, 2014).ⁱ

IT investment is not without risk, however. Despite the excess of best practices available to help guide IT deployment projects, organizations continue to struggle to achieve anticipated restructuring benefits. One study indicates that over 40 percent of all IT projects

fail to meet their business objectives (Kaplan & Harris-Salamone, 2009), and another survey of 5,400 large scale IS implementation projects (projects exceeding \$15 million) found that over 45 percent of all IT projects ran over budget while delivering 56 percent less value than predicted (Bloch, Blumberg, & Laartz, 2012).ⁱⁱ Such failures are not only frequent but are also quite costly; for example, a study of 134 European companies found the average cost of IT project failures to be \$14 million, with examples of individual failures as high as \$240 million (Rosen, 2005).

In response to this ongoing problem, much literature has been dedicated to answering the question: *Does IT deployment generate sufficient value to warrant the investment?* While some studies conclude that IT investments have weak or inconclusive effects on firm and industrial productivity (Brynjolfsson, 1993; Lin & Shao, 2006), other studies have found the contrary (Brynjolfsson & Hitt, 1996; Dewan & Kraemer, 2000). Chan (2000) asserts that contradictory findings in this area of research stem from a problem of measurement. Chan (2000) further generalizes this problem of identifying IT value as stemming from a focus on “hard measures” (p. 228), further concluding that such measures are distracting us from exploring the key underlying dynamics which generate such problems. Similarly, Orlikowski (2000) calls for a greater emphasis on the dynamics of technology *use* within work practice, claiming that the dynamic social nature of such *use* has important consequences on the returns from such investment.

Our study utilized the organizational routines theoretical lens to explore the dynamics of technology introduction and work practice disruption and change. We accept the premise that to be successful, the introduction of technology into an organization must coincide

with group exploration of new actions and behaviours that must, in turn, become embedded within organizational group behaviour as indicated by their routines. As noted by influential social theorist Coleman (1994), group-level behaviours are not necessarily the result of averaged individual-level behaviours (an implicit assumption found within research studies that utilize surveys and factor analysis). Such behaviours are at least partially emergent and thus subject to potentially complex interaction effects between individual participants (Abell, Felin, & Foss, 2008). To explore a more dynamic conception of usage and associated IT value generation, we must develop theories to explain the dynamic nature of interrelated individual experience and how such experience leads to group-level expressions of *use* behaviour in response to technology initiated disruption. Such understanding will open new avenues of exploration and set a foundation for the development of new monitoring and intervention strategies that can be leveraged by organizational leaders to help alleviate the high-risk and uncertainty often associated with technology investment.

The goal of this thesis is to introduce a “theory for analysis and description” (Gregor, 2006, p. 619) for technology initiated routine disruption. We will introduce a new theoretical framework to help us further understand the underlying dynamic group processes through which groups appropriate new technology into workgroup practices. To accomplish this goal, we integrate the literature on IT value generation and usage, dialectical change theories, and the emerging literature on organizational routines. We assert that technology usage by groups is never an achievement but rather a tenuous equilibrium that is the product of the constant dialectic tension between past behaviours, novelty, and new environmental

contingencies. A secondary goal of this research is to extend the nascent exploration of underlying micro-foundations of routine disruption and renewal in response to technology initiated change. Our guiding purpose is to generate specific insights into the organizational responses to mandated technology use scenarios where significant disruption to established routines is a necessary condition to accommodating their introduction.

In the remaining portion of this chapter, we provide background on IT usage, technology initiated change, and organizational routines. Next, we outline our objectives and define our guiding questions. We then provide the reader with a preliminary introduction to our field setting. And, finally, we close this chapter with a summary of contributions and an outline of the remaining chapters found within this thesis.

1.1 Background

1.1.1 IT usage

Many studies have explored the possible underlying causes of IS project failure. The popular DeLone and McLean model (Bossen, Jensen, & Udsen, 2013; DeLone & McLean, 1992, 2002, 2003, 2004; Hsu, Chang, Chu, & Lee, 2014; Petter, DeLone, & McLean, 2012; Petter & McLean, 2009; Seddon, 1997) identifies *failure to use* as a key impeding factor to achieving anticipated organizational benefits from technology investment. Similarly, other research has focused on post-adoptive *under-use* as a key impeding factor (Jasperson, Carter, & Zmud, 2005; Tennant, Mills, & Chin, 2013). Another large cluster of studies investigates this problem by identifying potential antecedent factors that significantly

influence *use* intentions and self-disclosed measures of individual usage (e.g. TAM (Davis, 1989), TAM2 (Venkatesh & Davis, 2000), TAM3 (Venkatesh & Bala, 2008), UTAUT (Venkatesh, Morris, Davis, & Davis, 2003)).

What is most desirable for the organizational deployment of technology is for groups within an organization to develop patterns of usage that embrace technology (Burton-Jones & Gallivan, 2007) in ways that balance consistency and meaning against the demands of environmental contingencies and the requirement for novelty. Such patterns of usage must respond to organizational attempts to adopt new and more efficient processes, but also expand, explore, and innovate new patterns of behaviour in response to localized contingencies. Following social constructivist views (e.g. DeSanctis & Poole, (1994), Alvesson & Sköldbberg, (2009)), such behaviour cannot be fully determined by exogenous forces; rather, it emerges from a complex set of group-level interactions and behaviours that work to achieve balance within an arena of such exogenous forces; “[this] emergent perspective holds that the uses and consequences of information technology emerge unpredictably from complex social interactions” (Markus & Robey, 1988, p. 588).ⁱⁱⁱ What is missing from much of the popular investigative methods used by IS researchers is a theoretical understanding of group level dynamics involved in generating new emergent usage behaviours and patterns of work in the face of (or in response to) new technology introduction. Though such understanding may not allow us to avoid fully the “unpredictable” property of emergent systems, it can nonetheless assist in our understanding the processual properties of such emergence and thus present opportunities for more effective intervention and monitoring strategies.

Consistent with the sizable literature on technology adoption, success, and value generation, our study contends that usage is an important and necessary condition for an organization to successfully deploy new technology. However, following Orlikowski (2000), Burton-Jones & Gallivan (2007), Pentland & Feldman (2008a), and others, we assert that “usage”, as conceived of in much of the current literature, is too distant from the dynamic nature of collective usage patterns and behaviour. It is our position that *usage* is subject to constant revision under the forces of routine formation and renewal and, therefore, best explored through understanding the effects and interactions of technology and the disruption and renewal of organizational routines.

1.1.2 Technology initiated change (aka technochange)

Usage of new technology (or *technology use*) by a collective group requires some form of organizational change. Markus (2004) introduces a new perspective on the problem of organizational change in response to technology introduction, one that she characterizes as a problem of *technochange*. According to Markus (2004), the introduction of new technology triggers complex organizational events that generate both high risk and potentially, high reward. From this view, we conclude that the successful introduction of technology requires both the organizational ability to generate situations that introduce risk through disrupting existing operations and the organizational capacity to resolve such disruptions to achieve an acceptable level of operational performance and predictability. The consequence of this view is that we must explore *system use* by engaging in the study of organizational routine disruption and renewal.

Gaskin (2012) expands further on these consequences to conclude that the introduction of technology is necessarily disruptive to historically accumulated patterns of behaviours (performances) and knowledge (ostensive structures) found within organizational routines. Given individual preferences for certainty and meaning, such disruptions can present a significant deterrent to accepting a technology. Lapointe & Rivard (2005) attribute the results from similar identified effects as manifesting multi-level resistance where individuals and groups resist disruption to the continuation of existing work practices. Furthermore, Markus (1983) highlights that not all resistance is detrimental to the organization, nor primarily focused on individual work practice. Resistance that consumes time and company resources only to delay the inevitable adoption and acceptance of a technology is detrimental to the organization, as it unnecessarily consumes valuable organizational attention and resources. On the other hand, resistance in response to disruptions that would negatively influence the long-term success of a company is beneficial to the organization. We agree with the articulation of the complexity of this problem but propose that such complexity stems from the value-laden nature of the *resistance* construct. We respond to this epistemological dilemma by focusing on the less value-laden and ubiquitous problem of routine disruption – which is common in both *good* and *bad* cases of resistance.^{iv}

If organizations are to realize greater value from IT investments, internal working groups must explore and identify new behaviours and actions that align with context-specific and localized goals, conditions, and contingencies (Edmondson, Bohmer, & Pisano, 2001). Such an exploration requires alterations to existing organizational routines, changes that

have proven elusive for many technology projects (D’Adderio, 2003; Pentland & Feldman, 2008a; Zuboff, 1988). Aldarbesti, Goutas, & Sutanto (2015) claim that technology projects that do not take into account these *softer* socio-technical dynamics will diminish the possible returns from such investment.

We argue that constructs such as resistance (Kim & Kankanhalli, 2009; Lapointe & Rivard, 2005), and similar concepts such as rigidity (D’Adderio, 2003; Leonard-Barton, 1992) and inertia (Collinson & Wilson, 2006; Polites & Karahanna, 2012), are a manifestation of organizational failure to effectively disrupt and renew affected organizational routines. Under this premise, any successful outcome from an IT introduction thus requires the organization to transition through a disruption and renewal process of their existing routines. Unfortunately, an initial review of the literature indicates a gap - our collective understanding of such a process remains an under-researched domain and is especially under-represented in technology change literature.

1.1.3 Organizational routines

Fundamentally, organizational routines are the critical means through which organizations develop and maintain their capabilities (Miller, Pentland, & Choi, 2012; Zollo, Winter, & others, 1999) and consistently execute their work tasks (Turner & Rindova, 2012). The rapid evolution of digital enterprise technologies is disrupting established organizational routines within organizations (Leonardi, 2011). This disruption of organizational routines results in a pause, stoppage, or interruption in the performance of a routine when “changes in the variables surrounding a routine are sufficient enough to inhibit the normal practice

of the routine” (Bloodgood, 2012, p. 380). Disruption to existing routines necessarily alters the properties of work performance and often generates a period of uncertainty that significantly impedes the organizational capacity to accomplish work effectively (Becker, 2004; Winter, 1995). Such disruption represents a substantial risk to the organizational capacity to accomplish strategic and operational goals (Loch, Sengupta, & Ahmad, 2013). This problem is especially acute in healthcare organizations, where large and continued investments in health IT is causing the disruption and renewal of many strongly embedded organizational routines (Edmondson et al., 2001; Goh, Gao, & Agarwal, 2011). In the case of health information technology (HIT) deployment, such effects can literally mean the difference between life and death (Tucker & Edmondson, 2003; Wachter, 2015).

Organizational routines emerge through repeated interaction between human and non-human actors involved in performing a set of tasks (Bapuji, Hora, & Saeed, 2012). As organizations become more adept at selecting and performing the associated actions necessary to accomplish tasks, routines that coordinate such actions become deeply embedded within the organizational practice (Bryant, 2014; Polites, 2009; Um, Yoo, Berente, & Lyytinen, 2012). These patterns of work serve as structures through which individuals refer to, understand, and map environmental triggers to associated actions required to respond to these triggers (Pentland & Hærem, 2015). As organizational leaders seek greater efficiency and productivity, such routines present themselves as ideal targets for digital technology-driven automation and reconfiguration (Su, Brdiczka, & Begole, 2013).

Deeply embedded routines are what Bapuji et al. (2012) describe as “strong” routines, which organizations frequently enact over time. Collinson & Wilson (2006) observe that strong routines exhibit inertial properties that result in propagating past behaviours in the execution of future work. Garfield & Dennis (2012) assert that when groups have “very strong routines” (p. 50), it can be difficult for an information technology to disrupt and modify its behaviour and performance. In such situations, routines become “path dependencies” (Garud, Kumaraswamy, & Karnøe, 2010).

Considering the properties of organizational routines outlined above, organizations must be capable of breaking or disrupting routines if they are to achieve increased, or altered, performance outcomes. Though path dependencies from organizational routines allow organizations to economize cognitive loading, these also result in organizational behaviour that can overlook important questions about new environmental conditions and contingencies. Levitt & March (1988) characterize such situations as “competency traps”, Leonard-Barton (1992) as organizational “rigidities”, and Arthur (1989) as the problem of “lock-in”. The phenomenon underlying each of these perspectives manifests when, despite the availability of new and potentially better^v technologies and sets of actions/activities, organizations continue to enact past behaviours even when those actions may be significantly misaligned with the current context. From a systems theory perspective, such behaviour is non-ergodic (Lempel & Ziv, 1976), exhibiting a property of path dependence, in that, independent of perturbations in the environment, such systems manifest identifiable and consistent patterns of behaviour based on historically accumulated actions.^{vi} Empirical evidence has also indicated that, as teams experience a higher frequency of disruptions to

existing routines, they are more likely to renew and alter existing routines and break path dependencies (Zellmer-Bnrhn, 1999). According to Gibson & Early (2007), understanding the “breaking [of] team routines is an important future arena” (p. 453) for technology research. Also, as Anand, Gray, & Siemsen (2012) note, exogenous disruptions to routines help to initiate necessary changes and “add [necessary] energy” (p. 1702) to a system of actions; but as Pentland & Feldman (2008a) indicate, it is the internal properties of routines that guide and initiate any resulting changes in behaviour from such disruptions.

Coinciding with an organization’s ability to *break* routines, organizations must also possess the ability to repair disrupted routines (Edmondson et al., 2001). Disrupted routines result in significant negative impacts on an organization’s capacity to realize its mandate and achieve sufficient levels of performance; therefore, any period of disruption must be resolved if expected performance outcomes are to be achieved (Betsch & Haberstroh, 2005) and resolved quickly if the cost and risk involved in such transitions are to be minimized. Resolving such disruptions requires a re-establishment of group behaviour under potentially new performance objectives and within a new environmental context. Such resolution is a necessary but not sufficient condition for realizing planned change outcomes.^{vii}

Our review of the literature on the role of digital technology in organizational routine formation, disruption, and renewal indicates that this remains an under-researched area. To our knowledge, few studies have integrated aspects of disruption and renewal of existing routines into a single theory of routine disruption and renewal. The few similar attempts include recent well-received work from Luciana D’Adderio (2008, 2011), and Brian

Pentland (Pentland & Feldman, 2008a; Pentland, Hærem, & Hillison, 2011; Pentland, Haerem, & Hillison, 2009). These studies have initiated much-needed theorizing about the role of technical artefacts in routine formation. However, these works stop short of exploring routine dynamics in response to organizational efforts to digitize existing routines and do not identify the dynamic process of disruption and renewal of routines in response to technology introduction. Moreover, although studies such as Brown (2015) provide valuable insights into possible sources of organizational routine divergence in response to changing technology, this work exhibits what has become known in the literature as a “black box” approach to routine conceptualization (Dionysiou & Tsoukas, 2013). Though such approaches have been common in routines theory (Pentland & Feldman, 2005), some researchers claim that this paradigm ignores important underlying internal dynamics of routines (Parmigiani & Howard-Grenville, 2011; Pentland & Feldman, 2005; Rerup & Feldman, 2011; Salvato & Rerup, 2010). Such “black box” views undoubtedly contribute to our understanding but their tendency to view routines as indivisible units or “*faits accomplis*” (Dionysiou & Tsoukas, 2013, p. 181) directs our research attention away from exploring further the important underlying mechanisms of routine change.^{viii}

1.2 Goals and Objectives

The goal for this thesis is to contribute to our understanding of the dynamics of organizational routine disruption and renewal in response to technology introduction. This effort aligns with calls in the technology change literature for future researchers to dig

deeper into the dynamics of work practice (Leonardi, 2012; Orlikowski & Yates, 2006; Whittington, 2006) and with calls in the organizational routines literature to explore the micro-foundational dynamics of organizational routine formation, change, and renewal (Argote & Ren, 2012; Bryant, 2015; Felin, Foss, Heimeriks, & Madsen, 2012; Felin, Foss, & Ployhart, 2015; Felin & Foss, 2012; Salvato & Rerup, 2010).

Rapid changes in technology create turbulence that destroys existing competencies (Akgün, Byrne, Lynn, & Keskin, 2007) and generates an uncertain future for participant actors as “old ways” become more difficult, if not impossible, and new ways remain ephemeral and under constant revision while users accumulate experience and legitimize new patterns of work. Such transitory states produce significant periods of flux in which individuals must negotiate new models of *what it is they do* while simultaneously exploring new work structures through participative action (Madapusi & Miles, 2011). Our contribution of a dialectic view in understanding how groups experience and engage in routine disruption will provide valuable insight into the process through which organizations use technology and help us understand the underlying dynamics for higher-level constructs such as resistance and rigidity, as well as problems with the organizational adoption of new technology. Dialectic views of change focus on the interaction between a thesis, and an anti-thesis, and through understanding the structure of such interaction, a means to help understanding organizational change.

1.2.1.1 Objective 1: Contribute insights into the micro-foundations of routines.

Though the concept of organizational routines has contributed to our understanding of several aspects of organizational behaviour, many avenues of important research remain open for exploration. In particular, there have been recent ongoing calls within the literature to bring greater focus into the micro-foundational aspects of organizational routines (Abell et al., 2008; Barney & Felin, 2013; Cohen et al., 1996; Felin et al., 2012, 2015; Salvato & Rerup, 2010). This “micro-foundations project” (Felin & Foss, 2006, p. 3) calls for further investigation into individual action and interaction with higher-level collective constructs such as organizational routines and capabilities – which, in turn, would extend our understanding of organizational behaviour, performance, and competitive positioning (Abell et al., 2008).

As has been the premise of many interpretations of technology initiated change, digital technology shapes the context within which work is performed (Tushman & Anderson, 1986). Technology serves as both an opportunity for change and an initiator of change but does not fully determine any changes that result (Barley, 1986). Through affordances and constraints, technology generates a *space for potential action*, but resulting group behaviour occupies only a *subspace* of this larger domain.^{ix} Routine micro-foundational effects constrain the set of all possible group actions into a smaller set of enacted or executed actions. We look to explore group- and individual-level interaction about how these subspaces of action are formed from the internal dynamics of routines. An objective of this study is to contribute to our understanding of these micro-foundational routine effects by exploring routine change from a dialectical theory perspective^x.

1.2.1.2 Objective 2: Contribute to our understanding of IT value-generation by investigating technology initiated routine disruption and renewal

To sharpen our contribution related to our first objective, we use our proposed theoretical lens of organizational routines to generate a novel perspective of IT value-generation and technochange. We focus specifically on the challenges of technology usage and group-level responses to technology initiated routine disruption and renewal. Consistent with recent models of routines as embodying a duality between the ostensive and the performative (Feldman & Pentland, 2003; Feldman, 2000; Pentland & Feldman, 2005), we frame our contribution to understanding IT value-generation as enabled through changes in organizational routines that result from changes in both the ostensive^{xi} and performative aspects of routines. Though technology contains embedded rules, the effects of such rules remain inert until enacted and embedded within organizational routines (Gorgeon, 2009). Such change in organizational routines requires a disruption of historically accumulated patterns of action and the ostensive meanings of such actions. Since disrupted routines leave an organization in a less than optimal position/period of flux (Weick, Sutcliffe, & Obstfeld, 2005), organizations must also repair disrupted routines by re-establishing both the meaning of work and the performance of it through the reformation of new, interdependent patterns of action that represent a group's capacity to accomplish work.

1.3 Guiding Questions

The following two questions serve to guide the literature review and will be refined and expanded upon in Chapter 3.

The guiding questions for this research are:

- How do organizational routines respond to technology initiated organizational routine disruption?
- How can we understand the process through which organizational routines renew and reform after such disruptions?

Findings from this research will contribute important insights to the largely unexplored phenomenon of technology initiated organizational routine disruption and renewal.

1.4 Field Setting

The case of technology initiated routine disruption under investigation for this study is a recent introduction of a new Computerized Provider Order Entry (CPOE) system at The Ottawa Hospital (TOH) in Ottawa, Canada. The specific routine under investigation is that of specimen collection order processing. In this subsection, we further elaborate the context within which this technology was introduced.^{xii}

The term CPOE (computerized provider/physician order entry system) has emerged to signify digitally supported versions of processes surrounding the facilitation of medical order requests. CPOE systems are becoming increasingly common in hospital and proponents of these systems claim that they reduce medical errors and increase the quality of care (in America, 2001). Some researchers, however, are raising concerns that CPOE systems open up new error pathways and contribute unanticipated consequences that manifest in unexpected errors and reductions in quality of care (Ash et al., 2007; Campbell, Sittig, Ash, Guappone, & Dykstra, 2006).

Recent attempts by TOH to improve the efficiency and accuracy of ordering processes have included the introduction of new digital artefacts in order to positively affect the set of existing embedded ordering routines.^{xiii} These efforts influence important mechanisms through which individual healthcare workers coordinate and create meaning in their work as they deliver patient care. This system has afforded opportunities to reimagine old processes and to automate and standardize many aspects of medical decision-making.^{xiv} Prior research findings indicate that CPOE systems significantly influence how work is conducted, what roles and responsibilities are assumed, and how people coordinate to deliver patient care (Kohn & others, 2004).

1.4.1 Drivers of technology initiated disruption and change in healthcare

Health information technology and health informatics are emerging as distinct subfields of information systems research. For the purposes of this research, this field setting simply represents an observational case but, considering the recent focus of this area within the IS

literature, it also compels us to provide further contextual detail to help set the stage for our research design and analysis, which will be elaborated on more fully in Chapter 4 and 5, respectively.

A review of the literature on CPOE deployment reveals two key drivers of the recent massive investment in health information technology.^{xv} The first is one of economic necessity, as rising healthcare costs and aging populations are compelling many health policy-makers to look for new ways to reduce spending. The second driver is the increasing use of digital technology to reduce medical errors and adverse events, especially as the complexity and volume of patient processing and treatment continue to rise (Wachter, 2015).

1.4.1.1 Driver #1 - Control cost of healthcare delivery

Healthcare spending continues to consume the largest share of public spending among the 34 OECD^{xvi} countries, averaging 9.05 percent of GDP in 2012 (as calculated by the author from the 30 reporting countries in latest OECD report issued on June 30, 2014; <http://www.oecd.org/els/health-systems/health-data.htm>). Many OECD countries are also facing a double burden of increasing healthcare spending and declining workforce participation (Davis, Schoen, Stremikis, & Fund, 2010). In response, many policy makers are encouraging significant increases to health information technology (HIT) spending. Such decisions are supported by the assumption that the deployment of new HIT will increase the quality of healthcare delivery, reduce errors, and decrease costs. Despite some positive initial results from these investments, achieving the planned outcomes has proven

to be quite challenging (Wachter, 2015). Understanding the dynamics of HIT disruptions in organizational structure and performance is thus an increasing concern, and many researchers are calling for more research into this area (Aarts & Gorman, 2007; Aarts, 2013; Campbell et al., 2006; Lorenzi & Riley, 2000; Novak, Holden, Anders, Hong, & Karsh, 2013).

1.4.1.2 Driver #2 - Eliminating iatrogenic events

An often referenced report by the Institute of Medicine^{xvii} – “To Err is Human: Building a Safer Health System” (Kohn, Corrigan, Donaldson, & others, 2000), highlights the risks of receiving medical care in the United States. Indeed, the prevalence of iatrogenic effects and the severity of associated adverse events found in this report “shocked the sensibilities of many Americans” (Shojania, Duncan, McDonald, & Wachter, 2002, p. 508). Despite any revelations this report may have contained, the prevalence of iatrogenesis dates back to the earliest days of medical practice.

Iatrogenesis, from the Greek “brought forth by the healer”, is a term that refers to the creation of adverse medical events and illnesses from the medical treatment itself. In the early history of medical practice, this included mysterious deaths due to then unknown viruses and bacteria that flourished in unsanitary hospital conditions, as well as the often “barbaric” medical practices of the day (Taleb, 2012). Today, causes of iatrogenesis include side effects from drugs, medical error, negligence, side effects from treatment, and unnecessary treatment for profit. One of the key drivers of health information technology

deployment has been to reduce the prevalence of iatrogenesis and the resulting adverse events in healthcare organizations (Weiner, Kfuri, Chan, & Fowles, 2007).

1.4.2 Technology initiated routine disruption in healthcare

When changes affect the system, routines are disrupted by turbulence and uncertainty. Hence, serious problems can arise when central healthcare authorities, driven by their own strategic agenda, disrupt a system that is moving along largely under the impetus of its local habits and routines. In such circumstances, people search for new ways of coping with the changing situation, some of which malfunction. (Hodgson, 2008b, p. 246)

Like organizations in general, healthcare organizations often deploy technology as a routine structuring device (Greenhalgh, 2008). Through the embedded rules and affordances found within a deployed technology, health organizations often assume that the resulting work structures and practices are strongly determined by the technologies themselves. However, in practice, such deterministic effects are often quite weak, and many resulting work structures and behaviours are unintended and unexpected (Barley, 1986). Even in cases where planners put great effort into designing systems to match existing work routines, such efforts still require a *filling in* of the work activities surrounding the systems affordances and constraints. Designers assume, or define, models of work which are not work practices themselves (Suchman, 1983; Suchman, 1995). Their designs require enactment, which necessarily involves a great deal of complex, in-situ elaborations expressed only through the participation in, and performance of, work

(Gaskin, 2012; Orlikowski, 2010). It is in this space between the designer's intentions and resulting behaviour where much remains to be explored and understood.

An illustrative case of the implications of this issue is provided in Cedars-Sinai Hospital's recent deployment of a customized CPOE. Despite the CPOE system having been developed in-house and, at great expense, tuned to the specific operations of Cedars-Sinai, physicians and nurses within the hospital rebelled against their new system, complaining that it was too great a distraction from their medical duties and did not sufficiently support the safe delivery of healthcare (Freudenheim, 2004). Scott, Rundall, Vogt, & Hsu (2005) provide a similar example, where a CPOE deployment at Kaiser Permanente Hospital in Hawaii resulted in a significant reduction of physician routine productivity. Paré, Sicotte, Poba-Nzaou, & Balouzakis (2011) also note that nurses often resist the usage of such technologies for fear of being distracted or removed from direct patient care. Such examples highlight the difficulty in predicting actual outcomes and effects that a new technology can have on existing organizational routines.

Beyond the institutional failure to deliver anticipated economic performance improvements, the introduction of IT can also generate new paths for error. Though studies have long acknowledged the significance of iatrogenic illness^{xviii}, the introduction of technology is proving, in certain cases, to exacerbate this problem by increasing the occurrence of certain adverse events in the diagnosis and treatment processes (Aarts, Ash, & Berg, 2007; Campbell, Sittig, Ash, Guappone, & Dykstra, 2007; Koppel et al., 2005; Weiner et al., 2007). Wachter (2015) offers an illustrative example in which a nurse administered thirty-nine times the prescribed dosage of a drug because of her confusion

surrounding the use of a newly deployed health information system – a system that was originally justified by claims that it would reduce such errors. This case is one of many that highlight that there are often significant unanticipated problems associated with such implementations even though the implementation of HIT has been beneficial in some cases^{xix}.

Due to the recent, and ongoing, investments that many hospitals are making in HIT and CPOE, many problems may not yet be manifested (Wachter, 2015). Problems associated with the introduction of technology into healthcare practice are often directly associated with the disruption of established organizational routines (Greenhalgh, 2008), and such problems can remain hidden until triggering events are engaged. This risk of IT-induced iatrogenic illness has become such a significant concern for HIT researchers that Weiner et al. (2007) have introduced the term “e-iatrogenic” to both put a name to this idea and issue, and serve as a call to focus more research efforts to look at this problem more deeply.

Recent widespread interest in using HIT to improve the delivery of healthcare has significantly disrupted many deeply embedded healthcare routines (Greenhalgh, 2008; Swinglehurst, Greenhalgh, Myall, & Russell, 2010). Ordering routines are often the target of interest here and such deployments attempt to disrupt and reconfigure deeply embedded routines that are often difficult to change (Ash et al., 2007). Despite this acknowledged disruption, there have been surprisingly few rigorous investigations into the impact on healthcare routines from significant changes in supporting technology. Novak, Brooks, Gadd, Anders, & Lorenzi (2012) note that the recent widespread public interest in the quality and efficiency of healthcare has resulted in a great deal of interest in measuring,

analyzing, and comparing organizational routine performances – but our lack understanding of organizational routine dynamics has, by and large, resulted in “under-identifying” the impacts such changes can have on an organization. As indicated by Greenhalgh (2008), IT artefacts represent important structuring devices in healthcare practice, but a great deal of research remains to be done before we can fully understand the process through which individuals react to routine disruption, and engage in activities to repair or change existing routines. As further noted by Greenhalgh (2008), managing routine disruption and renewal must become a key focus for health information technology researchers so they can generate new insights into the impact IT has on the delivery of quality healthcare.

1.5 Summary of Contributions

This study responds to calls within organizational routines literature for further exploration of micro foundations (Abell et al., 2008; Felin et al., 2012, 2015; Felin & Foss, 2012; Lewin, Massini, & Peeters, 2011; Vromen, 2011; Winter, 2013) to help understand the source of variation and change in the structure and performance of organizational routines. Moreover, we contribute to the processual view of IT value generation (Bharadwaj, 2000; Davern & Kauffman, 2000; Grabowski & Lee, 1993; Lucas, 1993; Markus & Soh, 1993; Markus, 2004; Soh & Markus, 1995), and answer calls in IT usage literature further conceptualization of the usage construct (Burton-Jones, 2005; Burton-Jones & Straub, 2006). We assert that these perspectives share a common challenge – that of understanding

the dynamic process that underpin technology initiated organizational routine disruption and renewal.

Guided by works on narrative networks (Bearman and Stovel, 2000; Pentland and Feldman, 2007, Goh et al., 2011) and narrative analysis (Riessman, 2000, 2008), we utilize an extended narrative analysis technique to identify an enacted routine in practice and key events that introduce variation and change in the performance of a routine. From this analysis, we establish that an espoused routine used to help guide a technology introduction can significantly underrepresent the complexity of the enacted routine in practice. Moreover, we demonstrate how a dialectic modalities lens can be used to generate insights into agent driven organizational routine repair and renewal, and show how two dimensions of dialectics (performative<->ostensive and performative<->environmental) act independently to produce varying levels of dialectic tension that motivate variation and change in the performance of an organizational routine.

Our contribution to theory involves taking theoretical underpinnings of organizational routines (Simon, 1965; Nelson & Winter, 1982; Feldman, 2000; Feldman & Pentland 2003; Leonardi, 2011) and concepts of dialectical driven organizational change (Nielsen, 1996; Kreiner et al., 2014, Putman et al., 2016) to demonstrate that significant divergences in actual versus expected behaviour both occur, and can be seen as a dialectic change process whereby agents motivate change in response to dialectic tension across two dimensions. This work adapts the emerging work on organizational change dialectics (Nielsen, 1996; Kreiner et al., 2014, Putman et al., 2016) to conceive of dialectic change as a generator of variation and change within organizational routines and suggest that dialectic tension is a

key driver of organizational routine change. To account for this, we introduce a new concept and model – “Dialectic Modalities of Routine Change” – to describe the four combinations of dialectic tension that can occur in the performance and enactment of a routine. Our research also makes valuable contributions to the discussion of organizational routine disruption (Jarzabkowski et al., 2012; D’Adderio, 2014; D’Adderio & Pollock, 2014; Cohendet & Simon, 2016) by exploring how working groups perceive disruptions in practice and how they respond to these disruptions to generate new patterns of action that repair and renew routines disrupted by the introduction of new technology.

It is our position that greater understanding and focus on routine disruption and renewal will ultimately assist managers in improving their practice of technology value realization by contributing further understanding to the process and events that generate divergence from initially planned outcomes. This research also provides a deeper theoretical understanding of technology initiated organizational change (Bloodgood, 2012) and technochange (Markus, 2004) processes by introducing a new analytic lens. As well, output from this research makes important contributions to our understanding of routine disruption and renewal and responds to calls within routines literature for more theoretical exploration as to the micro-foundational dynamics of routine change (Abell et al., 2008; Felin et al., 2012, 2015; Felin & Foss, 2012; Lewin, Massini, & Peeters, 2011; Vromen, 2011; Winter, 2013).

In the following chapters, we present our literature review, theoretical model, empirical context, data sample, analysis, and discussion of findings. More specifically:

- In Chapter 2, we review and synthesize the literature on IT value generation^{xx}, IT usage, and organizational routines to provide the context and motivation for our theoretical position;
- In Chapter 3, we highlight the specific problem of routine change, outline the shortcomings of existing change theories of routines, and introduce our dialectical model of change. We accomplish this by synthesizing results from the literature analysis conducted in Chapter 2, to produce the dialectic change model that guides our data collection and analysis;
- In Chapter 4, we present the details of our methodological framing and research design. Included in this chapter are details on the specific steps that were used to collect and analyze our data;
- In Chapter 5, we elaborate on the details of the case that serves as the empirical context for our investigation. Qualitative research requires the reader's engagement in the process of interpretation (Riessman, 2008), and therefore, to provide the reader with sufficient context for the following analysis, we elicit key features of the environment within which the routine under investigation is enacted;
- In Chapter 6, we provide details surrounding the execution of our data collection process and provide a summary of the collected data's key aspects;
- In Chapter 7 and 8, we present the qualitative analysis details of the collected data findings. Chapter 7 is segmented into three sections. The first section focuses on the identification of the original routine and the target routine and then contrasts these to elicit key management expectations surrounding the technology introduction project. In the second section, we establish how the routine is

performed in actual practice using a narrative analysis technique to document the structure of the nurse blood collection routine in practice. In the third section, we segment the overall narrative network into subroutines and which we further analyze to identify normal and exceptional, or disrupted, performance patterns experienced by nurses. In Chapter 8, we utilize aspects of the interpretive “dialectic modalities” lens defined in Chapter 3 to identify dialectic tensions and conflicts that may serve as a source of agent driven organizational routine variation and change;

- In Chapter 9, we discuss our findings, approach, and method and revisit and discuss our research questions; *and*
- Finally, in Chapter 10, we review contributions, present limitations, and discuss future research opportunities.

In summary, our objectives are consistent with Orlikowski & Yates' (2006) call for IT researchers to de-black-box such IT-related organizational phenomena: “We believe that such approaches [routines and practice perspective] are particularly valuable as they afford the possibility of accounting for the messy, dynamic, contested, contingent, negotiated, improvised, heterogeneous, and multilevel character of ICTs in organizations” (p. 132). Our approach answers this and other similar calls found within the literature by focusing on the problem of technology initiated routines disruption and renewal within organizations.

ⁱ CIO’s also indicated that one-quarter of all IT budgets were allocated to supporting business change (Deloitte, 2014).

ii Of particular note, this study (Bloch et al., 2012) also identified that one of the top five CIO conclusions from IT investment failures was that they were the result of unexplained or unidentified causes.

iii Markus and Robey relate their perspective to that of Pfeffer's "emergent" view of action in organizations: "Because participation in organizational decisions is both segmented and discontinuous, because preferences develop and change over time, and because the interpretation of the results of actions – the meaning of history – is often problematic; behavior cannot be [fully] predicted a priori either by the intention of individual actors or by the conditions of the environment (1982, p. 9).

iv The reader should not conclude that our motive is to diminish the importance of resistance research. We believe that through a deeper understanding the organizational dynamics of disruption (independent of constructs such as resistance, acceptance, and adoption), we can open up new avenues of research to understand these surface phenomena more deeply.

v Through whatever measure could be applied to measure “better”.

vi The term ergodic originates from mathematics, but has been used within economic modeling to explore the dynamics of endogenous preference formation (Horst, 2005). This concept is used to explore and explain propagation phenomenon such as the “QWERTY” keyboard and standard gauge railway systems.

vii As we have seen with early seminal works by Herbert Simon (March & Simon, 1958; Simon, 1955, 1956, 1957, 1965), such behavioural alignment is the result of individuals making decisions that cannot be fully rational, nor optimal (Foss, 2003; Simon, 1991, 1996). Individual cognitive capacity, access to information, and time are limited (bounded); therefore, decisions are the result of “satisficing” and often do not exhibit properties expected by assuming optimizing behaviour (though, it could be argued that on some level “satisficing” is an optimization but just not the “performance” optimization that is expected).

viii Black-box views have provided the necessary foundation for more *macro*-level exploration of firm and industrial behaviour (e.g. Nelson & Winter, 1982), but avoid explaining the underlying micro-foundational structures from which routine properties and behaviours emerge (Felin et al., 2015). The black-box perspective includes a relatively static image of routines, and has faced increasing criticism for largely neglecting the micro-foundational processes through which routines are accomplished, maintained, and changed (Feldman, 2000; Felin & Foss, 2009).

ix This effect is demonstrated in recent simulation studies by Brian Pentland (e.g. Pentland et al., 2012, Pentland, Haerem, & Khaledi, 2014) and this author (unpublished).

x Dialectic change theory versus evolutionary theory will be covered in-depth in Chapter 3. Though much of the literature on organizational routine change focuses on the evolutionary view of organizational routine change, such changes leave little room to investigate the non-random directed change often exhibited by routines. Agreeing with observations by Hales & Tidd (2009), we question the appropriateness of the genotype (evolutionary) view of routines. There have been recent calls within the literature to explore alternatives to such “black box” views (Felin et al., 2012; Pentland & Hærem, 2015; Williams & Edge, 1996), and we assert that one promising avenue is to view organizational routines change as a dialectic process (for examples of dialectic change processes to the more general problem of organizational change see Putnam (2015), Kreiner et al. (2014), Benson (1977), and Seo & Creed (2002)).

xi The ostensive and performative are two aspects of routines as introduced in the dominant model of routines – provided by Pentland & Feldman (2005).

xii Though our research is directed at investigating technology initiated routines disruption and renewal in more general terms, the growing literature on health information technology does compel us to provide

substantial contextual information. It is our hope that such details are interesting and important, but should not distract the reader from our core narrative.

^{xiii} Individuals may see this outcome as a “new” routine. From our perspective, we see the organizational response to a disruption as an old routine that is repaired and renewed to fit the new contextual factors brought out by the introduction of new technology. We argue that this perspective is supported when there exists an ongoing consistency in the overarching task set that the routine is fulfilling.

^{xiv} CPOE systems have varying degrees of automation in this area. Typically, such automation occurs by prompting the system user. For instance, warnings about dangerous drug interactions or the entry of a dosage that seems unreasonably high.

^{xv} For example, between 2010 and 2014, the US government spent over \$30 billion to incentivize and help accelerate the adoption of HIT into healthcare practice (Wachter, 2015).

^{xvi} The Organization for Economic Co-operation and Development is an international economic organization of 34 countries founded in 1961. The OECD’s mission is to stimulate economic growth and world trade. More information can be found at <http://www.oecd.org>.

^{xvii} Google Scholar indicates 14,856 citations as of Dec. 2, 2015.

^{xviii} From Kerr (1975): “In one study of 14,867 tests for signs of tuberculosis, 1,216 positive readings turned out to be clinically negative; only 24 negative readings proved clinically active, a ratio of 50 to 1” (p. 771). Such false positives result in exposing a significant number of patients to unnecessary and often dangerous, treatment – and false negatives in denying patients potentially lifesaving treatment.

^{xix} A study prior to the recent proliferation of HIT indicated that 1 in 15 hospitalized patients received improper dosages or drugs (Bates et al., 1995).

^{xx} The IT value literature looks at how organizations move from technology investment, introduction, and ultimately some value/benefit for the organization (e.g. Soh & Markus (1995), Chan (2000), Davern & Kauffman (2000)). Identifying both how organizations change and the necessary conditions for such changes to enable IT value creation are the key focal points of many studies within this genre, and are thus the appropriate literature in which to situate our discussion.

Chapter 2: Literature Review

Our goal for this chapter is to review the literature on IT Value, IT usage, and Organizational Routines. In doing this we seek to integrate and extend the organizational routines lens and apply this extended view to generate new insights into collective IT usage within organizational groups. The IT value literature is important for this discussion as it frames both the problem and the contribution into which this research is situated. We look to understand organizational routine disruption in response to technology introduction, and how organizational routines are renewed in the face of technology introduction.

2.1 Defining IT Value Generation and Performance

To situate the problem of technology initiated routine disruption, we review the literature on IT value and the problem of IT value generation. Our review indicated two general approaches, or genres, within the IT value literature. The first genre involves identifying returns from IT investment by firms. Included in this genre are investigations into productivity (Brynjolfsson & Hitt, 1996; Brynjolfsson, 2003; Davis, Collins, Eierman, & Nance, 1993; Dewan & Kraemer, 2000; Hitt & Brynjolfsson, 1994; Lin & Shao, 2006; Stratopoulos & Dehning, 2000), performance (Cline & Guynes, 2001; Kauffman & Weill, 1989; Maiga, Nilsson, & Jacobs, 2013; Sircar, Turnbow, & Bordoloi, 2000; Weill, 1992), and more general forms of impact (Ashurst, Doherty, & Peppard, 2008; Cline & Guynes, 2001; Hitt & Brynjolfsson, 1994; Mahmood & Mann, 1993). Examples of questions found

in the first genre of literature include: how much IT value is created, how any value should be measured and identified, and if such value is significant.

The second genre involves identifying the *process* of value generation (Bharadwaj, 2000; Davern & Kauffman, 2000; Grabowski & Lee, 1993; Lucas, 1993; Markus & Soh, 1993; Markus, 2004; Soh & Markus, 1995). This later genre focuses on the process by which technology investment is translated into value (Soh & Markus, 1995), how capabilities are generated (Tripsas & Gavetti, 2000), through what means is IT most impactful (Spaulding & Raghu, 2013), and what necessary conditions must be met for any realization of benefits (Grant & Collins, 2016). The literature review on IT value generation that follows is framed by these two genres.

2.1.1 Identifying returns from IT investment

Organizations invest heavily in information technology (Gartner, 2014; Nakata et al., 2008). Organizations make these investments under the expectation that they will generate significant organizational benefit, typically through measured improvement in productivity (Brynjolfsson, 2003). Such investments are often justified as strategic and a key means through which organizations generate a number of strategic benefits (Grant, 2003; Wade & Hulland, 2004). Despite these common expectations, achieving such benefits has proven to be surprisingly difficult for organizational leaders (Grant, 2010).

Early investigations into this problem explored the level of productive impact IT investments have on the economy and the industries within it. After years of assuming that

information technology investment was having a significant impact on productivity, early research results on this problem found that, contrary to the general assumptions of the time, macro productivity measures did not show any significant improvement. In his well-cited works surrounding this now apparent *productivity paradox* (Brynjolfsson, 1993), Brynjolfsson notes that during a period when computing power had increased significantly, macroeconomic indicators of productivity had stagnated. Spurred by Robert Solow's comment, "you can see the computer age everywhere except in the productivity statistics" (as cited in Brynjolfsson, 1993, p. 67), Brynjolfsson and others (Lin & Shao, 2006; Stratopoulos & Dehning, 2000) explored the question *does IT provide returns beyond the costs?* and through the exploration looked to identify measured improvement in productivity. Some studies found no indication of improvement (Brynjolfsson, 1993), while other studies found that that such improvement was indeed there (Mooney, Gurbaxani, & Kraemer, 1996). Some studies attributed these contradictory findings as stemming from a problem of measurement (Chan, 2000).

2.1.1.1 A Problem of measurement – Productivity vs. performance

A key discussion that emerged from this productivity paradox centered on concerns that the measures used to capture effects are flawed (Chan, 2000). Chan notes that the IT productivity paradox "hype" (p. 226) resulted in excessive focus on hard numbers and "big IT wins" (p. 226) to the detriment of important qualitative judgments and observations, and incremental process and product improvements. Sircar et al. (2000) highlight that these early studies exhibited a "definitional [problem]" (p. 70), observing that although

productivity and performance are not that similar in scope, they are often treated as such by information systems literature.

2.1.1.1.1 Productivity

Productivity, with its roots in the field of economics, is a measure of output produced over inputs consumed. Researchers investigating IT productivity gains look to identify increased efficiency as measured increases in units of output per a given set of input units consumed to produce said output. Such measures typically look to quantify the productivity of collective entities, for example, the productivity of a geographic region, country, industry or firm. Unless otherwise specified, the input considered in such measures is that of units of labour or capital. When referring to the *productivity paradox*, given this model, what we are claiming then is a lack of measured increase in production output per unit of labour or capital despite significant investments in IT. Such an analysis is subject to a multitude of influences, many of which are not related to technology itself (Brynjolfsson & Hitt, 1996). For instance, market forces (such as an overall increase in efficiencies) can shift supply curves in aggregate, thus de-valuing industrial output on a per unit basis^{xxi}. These and other complex dynamics can hide the effects of technology-induced performance increases, and to conclude from these measures of productivity that technology has little, or limited, impact is naïve.^{xxii}

An illustration of this naïve analysis is illustrated in the popular work of Nicolas Carr – “Does IT Matter?” (Carr, 2004), and the more boldly stated, “IT Doesn’t Matter” (Carr, 2003). Carr (2003) highlights that IT is valuable when others use it; for example, a fax

machine is only useful if others have a fax machine, negating any competitive advantage potential from this technology. Although Carr does not go so far as to model the effects he speaks of when he argues for vanishing advantage from IT investments (Carr, 2003, p. 6), he is, in essence, implying the aforementioned shifts in the supply curve. That is, once every company in an industry uses the technology, the value from any productivity increase brought on by the technology would be competed away through market forces. What Carr overlooks is that (1) the performance of these companies has increased, and (2) rarely is information technology embedded into organizational practice in the same way across individual companies within an industry.

2.1.1.1.2 Performance

In contrast to productivity, performance measurement can take on many different forms (Sircar et al., 2000). Unlike the economic roots of productivity measures, performance is rooted in theories of firm-level strategy and competitive advantage (Sircar et al., 2000, p. 70). These theories predict that IT provides competitive advantage by enabling new organizational capabilities that enable a business to respond more quickly to the contingencies of the environment in which it operates (Clemons, 1986; Porter & Millar, 1985). Such effects increase a firm's *potential* for performance, and thus represents only a possibility. In order to achieve any effect, organizational leaders must effectively deploy the technology under current and forecasted conditions. This observation is represented within many "processual" models of IT value generation (Chang & Ye, 2011; Markus & Benjamin, 1996; Marshall, McKay, & Prananto, 2004; Robey, Anderson, & Raymond,

2013; Soh & Markus, 1995) where any positive effects of the technology is subject to an achievement of identifiable necessary conditions.

Likewise, specific information technologies often generate indirect effects through supporting decision-making processes made possible by enhanced abilities to scan the environment, and make more timely and accurate business decisions (Bhatt & Zaveri, 2002). In terms of IT performance impact, the plethora of measures such as profitability, revenue, return on assets, cash flow, number of products, and market share, confound the problem of IT value generation further. As Croteau & Bergeron (2001) note, “measuring organizational performance can be a problem since there is no universally recognized measure of this concept” (Croteau & Bergeron, 2001, p. 81). By extension, studies considering IT investment effects on performance then must also reflect the diversity of measures possible given the plethora of performance measurements available. This plurality of possible measurements has resulted in creating similar contradictory findings as in the literature on productivity (Sircar et al., 2000). To address this problem, a more universal target for IT value research must be developed.

Though research into the effects of IT on performance and productivity continues to be a key area to explore^{xxiii}, it is an ongoing project; organizational leaders need actionable guidance on the impact governance practices can make. Of particular relevance to our study, we note that some researchers argue that we should reframe this question to a more general form of “how” value, in any form, is achieved (Markus, 2004). This approach has inspired a cluster of IS research that explores the processual antecedents to value generation from IT (e.g. DeLone & McLean, 1992, 2003; Goodhue & Thompson, 1995; Lucas &

Spitler, 1999; Davis et al., 1993; Davis, Bagozzi, & Warshaw, 1989; Venkatesh & Davis, 2000). Focusing on processual models avoids the *baggage* associated with measures of productivity or performance^{xxiv}, and subtly shifts the problem away from identifying “hard measures” (Chan, 2000, p. 228) to exploring the important dynamic aspects of IT investment; the deployment, usage and ongoing management necessary for any measurable effect to occur.

2.1.2 Identifying how value is returned

Another avenue of discussion around the productivity paradox stems from the observation that returns from IT investment are not consistent across industries; some organizations achieve greater success from their IT investment than their peers (Stratopoulos & Dehning, 2000). Brynjolfson sums up this problem nicely: “IT isn't like a certificate of deposit where you can invest your money and expect a guaranteed rate of return” (Brynjolfsson, 2003, p. 1). In other words, returns from IT investments are not an inherent property of these investments. Unlike stocks, bonds, or other investment vehicles, the risk in achieving anticipated benefits from IT investment is not entirely exogenous. Much of this risk is a function of organizational capabilities and how management proceeds (and has proceeded in the past).^{xxv} The introduction of technology into an organization produces complex organizational effects, effects that must be understood, tamed, and managed - if any anticipated results are to be realized (Kallinikos, 2004). Given these fundamental observations, we identify two new subgenres of literature on IT value, one that focuses on conditions through which IT benefits are realized, and the second focusing on through what

means value is achieved. These emerging genres represent an important shift in focus from IT benefits measurement to how and under what conditions any IT investment benefits are achieved.

2.1.2.1 Under what conditions? – The Rise of factor models

A number of studies focused their attention on identifying factors that inhibit or enhance the realization of IT investment beneficial organizational outcomes. The popular DeLone and McLean model (DeLone & McLean, 1992, 2002, 2003; Gable, Sedera, & Chan, 2008; Petter, DeLone, & McLean, 2008; Petter et al., 2012; Petter, DeLone, & McLean, 2013; Petter & McLean, 2009; Tate, Sedera, McLean, & Burton-Jones, 2014) defined a structure of casual factors the lead to organizational impact. Within the DeLone and McLean model, system usage is identified as a key antecedent to individual and organizational level impact. Similarly, Davis's TAM model (Davis et al., 1989; Davis, 1989)^{xxvi} defined system usage as a primary dependent variable of interest. These and other similar factor models (e.g. TAM (Davis, 1989), TAM2 (Venkatesh & Davis, 2000), TAM3 (Venkatesh & Bala, 2008), and UTAUT (Venkatesh et al., 2003))^{xxvii}, implicitly assume self-disclosed system usage as a necessary condition for any measurable return, or success, from IT investment. Many of the studies that followed, shifted emphasis from *hard measures* of IT value to measurement of disclosed individual perceptions and self-disclosed usage frequency.

Emphasis on usage is interesting; logically, one can conclude that a necessary condition of IT investment impact on organizational performance is that members of the organization must use the technology introduced (Burton-Jones & Straub, 2006). Using this reasoning,

many studies incorporate some measure of usage as a key dependent variable. The most common subset of these studies, gaining tremendous popularity within the field of IS studies over the years, is exhibited within the many studies that have focused on developing technology acceptance models (TAM's) (Brown, Massey, Montoya-Weiss, Burkman, & others, 2002; Chuttur, 2009; Davis et al., 1989; Davis, 1989; Li, Hsieh, & Rai, 2013; Pynoo et al., 2012; A. Schwarz & Chin, 2007; V. Venkatesh & Bala, 2008; Venkatesh & Davis, 2000; Venkatesh et al., 2003).

The increasing number of TAM's is causing some to claim that TAM has gained too much popularity (Benbasat & Barki, 2007). Since Davis's original work nearly thirty-five years ago, a steady stream of TAM studies has consistently validated combinations of core constructs of TAM (*usage, perceived ease of use and perceived usefulness*). Such established evidence influences many researchers to focus on answering research questions that are likely be validated as true. This influence limits exploration of less trodden paths that could unearth new approaches (Benbasat & Barki, 2007). Straub & Burton-Jones, (2007) sums this problem up by stating that TAM has "over-conquered [the field]":

Caesar said, with respect to Gaul, that he came, he saw, and he conquered ("Veni, vidi, vici"). To a large extent, TAM has achieved this same distinction. In fact, some would argue that TAM has "over conquered" in the sense that it has achieved this too well by creating a dominant but stifling paradigm. (Straub & Burton-Jones, 2007, p. 224)

With TAM publications expanding to occupy an estimated “10% of our precious journal space” (Hirschheim, 2007, p. 205), there is a growing call for researchers to take greater risks and make a lateral move away from TAM to generate new and more fruitful streams of investigation that improve practical knowledge of the problem. As indicated by the number of articles in a special issue of *Journal of the Association of Information Systems* (Volume 8, issue 4), there are a number of potential avenues open to expanding our understanding of technology usage and adoption. Straub & Burton-Jones, (2007) assert that that we must strive to develop more sophisticated conceptualizations of what systems usage means.

2.1.2.2 Through what means? – The Rise of processual models

Technology introduction involves a series of necessary steps that must be successfully executed in order to achieve any planned benefit(s) (Markus & Robey, 1988). In contrast to factor models surrounding usage, a group of papers has taken a more processual view of value generation from IT (Chang & Ye, 2011; Grabowski & Lee, 1993; H. C. Lucas, 1993; Marshall et al., 2004; Soh & Markus, 1995). As indicated in the discussion of problems with value generation, IT investments do not inherently generate returns (Brynjolfsson, 2003), and in response, these studies (in contrast to the TAM studies) look to generate valuable insights into the necessary phases through which technology value and benefits are created.

Process theory posits that any benefits from IT investment are the result of a series of necessary, but not sufficient, conditions (Markus & Benjamin, 1997). This cluster of

research offers a number of different perspectives, each with a particular focus on the conditions necessary for achieving benefit from information technology introduction.

Lucas (1993) proposes two necessary conditions required to generate positive impact from information technology investment: that IT technology design fit the task(s) at hand, and that the system is used appropriately when executing tasks. Like all processual models mentioned herein, these conditions are necessary but not sufficient conditions for value generation. That is, by using Lucas' model to illustrate that, although technology design fit and appropriate use are necessary conditions for IT to positively affect firm performance, the achievement of these conditions is not sufficient to ensure performance.

Expanding on Lucas's idea of appropriate design technology fit for a given task, Grabowski & Lee (1993) introduce an expanded technology fit model. In this model, three necessary conditions for technology introductions must be met to achieve performance: technology must fit the strategy of the organization, it must fit the cost-structure of the organization, and finally, there must be some fit with and within a portfolio of information applications maintained by the organization.

Soh & Markus (1995) build off of these and other previously proposed models (Beath, Goodhue, & Ross, 1994; Sambamurthy & Zmud, 1994) to introduce a temporal model of the necessary conditions for IT benefits realization.

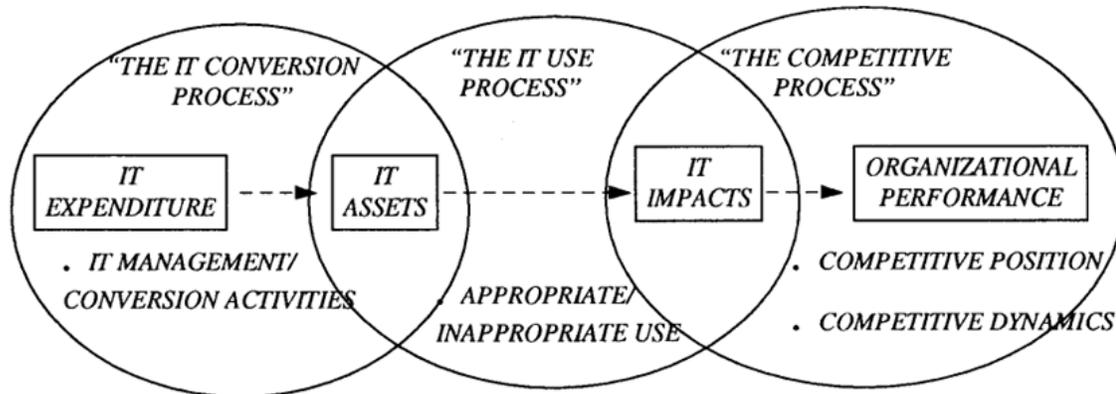


Figure 1: How IT creates business value - A Process theory (Soh & Markus, 1995).

Other than the obvious *expenditure*, the first necessary condition identified by Soh & Markus (1995) relates to the creation of an IT asset, which in their view includes the successful design and deployment of the technology. The next necessary condition is that the IT asset must have an impact on the performance of the organization. The final condition relates to organizational performance. Not all impacts result in targeted value generation; therefore, a necessary condition for value generation is that the impact must result in organizational performance improvements.

Unlike previous conditional models, Soh & Markus (1995) include a second dimension: the processes through which each condition is met or generated. Within this perspective, there are three key processes identified:

- The IT Conversion Process: the process through which technology investment is turned into installed infrastructure
- The IT Use Process: the process of using the technology in practice

- The Competitive Process: the process in which impacts are directed towards strategic goals in order to achieve appropriate performance that generates a better competitive position within an industry

2.1.3 IT value summary

Despite early findings supporting a *paradox problem*, later studies provide convincing evidence that disputes this paradox and provide strong evidence that, under the proper conditions, technology can provide value to organizations. Arguments surrounding IT value evolved from questioning if such value exists, to highlighting that achieving such value is more complex and difficult than commonly assumed. This work has led to calls for greater focus on “how” IT adds value; within this work, we find responses such as Soh & Markus (1995) and Grant & Collins (2016) who explore processual decompositions of IT value generation. These processual views identify key phases and necessary conditions through which a successful transition from IT investment to value creation occurs. Such approaches avoid the ambiguities and value-laden nature of IT usage and IT value measurement to focus instead on the means through which any impact is achieved. Along these casual temporal chains, the importance of IT usage stands out in particular. In the next section, we will turn our focus specifically to the problem of IT usage.

2.2 IT Usage

Though the processual view has inspired many areas of interesting research, a particularly troublesome condition for achieving benefit from IT investment has been IT usage (Burton-Jones & Straub, 2006). In this section, we define IT usage and explore the key issues within the existing literature on IT use and usage.

System usage is the application of information technology by individuals, groups, or organizations in the engagement of work (Straub, Limayem, & Karahanna-Evaristo, 1995). Burton-Jones (2005) defines usage as an “activity” involving three elements: a user, a system, and a task, resulting in a refined definition of usage as “user’s employment of one or more features of a system to perform a task” (p. 77). IT usage, also commonly labeled as system usage (Straub et al., 1995), post-implementation usage (Saga & Zmud, 1993), or post-adoption usage (Jasperson et al., 2005), is a necessary condition for obtaining IS success and ensuring long-term viability (Bhattacharjee, 2001).

System usage is widely explored in IS empirical research (Zmud, 1979). Our review of the literature indicates two general forms of system usage measures: subjective and objective.

2.2.1.1 Subjective measures

Subjective measures are the foundation of many TAM studies, and the more common of the two types.^{xxviii} Subjective measures of usage derive from survey instruments where individuals are asked to indicate their perceived system *level of usage of* or *intention to use*, measured using the Likert scale and absolute scale. Examples of the choice of answers

include, “I intend to use the [X] system” (Smith, Grant, & Ramirez, 2014), “Assuming I have access to the system, I intend to use it” (Venkatesh & Davis, 2000), or “I use the system frequently” (Thompson, Higgins, & Howell, 1991) and for absolute scale questions such as “How many times do you believe you use [X] during a week”? (Malhorta et al., 1999)

2.2.1.2 Objective measures

For objective measures, some form of computer measurement of usage is employed, most commonly through reviewing archival information such as system logs (Deng & Chi, 2012; Venkatesh et al., 2003). However, despite the proliferation of monitoring systems that record individual level system usage events, very few studies engage this method of measurement. Although existing literature does not offer any answers as to why this is the case, we offer two possible explanations. First, to conduct factor model studies on usage, user responses from surveys must be mapped to actual usage information archived and logged within the system. This mapping requires breaking anonymity, which may result in both ethical and measurement bias problems.

A second problem is indicated in psychology research exploring theories of planned behaviour (the foundation of later TAM models such as the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003)). In this research, evidence suggests that self-disclosed subjective measures are better predicted than actual objective measures (Armitage & Conner, 2001). To our knowledge, this observation (and its implications) has not been explored in the IS literature. We offer that, if self-disclosed measures of usage are

better predicted, then (1) self-disclosed usage is a biased measure, (2) a hidden factor, and indication of a spurious correlation may be indicated, and (3) any claims such models make about effects on usage may be more accurately stated as being effects on *perceived* usage and not *actual* usage. Although not the focus of this research, hidden factors that influence the perception of use relative to actual use presents an intriguing, and unexplored avenue for future research.

2.2.2 Conceptions of IT usage

Few constructs in information systems research have received as much attention and focus as system usage (Burton-Jones & Straub, 2006; DeLone & McLean, 1992, 2003). According to Straub et al., (1995), “there is widespread agreement among researchers that system usage, defined as the utilization of information technology (IT) by individuals, groups, or organizations, is the primary variable through which IT affects white collar performance” (p. 1328). In factor models, IT usage is often the dependent variable (e.g. Davis et al. (1989), Davis (1989), Venkatesh & Davis (2000), Venkatesh et al. (2003), Venkatesh & Bala (2008) and Venkatesh, Brown, Maruping, & Bala (2008)). In processual models, IT usage is often identified as a necessary condition for IT value generation (Chang & Ye, 2011; Marshall et al., 2004; Smith & Crossland, 2008; Soh & Markus, 1995).

Burton-Jones & Straub (2006) provide an extensive historical review of system usage in which they segment the literature into one of four categories: IS success (DeLone & McLean, 1992; Goodhue, 1995; Henry C Lucas & Spitler, 1999), IS decision-making (Barkin & Dickson, 1977; Szajna, 1993; Yuthas & Young, 1998), IS acceptance (Davis,

1989; Straub et al., 1995; Venkatesh et al., 2003), and IS implementation (Ginzberg, 1981; Hartwick & Barki, 1994; Henry C Lucas, 1978). In each of these literature segments, system usage is identified as a key condition for various important outcomes.

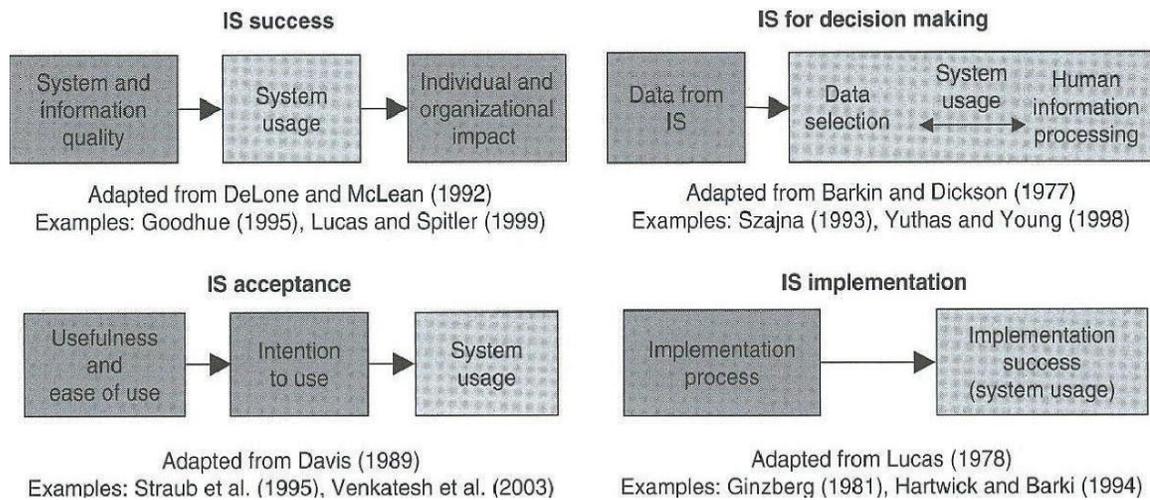


Figure 2: Past conceptualizations of the system usage construct (Burton-Jones & Straub, 2006).

Though the work of Burton-Jones & Straub, (2006) is quite thorough, it overlooks another important class of models: the aforementioned processual models derived from Soh & Markus, (1995). These conversation process models include the Modified Process Model for Realization of Business Value from IT (Marshall et al., 2004), Extended Process Model of IT Value Realization (Smith & Crossland, 2008), and Value Realization Cycle (Grant & Collins, 2016).

For an excellent summary of the processual view, Chang & Ye (2011) provide an aggregated IT value conversion model:

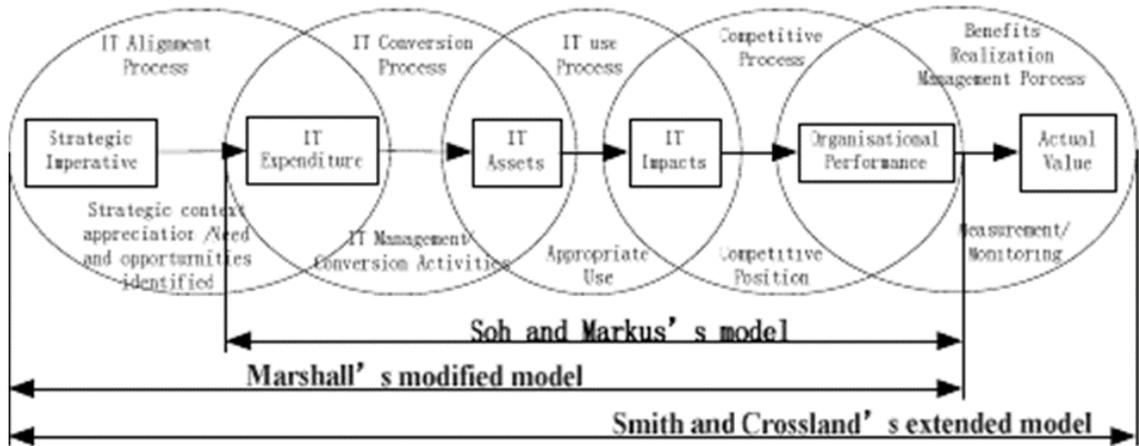


Figure 3: Combined value conversation process model (Chang & Ye, 2011).

A significant difference between the processual models and the models listed by Burton-Jones & Straub (2006) is that usage in the processual models is a *process*. Each of the other four categories mentioned in Burton-Jones & Straub (2006) is a factor model or variance based model. Empirical evidence to support such models is generally derived from self-disclosed cross-sectional data derived from survey instruments or measures derived from archival usage data such as event logs. Unlike the factor models, the processual models treat IT usage as a process, and thus, an ongoing accomplishment. Factor models require the establishment of a measurable latent variable, that of “usage”, and this is often narrowly defined as frequency or interaction with a system. Although the processual view of IT usage is identified as a much more realistic and accurate representation of the dynamic nature of actual IT usage, from this critical perspective, a key issue is that, at a fundamental level, the literature has not clearly defined a theoretical conception of a dynamic process of *use*. The gap represents a significant opportunity to further develop this construct, to which this study will seek to contribute.

2.2.3 Deterministic views of usage

Achieving IT investment benefits requires the restructuring of organizational practice, and such restructuring necessitates the establishment of new patterns of action associated with the fulfillment of tasks (DeSanctis & Poole, 1994). Many early models of IS deployment assumed a deterministic stance on IT usage (Sarker & Sahay, 2003). In such deterministic views, system usage is seen as an inherent property of the technology, and in turn that, technology and the process through which it was introduced determines usage outcomes. Following this line of thinking, Woolgar (1991), for example, argues that system designers actively “configure” users, and Akrich (1992) makes the case that appropriate user interaction with a technology is “scripted” into its design. According to Leonardi (2008), “virtually all ... research on technology ... owes some intellectual debt to [such] technologically deterministic thinking” (p. 4), but as Leonardi (2008) also indicates, such views do not account for the emergent, and often unintended or expected patterns of actual usage that manifest in practice.

The deterministic view of technology assumes that properties of the information technology design determine usage outcomes, and therefore, that *use as an inherent property of the system*. This view parallels the structural determinism stance^{xxix} found in early sociological and organizational theory (for the elaboration of sociology’s “structuralist” school, see Giddens (1984)). In such views, structure (in the case of IT use, embedded rules and material effects of the technology) has primacy over agency, and determines the outcomes of individual actions and behaviours. Clearly, system use requires the necessary skills to use IT assets in order to accomplish tasks, but such skills are only

fully realized and developed through the ongoing enactment of system use within the complex contingencies of the local environment and work tasks at hand (this follows structuralist views of Giddens (1984), and is similar to routines as “an ongoing accomplishment” (Feldman, 2000, p. 613)). As we have indicated previously, this accomplishment of use post-IT introduction is an emergent and ongoing construction that often produces unintended and unexpected outcomes. Such observations compel us to contemplate the limitations of any deterministic stance on resulting IT usage outcomes.

2.2.4 Constructivist views on usage

Barley (1986) highlights how early IS research considered information technology a strong structuring device; technology strongly determined resulting organizational structure. In such a view, simply deploying IT into an organization would produce pre-determined usage and resulting benefits. As Barley’s early research indicated, however, such deterministic effects were much weaker than originally assumed. Usage is emergent and complex and unintended outcomes and consequences stem from such complex and unpredictable usage effects (Tenner, 1997).^{xxx} Due to these complexities, IT usage has been a particularly important area to understand for IT implementation success (Markus & Mao, 2004).^{xxxi}

The constructivist stream of IS has its roots in social constructivist works found within the field of sociology, especially in the seminal work of Berger & Luckmann (1966). Berger & Luckmann (1966) claim that “reality is socially constructed” (p. 13), and to analyze and understand this reality, we must develop a sociology of knowledge. In their analysis of

Bergman and Luckman, Alvesson & Sköldbberg (2009) summarize their position as follows:

Human beings differ from other animals in their less developed instinctual behaviour and in their great flexibility. In order not to become chaotic, human acting must therefore be confined by some form of stability. This happens through a ‘social order’. ...The social order is thus a human product, or more specifically ‘an ongoing human product’; it is not something inherent in the “nature of things”, nor does it express any “natural law”” (Alvesson & Sköldbberg, 2009, p. 26).

The result of Bergman and Luckmann’s analysis is the proposal that information technology itself is a social stability, and as such, an ongoing product of social construction. However, as Alvesson & Sköldbberg (2009) playfully add, “social constructionists tend, unfortunately... to stop where the real fun begins, instead of posing questions such as: “Why do people construct society in the way they do?” and “How do these constructions function, as patterns of social reality, once they have been constructed?”” (p. 37).

Lyytinen (2011) suggests that managers contribute in creating illusions of deterministic effect. As managers seek to use IS as a central element in their reified model of control, they create an *illusion* that IS deployment channels organizational member behaviours. Though IS researchers such as Barley, (1986) have identified the rather tenuous relationship between the designed actions embedded and assumed within an information system, and the actual emergent outcomes, Lyytinen indicates that the existence of

managers, whose jobs exist under the assumption of control, necessitate that significant levels of control are in fact possible. This idea of control can be traced back to the earliest of human history, but with the rise of scientific thought associated with modernity, it has been amplified to a level where our sense of control moves beyond what should be any reasonable expectation of our ability to control. As Lyytinen (2011) argues, we must be aware of our desire for control as this “blind(s) us to the things we can’t control by seeking to control them” (p. 269).

The “control” (deterministic) versus “emergent” (constructivist) dichotomy has been a key area of discussion within IS. Highlighting the naivety of deterministic views has been a common opening volley in attempts to justify the need to understand the emergent and socially constructed interaction between organization and technology (Ciborra & Lanzara, 1994; Ciborra, 2009; Vaast & Walsham, 2005; Walsham & Han, 1991; Walsham, 1993). As this body of literature has evolved, so has the approach, with a more balanced approach emerging from a sociomaterial perspective positioning technology as a bundle of material effects and socially constructed actions (Bergholtz, Eriksson, & Johannesson, 2013; Orlikowski & Scott, 2015; Orlikowski, 2007; Robey et al., 2013). Taking one such sociomaterial view, Leonardi (2011) poses the question of what happens when flexible technologies meet flexible social processes [in the form of organizational routines], and concludes that the result is a process where both materialist and social effects exist independently but are integrated in the practice of work through a process of imbrication. To imbricate means to arrange distinct elements in overlapping patterns so that they function interdependently. The significance of this view is that, contrary to previous

“duality” views of structure and agency used in sociomaterial theory, Leonardi (2011b, 2013a) convincingly argues that these are best represented as a dualism in which both technology (structure) and agency can exist, at least to some degree, independently from each other. Such a view opens up both technology and agency for endogenous interaction.^{xxxii}

2.2.4.1 IT usage as aggregate outcome

Much of the literature on IT usage focuses on individual level usage, and there has been very little work to identify usage as an aggregate, or group level, dynamic structure (Burton-Jones & Gallivan, 2007).^{xxxiii} This focus on individual level usage indicators ignores, or overlooks, potentially important group level dynamics. Recent exceptions to include Burton-Jones, Burton-Jones & Gallivan (2007; 2005), followed by the work of Racherla & Mandviwalla (2013) and Rizzuto, Schwarz, & Schwarz (2014), all of which have identified the need to further theorize IT usage as an aggregate and group-level activity.

The challenge of identifying such a construct is to identify the key mechanisms through which aggregation of usage can occur (Burton-Jones, 2005). Like the multilevel challenges in other organizational constructs such as: organizational routines (Abell et al., 2008; Vromen, 2011), organizational behaviour (Staw, Sandelands, & Dutton, 1981), organizational change (Gersick, 1991), and organizational resistance (Lapointe & Rivard, 2005), the challenge in defining collective IT use is to avoid simple averaging of individual behaviour, and to understand group level properties of usage, adoption, and appropriation

as the result of micro-level interactions (Kozlowski, Chao, Grand, Braun, & Kuljanin, 2013).

Recent promising work in the area of organizational routines has begun to explore the interaction between technical artefacts and the organizational behaviour manifest in organizational routines (Cacciatori, 2012; D'Adderio, 2008, 2009, 2011; Iannacci, 2014). We will explore the linkage between IT usage and organizational routines in our review of the routines literature, and in our construction of our theoretical model in Chapter 3.

2.2.5 Summary of IT usage

In conclusion, the concept of IT usage encompasses simple subjective and/or objective measures of IT usage on one end of the spectrum, to complex conceptualizations of IT usage as a process of material determinism and socially constructed imbrications on the other. Our review of the literature indicates a lack of research investigating this later perspective and an over-abundance^{xxxiv} of research looking at individual disclosure of usage represented in the former. This indicates a significant research gap in the theorizing and empirical investigation of IT usage as a middle-level process between individual usage and organizational governance. Our assertion from this review is that such processual models allude to the potentially dynamic nature of IT usage as an ongoing accomplishment that can be more fully understood and explained using routines theory^{xxxv}.

As indicated in the work of Burton-Jones (Burton-Jones & Gallivan, 2007; Burton-Jones & Straub, 2006; Burton-Jones, 2005), when introducing a new IS system, IT usage requires

group level changes in behaviour and activities in response to the localized contingencies of enacting work in practice. Within the deterministic/constructivist debate, this paper takes the middle ground established by the sociomaterial view as illustrated in the works of Leonardi (Leonardi & Barley, 2008, 2010; Leonardi & Jackson, 2004; Leonardi & Rodriguez-Lluesma, 2012; Leonardi, 2010, 2011). This position opens the opportunity to incorporate organizational routines to generate new insights into the dynamics of group level usage necessary to generate any benefits from the introduction of technology into practice. Our focus for this research will be to conceptualize IT usage in a rather novel way by introducing and extending organizational routines theory as a lens to better understand the dynamic process of IT usage by groups.

2.3 Organizational Routines as a Theoretical Lens

In this section, we review the literature on organizational routines to identify new approaches to investigating the interaction between technology introduction and resulting organizational IT usage emergence. We wish to explore organizational routines as an appropriate theoretical lens to generate new insights into organizational IT usage to help overcome current difficulties surrounding the theoretical underpinnings of IT usage as ongoing group level accomplishment.

2.3.1 Introduction to organizational routines

In everyday language, routine implies stability, repetition, mundaneness and predictability (Cohen, 2007). The Oxford Online dictionary offers three definitions of routine: as a noun – “a sequence of actions regularly followed”; as adjective – “performance as part of a regular procedure rather than for a special reason”; and as verb – “organize according to routine” (Oxford Dictionaries, n.d.). Merriam-Webster’s Online Dictionary provides a more expanded definition: “A regular course of procedure, or habitual or mechanical performance of an established procedure” (Merriam-Webster Dictionaries, n.d.).

Organizations develop appropriate routines for achieving higher levels of productivity and output quality. Organizational routines emerge from the collective behaviour of individuals and are adapted and deployed in relation to cultural values, identity, and collective motivations (Lazaric & Denis, 2005). Through routines, organizations achieve a distinct set of behavioural characteristics and structures (Nelson & Winter, 1982) fundamental to an organization’s ability to differentiate, realize its mandate, and achieve strategic competitiveness and mission fulfillment (Salvato, 2009). Organizations live, and often die, by their routines and the routines an organization selects to maintain, adapt, develop, or execute are a key determinant of its success (Hodgson, 1997). Moreover, organizational routines provide organizational members a rationale for organizing (Cyert, March, & others, 1963; Nelson & Winter, 1982), a means through which to achieve competitive advantage (Barney, 1991; Teece, 2007), and help establish organizational uniqueness across similar industries (Hoopes & Madsen, 2008). Organizational routines embody the tension between change and stability (Pentland et al., 2011), and result from effortful

accomplishment directed to achieve perceived organizational goals (Pentland & Rueter, 1994).

In the field of organizational studies, a routine is a “distinct modality of organizational action” (Cohen, 2012, p. 1383), or more colloquially “a way of doing things” (Winter, 1986, p. 165). Winter (1964) defines organizational routines as “pattern[s] of behavior that [are] followed repeatedly, but [are] subject to change if conditions change” (p. 264). Parmigiani & Howard-Grenville (2011) define routines as “repetitive patterns of interdependent organizational actions” (p. 414). Routines have important properties such as being problem focused (Teece & Pisano, 1994), recurrent (Becker & Lazaric, 2003), and a “potent predictor of [individual] behavior” (Betsch, Haberstroh, Glöckner, Haar, & Fiedler, 2001, p. 25). Early use of organizational routines served to support analysis of aggregate habitual organizational behaviours (Simon, 1965). Later works identified routines as an organizational equivalent to individual skill (Nelson & Winter, 1982). More recent work positions the organizational routines as a complex multi-level social structure (Becker & Lazaric, 2003) and a store of tacit and procedural knowledge about how to accomplish work (Kogut & Zander, 1996).

2.3.1.1 Why organizational routines?

As “a unit of analysis” (Pentland & Feldman, 2005, p. 794), the organizational routine lens has emerged as an important perspective in organizational studies (Felin & Foss, 2004), and management research in general (Foss, Heimeriks, Winter, & Zollo, 2012). Initially regarded as “stable and inflexible” (Howard-Grenville, 2005, p. 618), organizational

researchers increasingly position routines as a valuable source of endogenous organizational change (Gorgeon, 2009; Güttel & Konlechner, 2010; Parmigiani & Howard-Grenville, 2011; Pentland, Feldman, Becker, & Liu, 2012; Pentland et al., 2011; Turner & Fern, 2012).

More recently, studies have focused on unpacking the concept of routines (Bryant, 2015; Gaskin, 2012; Iannacci & Hatzaras, 2012). These views look at revealing routines as a dynamic organizational structure and a key theoretical lens through which to explore organizational change (Becker, Salvatore, & Zirpoli, 2005; Cyert et al., 1963; Nelson & Winter, 1982; Pentland & Feldman, 2005; Simon, 1965), and the use of information technology in practice (D'Adderio, 2011; Gaskin, Schultz, Berente, & Lyytinen, 2010; Pentland & Feldman, 2008a).

Early work on routines can be found in Economics literature dating as far back as Stene (1940); the concept of organizational routines, however, primarily entered the field of management research through the seminal work of Nelson & Winter (1982). In this early work, Nelson and Winter (1982) introduced a broad definition of organizational routines that encompassed learning, skills, and organizational structure surrounding core business processes. They presented organizational routines as a more encompassing concept than business processes. According to Nelson and Winter (1982), routines represent an organizational store of knowledge about established work patterns, and also serve to provide a definitional reference for what it is organizations *do* to accomplish work.

Economists have long noted that though neoclassical models predict an eventual leveling of firm performance across industries, this was not ever fully observed in practice. As a contribution to heterodox economic thought, Nelson and Winter (1982) introduced routines as genetic-like encoding that stores information about *how work is accomplished* within industries. Their evolutionary organizational routines and capabilities theory explained why industrial homogeneity is rarely, if ever, fully achieved. More fundamentally, Nelson and Winter (1982) extended economic theory to help model and explain why we find firm differences, rather than similarities, across industries.

2.3.2 The Paradox of routines: A Source of stasis and change

“Innovation in semiconductors? I’m not sure there is innovation in semiconductors. They just keep doing the same thing, over and over.”

Dr. Ralph Gomory, VP R&D, IBM (as quoted in S. Winter, (2013))

Organizational routines emerge from idiosyncratic processes of local learning (Salvato, 2006). This property of routine formation supports theories for why firms differ and how such differences lead to differentiated advantage (Nelson & Winter, 1982). In contrast, routines also exhibit a contracting property, where repeated performance tends to enforce the establishment of simplified representational patterns of action behaviour (Nelson & Winter, 1974; Pentland et al., 2012). This reinforcing property has been used to explain why differences between organizations tend to persist and remain durable (Nelson and

Winter, 1982). Based on these contrasting properties, routines simultaneously possess both flexibility and consistency in action (Feldman, 2000; Feldman and Pentland, 2003).

This paradox served as the impetus for Nelson and Winter's (1982) proposed evolutionary theory of routines, and inspiration for work on the organizational evolution of capabilities (e.g.: Dosi et al., 2000; Helfat, 2000, Hoopes et al., 2003). The main thrust of this stream of research is to answer questions about how routines can simultaneously be both a source of change and consistency.

A review of the literature reveals two important themes relevant to this discussion. The first theme being *inertia* (e.g. Polites & Karahanna, (2012), Gilbert, (2005), Hodgson & Knudsen, (2004a)), conceptualizing routines as a force, or cause, that contributes to the formation of rigidities that impede organizational change. The second theme focuses on the generative effects routines have on organizational behaviour and change (e.g. Pentland et al., (2012), Feldman, D'Adderio, Lazaric, & Pentland, (2015), Pentland et al., (2011), Pentland & Feldman, (2008a), Labatut, Aggeri, & Girard, (2012), and Pentland & Feldman, (2005)). In this second view, routines are a source of change and can generate organizational change.

2.3.2.1 Organizational routines as a source of inertia

Mass is fundamental to inertia; it is the measure of a body's resistance to changes in motion. Inertia is resistance to changes in motion, while the similar concept of momentum is the resistance to changes in direction of a body in motion. Organizational theorists have appropriated these related concepts to describe organizational change (e.g. Gilbert, 2005;

Kaplan & Henderson, 2005; Polites & Karahanna, 2012; Romanelli & Tushman, 1986; Schwarz, 2012; Lee, & Maciejewski, 2014). Inertia, the term most notably used to describe two related phenomena exhibited by organizations, is: 1) a *mass-like* property that results in inertial forces that cause certain organizational structures to exhibit greater resistance to change, and 2) a momentum-like property which causes path-dependent behaviours that make certain vectors of change difficult to redirect.

One of the first major treatments related to organizational routine inertia comes from Hannan & Freeman (1977). In the article titled “The population ecology of organizations”, Hannan and Freeman argue that adaptation of organizational structures to environmental conditions occurs principally at the population level. Repurposing population ecology theory in order to model key underlying properties of organizations, Hannan and Freeman (1977) identify that organizations exhibit stasis, and seldom succeed in making sufficient changes to respond adequately to radical environmental changes. In a later paper, they refer to this concept as *structural inertia*:

Our definition of structural inertia implies that a particular class of organizations might have high inertia in the context of one environment but not in another. For example, the speed of technical change in the semiconductor industry has been very high over the past twenty years. Firms that would be considered remarkably flexible in other industries have not been able to reorganize quickly enough to keep up with changing technologies. (Hannan & Freeman, 1984, p. 152)

Hannan and Freeman (1984) conceptualize *organizational routines* as the source of inertia. In their view, the continued performance of routines (enacted with sufficient frequency) decreases variability and increases resistance to change. The implication is that as organizations age, their internal routines exhibit less variance and become more difficult to change. Repurposing biological ecological theory as a framing device, Hannan & Freeman (1984) present an ecological model of routines: through death, routines are eliminated; through concerted organizational effort and cost, new routines are formed. The implications of this view are that routines change through population level dynamics and inertia is eliminated through the death of routines.^{xxxvi}

Using experimental evidence, (Cohen & Bacdayan, 1994) confirm that, over time, organizational routines develop this inertial property. By studying non-collaborative play in a simple card game, Cohen & Bacdayan (1994) found that repeated performances of the game revealed mutually dependent patterns of play between multiple non-collaborating players. They observed that during an initial phase of exploration, players formed and altered routines as they strived for increasingly better patterns of play. Once players found optimal patterns, strategies and play patterns remained relatively static. Later, as changes in game rules were introduced, players continued to show a clear tendency for “negative transfer” (Kogut & Kulatilaka, 2001) as they continued to apply previously acquired patterns of gameplay despite the proven ineffectiveness of these patterns within the new rule set.

Gersick & Hackman (1990) posit that the temporal propagation of routines is the result of the social construction of group level habits. In their view, routine formation is a social

entrainment process, in which the influence of the experience under earlier conditions persists, through collective habit, even if those earlier conditions no longer remain present. Such a process results in groups performing routines even after the conditions that initiate them disappear, or are substantially altered. As their theory of routine formation and maintenance gives primacy to the socialization of experience, they suggest that the social entrainment process has “more conceptual teeth” (Gersick & Hackman, 1990, pp. 81–82) than the previous conceptions of organizational inertia.

Gilbert (2005) continues the discussion of inertia but argues for the importance of organizational resources as a source of this routine inertia. Gilbert (2005) begins by criticizing the literature on routines as having inadequately defined inertia. He observes that the literature has conflated two key inertial effects: (1) rigidities resulting from a failure to change resource investments and (2) rigidities resulting from a failure to change organizational processes that use those resources.

2.3.2.1.1 “Black Box” Views of Routines

Much work looking into the inertial property of routines exhibits what has become known as the “black box” perspective of routines. As Winner (1993) states:

The term black box in both technical and social parlance is a device or system that, for convenience, is described solely in terms of its inputs and outputs. One need not understand anything about what goes on inside such black boxes. One simply brackets them as instruments that perform certain valuable functions. (p. 365)

For example, Gilbert (2005) assigns causal power to aggregate level constructs, and as such, does not define any systemic causes for the inertial properties that he claims are exhibited by routines. Similarly, though Gersick & Hackman (1990) describe deep structure as a cause for inertia, they fail to describe the process through which such deep structure would emerge or be created.

This debate, in many ways, mirrors the classic debate between behaviourism and *innatism* found in the fields of psychology and linguistics. Behaviourist theories such as those found in the behaviourist views of B.F. Skinner (see Skinner, 2011), posit that behaviour is shaped by operant conditioning, and therefore, the result of experience. By contrast, Noam Chomsky's (1980) *poverty of stimulus* argument is that learning processes such as language acquisition cannot be fully explained by experience, and as such, must involve some inherent *deep structure* innate to the individual. This later approach, in many ways, parallels the black box approach found in routines theory; that is, routines inherently exhibit a deep structural property that transcends any specific experience, and exhibits this property independent of experience.^{xxxvii}

2.3.2.1.2 "Open Box" Views of Routines

To many in routines theory, the subjugation of routine properties to some *deep structure* seems unsatisfying (see micro-foundations critique found in Abell et al. (2008; 2015; 2009). In some sense, this approach *kicks the ball forward*, and avoids fully explaining the process through which such properties emerge, thus limiting the development of practical insights that identify effective intervention strategies for organizational leaders. To address

this “black box” concern, a segment of literature on routines has focused on investigating the underlying structure of routines, thereby developing a more “open box” view of routines.

One attempt to develop an “open box” view of routines is seen in van der Steen (2009) who focuses on the process of incorporating new rules within an organization, conceiving routines as bundles of rules that define and reflect organizational structure. Organizational structures generate stability in performance and consistency in action, but conversely generate resistance to any necessary changes that violate this structure. Despite this attempt, van der Steen (2009) acknowledges that, although routines are the source of change, the mechanism through which inertia emerges from such change remains insufficiently explored.

Another interesting approach to the routines is exemplified in Lazaric & Raybaut (2005). Lazaric and Raybaut (2005) highlight the role of routines as a representation of an ongoing and continually updated organizational level truce. Lazaric and Raybaut (2005) argue that though inertia is often seen as an impediment to an organization’s capacity for making appropriate changes to best match the environment, such conceptions imply *correct* or *optimal* organizational change can be identified. In environments that experience periods of pervasive uncertainty, any understanding of what is necessary for survival is elusive, and if obtained, incomplete, and therefore, unobtainable. Thus, during periods of pervasive uncertainty, the inertial properties of routines create continuity in behaviour. Such effects allow the organization to continue to produce output and provide meaning to members during times when to do otherwise would be risking unnecessary, costly, and potentially

damaging organizational turmoil. Viewed as a *truce*, Lazaric and Raybaut *open up* routines to view them as an ongoing organizational discursive process.

2.3.2.2 Organizational routines as a source of change

In contrast to the literature focusing on the static nature of routines, a second major genre of routines literature explores the role of organizational routines in enabling organizational change. Turner & Rindova (2012) claim that understanding how routines change is an important opportunity for researchers to develop new insights into organizational change in general.

As briefly touched upon earlier, the contradiction between organizational routine inertia and change was addressed by viewing change as ecologically caused or generated. In such views, change in routines is at the population level. Advanced theorizing in the area describes this change in terms of evolutionary processes (Breslin, 2012, 2015; Hodgson, 2003b; Tennant, Mills, & Chin, 2014). Under this theoretical view, organizational routines change through a process of variation, selection, and retention. This approach also falls into, and propagates the problem of, a “black box” view, in that, routines exhibit inherent structures independent of environment, much like that of genes and routines exhibit a property of random variation in performance. Depending on context, certain variations are selected for, and others ignored; however, such change processes are, again, at a population level and avoid descriptions as to any underlying dynamics that can explain routine change at the unit level.

Feldman & Pentland, (2003) present an influential “open box” perspective on routine change. In this view, routines are conceived of as initiators of, rather than responders to, change. Their practice-based view adapts concepts from Actor Network Theory (Latour, 2005), Practice Theory (Callon, 1987) and Structuration Theory (Giddens, 1984) to develop a more dynamic theory of routines. In their view, routines exhibit constant variation in performance due to the effects of agency, and this variation serves as a generative mechanism.

Despite much of the literature exploring the tendencies for routines to create inertia and reduced variability, Pentland and Feldman (2005) argue that routines are also generative – in that they can be a source of change. The primary support for these arguments focuses on the performance of routines, that people naturally introduce variability into the performance of routines. As noted in Feldman’s (2000) early work, “when we do not separate the people who are doing the routines from the routine, we can see routines as a richer phenomenon” (p. 611).

In support of this argument, Pentland and Feldman (2005) introduce routines as consisting of two distinction aspects, the ostensive (abstract pattern) and performative (specific actions). With Pentland and Feldman (2005), the ostensive represents the “abstract patterns that participants use to guide, account for and refer to specific performances of a routine” (p. 795), and the performative as “actual performances by specific people, at specific times, in specific places.” (p. 795).

Pentland and Feldman (2005) relate their contribution to the many duality structures that have emerged from the social-sciences:

There are many related distinctions that can be applied to organizational routines, such as structure/agency (Giddens, 1984; Sewell, 1992), objective/subjective (Bourdieu, 1990; Searle, 1995); and disposition/behavior (Hodgson, 2003). While these distinctions are useful, we adopted the terminology used by Latour (1986) because it focuses attention on collective performances and on the ability of both participants and observers to create the ostensive aspect from these performances. Latour's (1986) language best expresses the aspects of organizational routines that are needed to explain their generative properties, as observed in empirical field studies. Without these two aspects, a routine cannot produce 'repetitive, recognizable patterns of interdependent actions, carried out by multiple actors' (Feldman and Pentland, 2003: 95). Like structure and agency, these two aspects are mutually constitutive; the ostensive does not simply guide performances (as a script guides a play); it is also created from the performances. (Pentland & Feldman, 2005, p. 795)

By incorporating the idea of duality into the concept of organizational routines, Pentland and Feldman make a significant, and an increasingly popular, contribution to the ontological position found within organizational routines research. Through a dynamic co-

constitution of each aspect of the routine, routines are introduced as a source of, rather than responder to, change.

2.3.2.3 *Inertia and change: A Summary*

In summary, there is a growing divergence in the conception of the causes of the inertial property of routines, and a lack of literature that explores the generative properties of routines.

The routines literature exhibits divergent views on the cause(s) of routine inertia. Lazaric & Raybaut (2005) attribute causality to organizational truce, and if truce is preferred over conflict, then truce is a cause of inertial effects on the organizations. Gilbert (2005) defines inertia as fundamental property of routines and exhibiting a “black box” perspective on routines that only begs questions about the underlying microfoundations that create such a property. Finally, Martijn van der Steen (2009) attributes causality to organizational rules and rule changes, but admits to a lack of understanding about the process through which these rule changes interact with routines to generate new behaviours.

The literature on the inertial properties of routines indicates fundamental ontological divisions that exist within the discussion about routines. If we are to uncritically accept that a group of individuals exhibits a collective agency (e.g. Gilbert (2005)), then we must also accept that social structure has a coercive *force* and *power* over individuals. If such views acknowledge individual agency, then we cannot posit structure as independent of the individuals within it. Clearly, we face a problematic choice: do we accept that

organizational routines have no causal force, or accept that they do? If we choose the latter, how should the free will of individuals that enact the routine then be rationalized?

This thesis will develop the position that routines (and properties) emerge from the ongoing process of accomplishing tasks, but such a process is framed by key identifiable dialectics. Furthermore, this paper posits that similar to routines, group-level IT usage is the result of ongoing negotiation, both explicit (through artefacts such as system usage manuals or processes such as peer interaction, and management intervention and training), and implicit (through actions derived from the performance of work in-situ).

2.3.3 Routines as truce and an ongoing process of negotiation

Organizations cannot function without rules (Rodrik, Subramanian, & Trebbi, 2004). Rules are necessary for coordination between multiple actors, and act as the artefacts of a process of negotiated truce. Such rules constitute the persistent properties of organizational structure and behaviour. Despite guidance provided by rules, they cannot ever fully cover all contingencies of the environment in which work is accomplished; the “world” (aka environment) is so complex that it would be impossible to pre-determine what is an optimal “rule” for every situation (Rodrik et al., 2004). Rules, therefore, are always somewhat incomplete, and require some level of negotiated discretion in order to “fill-in” necessary gaps. Through a process of routine formation, rules are negotiated and established to support the coordination of localized patterns of actions. In this view, the rule structure of routines emerges from a process of routine formation. A routine, thus, represents a set of accepted patterns through which the organization can get along and accomplish work.

Organizational routines define tacit and explicit organizational agreements that aid in coordinating activities across different individuals and organizational functions (Zbaracki & Bergen, 2010). Differences across groups and individuals can generate discord as competing interests attempt to vie for control (Bechky, 2003; Zammuto, Griffith, Majchrzak, Dougherty, & Faraj, 2007). Routines, as means of getting on with the work at hand require and represent both an explicit and tacit agreement about what are the acceptable and effective action patterns in the execution of a set of work tasks. This idea of routines as a form of negotiated order is generally absent from the dominant perspectives on routines (Gavetti, Levinthal, & Ocasio, 2007). One exception to this observation is the represented in the work of Nelson & Winter (1982), and the idea of routines as truce.

Nelson and Winter (1982) use this metaphor of “truce” to illustrate the formation and maintenance of organizational routines:

When one considers routine operation as the basis of organizational memory, one is led to expect to find routines patterned in ways that reflect characteristics of the information storage problem that they solve. When one considers routine operation as involving a truce ... one is led to expect routines to be patterned in ways that reflect features of the underlying problem of diverging individual member interests.

(Nelson & Winter, 1982, pp. 110–111)

Following a similar theme of routines as an ongoing truce set out by Nelson and Winter (1982), van Raak, Paulus, & van Der Made (2007) introduce the formation of routines as

a process of negotiated order, and use this to explain the formation of routines as a process of “give and take” (p. 1077) between differing organizational perspectives, which ultimately results in suboptimal result from any single perspective. As Feldman & Rafaeli (2002) note, “seemingly routine behaviour in organizations frequently involves human beings making interpretations regarding the appropriate actions to be taken in a particular context.” (p. 321). This discussion about routines reflects similar concepts have been explored in general organizational studies, such as “negotiated order” (Day & Day, 1977) (in response to understanding the complexities surrounding division of labour (p. 128)), “practical action” (Suchman, 1983) (in response to a problem of procedural incompleteness (p. 321)), “situated action” (Suchman, 1986) (exploration of narratives of localized knowing and acting), and “symbolic interactionism” (Dionysiou & Tsoukas, 2013) (exploring the construction of, and interaction between, meaning and action). The significance of these more dynamic “negotiated” (or more generally, “socially constructed”), views of routines is that they present routines as an ongoing enactment of social agreement, and thus, under constant tension from identifiable forms of internal discourse or group dialectics. This view opens up many interesting avenues for exploration into the specific dynamics that underlie the surface properties of routines that we observe. Identifying key universal and situational tensions that require negotiation and agreement will thus open up new paths of explanation and discovery as to the dynamics of technology initiated routine disruption and renewal. This approach diverges from the dominant evolutionary change view that permeates much of the routine literature, but aligns well with a dialectic theory of organizational routine change that we will expand upon in Chapter 3.

2.3.4 IT artefacts and routines

At the discretion of the participants, artefacts can be “enrolled” (Pentland & Feldman, 2008b, p. 11) in the performance of organizational routines. In this view, artefacts are understood as material, physical attributes that both constrain and enable action (Leonardi, 2011). Though the physicality of artefacts is generally considered to lie outside social influence (“we can’t easily walk through walls” (Leonardi, 2011, p. 150), the affordances^{xxxviii} that artefacts provide are very much contextualized by the social structure in which they are used. People explore, find, and perceive new affordances through the enactment of routines (Zammuto et al., 2007).

A review of the recent literature reveals considerable differences in the treatment of the technical artefact in considering organizational routines. Feldman (2000) and Cacciatori (2012) consider artefacts external to the model; Pentland & Feldman (2005) conceive of artefacts as an exogenous influence; and some such as D’Adderio (2008, 2011), Leonardi, (2011) and Goh et al.,(2011) view artefacts as integral to organizational routines.

Cacciatori (2012) highlights that agency occurs within, and is shaped by, the “artefactual context in which individuals operate” (p. 1560). Cacciatori introduces two ways of characterizing the role artefacts play in routines. He begins by making the distinction between “speaking” (i.e. visual and textual knowledge) artefacts and “silent” (i.e. tools, office layouts, software) artefacts. He then classifies the artefact as either “generic” or “specific” to occupations. This two-dimensional model is used to infer that any increase in the level of “speaking” increases the artefact’s problem-solving potential, while increases

in specificity increase its conflict potential (thus, clearly drawing on the “cognitive” and “truce” aspects of routines). Cacciatori’s (2012) study concludes that routine formation is “strongly dependent on the action of individuals” (p. 1578), but that “action was constrained by the resources that were provided by structures, especially the artefacts, frames, and objectives of [the agents] profession” (p. 1578).

Recent work by Leonardi (2011) explores what effects increasingly flexible technology has on routines. Leonardi (2011) extends the previous discussion on routines by introducing the concept of imbrication. He claims that scholars are beginning to recognize that people often enact their human agency in response to a technology’s material agency. He states “it is by means of a technology’s ‘performativity’ that it does things users cannot affect or control” (Leonardi, 2011, p. 148). This argument asserts that human and material agencies are interlocked in an imbricated pattern that exhibits a co-constitutive structure, yet each remains distinct in their particular role. In Leonardi’s view, technology is seen as having agency. This contrasts with typical conceptions of routines, where technical artefacts are positioned as mute and, at most, a constraint on a set of actions that can occur. This conception clearly places technology “inside” the dynamic process of routine formation. In this view, human and material agents become the building blocks of organizational routines.

Another influential treatment of artefacts and their role in routines comes from a pair of papers by Luciana D’Adderio (2008, 2011). D’Adderio (2008) begins by praising routines as an “invaluable resource to capture organizational change” (p. 769), but also highlights the need for a fuller theoretical understanding of micro-level dynamics, specifically the

influence of artefacts and agencies in the evolution of existing organizational routines. In this contribution, D’Adderio states, “neglecting to include tools and artefacts in the study of routines dynamics can only provide at best a partial picture” (D’Adderio, 2008, p. 770). D’Adderio is critical of current literature in “overemphasizing the power of human agents’ discretion” (p. 773). A recent contribution from D’Adderio (2011) is more direct in its argument for the need for artefacts to take a central role in the understanding of routines. D’Adderio’s (2011) recent work posits that artefacts hold a distinguished “vantage point” (p. 199), and serve as anchors of representation that support and respond to performance. She states: “this theoretical device thus could open up the way for an entire population of studies focusing on the [dynamics of routines] as seen through the lens of artefacts” (D’Adderio, 2011, p. 224) (see Figure 4).

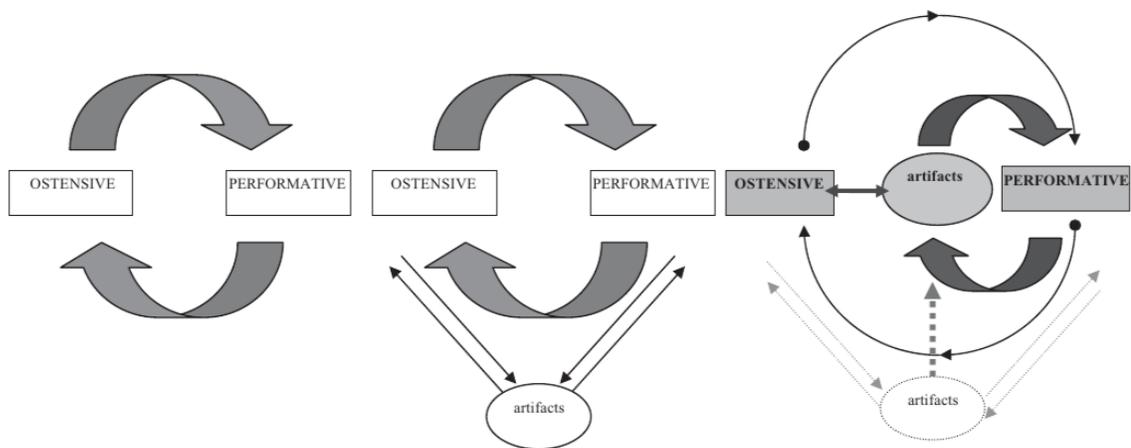


Figure 4. Artefactual representation in routines theory (D’Adderio, 2011).

Goh et al. (2011) extend the reach of previous work on adaptive structuration theory (DeSanctis & Poole, 1994). By expanding the domain of users to include artefacts, they give artefacts agency. Much like Leonardi (2011), they synthesize the dualistic nature of

material and human agency, but instead of viewing this as a process of “imbrication” (Leonardi, 2011), they conceive of this interaction as a vacillation between symbolic interpretation and material affordances. In their view, artefactual technology “ignites [...] resistance,” which fuels a longitudinal process of interaction between “symbolic expression” and “functional affordances” (DeSanctis & Poole, 1994, p. 582–583). This cycle can become either virtuous, or vicious; exogenous influence, such as leadership, is seen as key to directing and enabling any virtuous cycle.

2.3.4.1 Relating routines to IT use

How newly introduced information technology enables changes in organizational routines is both theoretically and practically important (D’Adderio, 2011). Organizations accomplish work through established patterns of interrelated action as represented in routines. If these work patterns change, those involved in enacting the work may no longer be capable of completing work with the same quality or speed (Cohen & Bacdayan, 1994, 1994; Egidi, 1995). The introduction of technology disrupts patterns of work, and thus generates a period where old, established, and predictable patterns of work represented in routines, to some degree, no longer apply (Martijn van der Steen, 2011). This disruption is resisted by those who wish to propagate past behaviours for which they have become comfortable - either because of habit (Limayem, Hirt, & Cheung, 2007; Polites & Karahanna, 2012, 2013; Wu & Kuo, 2008), or the need to reduce uncertainty (Becker & Knudsen, 2005; Dosi & Egidi, 1991). Thus, organizational usage of IT requires a period of organizational disruption that necessitates a renewal process to establish new patterns of

action required to accomplish important organizational tasks (Garfield & Dennis, 2012; Polites & Karahanna, 2013).

Considering the lack of theoretical understanding and development of the IT use construct (Burton-Jones & Grange, 2012; Burton-Jones & Straub, 2006), the concept of routines also holds the potential to further understand IT usage as an organizational routine. Usage, in this conception, is about the accomplishment of tasks, and for any “identification” of use to be possible among those accomplishing a task, some form of an ostensive structure must exist. Furthermore, conceptualizing *IT use* as a performance of work (Burton-Jones, McLean, & Monod, 2014) and routines as a structure of performativity (David, Rowe, & others, 2013) can allow us to bridge these two concepts and assist in our conceptualization of IT usage as the negotiated order of actions assembled in localized contexts.

Though future research may indicate *use* and routines as closely related (and possibly synonymous) concepts, the focus of this thesis is specifically on the process of technology initiated disruption of existing and established organizational routines, and more specifically, how routines are renewed and repaired in response to technology change. Pentland & Feldman (2007) assert that routines are relevant and key to the discussion of technology use, stating “when people in organizations use tools to do tasks, they most often do so as part of an organizational routines” (p. 786). Though much of IT-usage literature has focused on individual usage, by using organizational routines as a theoretical lens, this thesis will introduce a novel perspective by focusing on IT usage as a process of organizational routine disruption and renewal in response to technology initiated change instead.

2.3.5 The Embeddedness of Routine Change

The embeddedness of human agency and patterns of action have been a key area of study within social science for several decades (Dacin, Ventresca, & Beal, 1999; DiMaggio & Powell, 1983; Emirbayer & Mische, 1998; Lounsbury & Crumley, 2007). Embedding context is a key aspect of one of the more popular theories of explaining institutional diversity and sameness, that of Institutional Theory (DiMaggio & Powell, 1983; Scott, 1987, 2005). Institutional theory has also been a key area of insight into organizational routines (Hodgson, 2008a; Vromen, 2011).

Institutional theorists assert that isomorphic pressures generally cause organizations to adopt similar practices (Seo & Creed, 2002). Though some recent branches of institutional theory have presented a more dynamic processual view (see Neo-Institutionalism and Processualism (Barzelay & Gallego, 2006)) – where the formation of organizational structures are seen as not fully explained by reference to environmental conditions that unambiguously dictate the establishment of organizational patterns and structures (Hasselbladh & Kallinikos, 2000; Meyer & Rowan, 1977; W. R. Scott & Meyer, 1994) – owing to its definition, this theoretical perspective remains a largely top-down view of understanding why different institutions develop similar organizational structures. In this view, structures such as schemes, rules, norms, and routines become established as *authoritative*, and through a process of legitimation create alignment across differing contexts. Despite those exceptions which have incorporated a more dynamic view of institutional formation and change, institutional theorizing is often criticized as focusing more on the attenuation of divergent forces rather than as a generator of change. As Seo &

Creed (2002) summarize, institutional theory is “able to offer more insights into the processes that explain institutional stability than those the explain institutional change” (p. 222).

Supported by work done by Dosi, Nelson, & Winter (2000), Pentland et al., (2011), and others, we take the position that an embedding context is integral to the process of routine disruption and renewal, but also fundamentally exogenous to the underlying micro-processes from which routines are created and maintained. Unlike more deterministic approaches as seen in contingency-based theories (see Meyer & Rowan (1977) and Schoonhoven (1981)), we assert that organizational routines do not *perfectly match* the context within which the routine is enacted because of endogenous processes that express the routine have structural properties that are disconnected with the institutional environment at some level. As past research has shown (Feldman, 2003; March, 1996; Pentland et al., 2012), routines produce some level of structure that is not alone predicted by the exogenous forces placed upon it. The embeddedness view of organizational routines thus admits that exogenous factors are indeed at play, but instead focuses on the important underlying endogenous processes which generate change within the routine. Only by opening the “black box” of routines will we understand the path to explore further how routines respond to exogenous shifts such as technological change. This approach matches closely with Van de Ven & Poole's (1995) work on identifying key underlying mechanisms of organizational change.

2.3.6 Summary of Organizational Routines

Organizational routines represent an important lens through which we can better understand properties of inertia and change in organizations, and their relation to IT usage and technology disruption. Within the literature on routines, we find a focus on both the static nature of routines and as a much more dynamic and generative mechanism of change. One of the key challenges in studying and using organizational routines is understanding the micro-foundational processes that can explain the generative properties of routines. Such “open box” views have emerged as an important subset of discussion in the information systems literature. This literature looks to understand routines as a product of micro-foundational processes that underpin organizational change and inertia. Though the evolutionary perspective dominates much of routine change literature, a view of routines as the result of negotiated agreement, or truce, holds promise in helping to generate new insights into the introduction of technology into practice. Relative to the evolutionary view, the truce view offers a much more “open box” view of the micro-foundations of routines – and the casual structure through which routines exhibit surface-level properties such as inertia and change.

2.4 Summary

In the following chapters, we develop our proposed analytic lens based on a dialectic view of organizational routine change (Chapter 3), elaborate our research design and method (Chapter 4), detail the organizational content from which our data is collected (Chapter 5),

review the data collection process and summarize our data (Chapter 6), present our analysis and findings (Chapter 7 & 8), discuss our findings (Chapter 9), and conclude with future research, contributions, and limitations (Chapter 10).

^{xxi} By using a standard supply and demand model, we can see that technology that increases efficiencies across an industry shifts the supply curve to the right. If demand remains consistent, it results in new market equilibrium and a decrease in per unit price of output at all levels of production.

^{xxii} We do not to claim that researchers exploring this paradox are naïve. It is our position that these researchers contributed necessary challenges to long held assumptions that technology has a strong positive effect on productivity, independent of (or ignoring) more complex factors. This work set the foundation for future findings that demonstrated that the translation from IT investment into returns is not *fait accompli* and requires organizational capabilities specific, or unique, to an organization.

^{xxiii} Agarwal & Lucas (2005) suggest that demonstrating the value of investing in IT is a fundamental contribution to the IS discipline.

^{xxiv} It is not our intention to degrade the important research occurring with respect to IT and productivity and performance; however, if we continue to focus on issues of measures, we may suspend or postpone the generation of valuable insights into how organizations govern and manage deployments and insights into how organizations respond to such deployments.

^{xxv} Capabilities take time to develop within an organization. The pre-existence of certain capabilities, developed in advance of technology introduction, can greatly assist in the translation of IT investments into organizational benefits (Ravichandran & Lertwongsatien, 2005).

^{xxvi} The TAM model evolved from Fred Davis's dissertation work at MIT (Davis, 1986). Though there were multiple authors on the original seminal TAM paper (Davis et al., 1989), this model is generally attributed to Davis (Davis, 1986, 1989).

^{xxvii} Diagrams of each of these models are included in Appendix A.

^{xxviii} As evidenced by the popularity of the TAM, UTAUT, and similar models.

^{xxix} Structural determinism is the stance that the structure of society determines the subjectivity (or at least behaviour) of individuals who are members of that society. Early sociologists took this position, almost out of necessity, in order to reify and study the structural aspects of society.

^{xxx} Tenner's earlier work (Tenner, 1988) offers an illustrative example. Tenner highlighted how, paradoxically, the proliferation of computer information systems across business organizations resulted in more paper being produced than before the system's introduction. The paradox is that these systems were part of what was being touted as the *paperless* office.

^{xxxi} Markus & Mao, (2004) call for a distinction between *system development success* and *implementation success*. The focus of this thesis fits into the later concept. This paper is most concerned with the process of implementation, and specifically the embedding of new patterns of action into existing work practices.

^{xxxii} Though the discussion and debate surrounding the implications of this duality versus dualism discussion is informative, covering this topic in any detail would be a distracting digression from the purpose of this paper.

^{xxxiii} Burton-Jones & Gallivan (2007) coin the term for this focus on individual use as “level bias” (p. 657).

^{xxxiv} In reference to, and repurposing of, the comments of Benbasat & Barki, (2007).

^{xxxv} It’s important to note that routines too are “effortful accomplishments” (Pentland & Rueter, 1994, p. 488).

^{xxxvi} Winter (2013) provides an analogy of a large ship to further illustrate this process. If an organization needs to “right the ship”, it is easier to plant one’s flag on another ship that is going in the right direction than it is to spend time and energy righting the current ship (Winter, 2013).

^{xxxvii} It’s interesting to note that in linguistic theories of language acquisition, behaviourism has fallen out of favour in relation to innatism (Chomsky, 1980). Literature on routines, therefore, experiences a similar dilemma: are routines completely the result of behavioural acquisition, or are they the result of innate structure? These views are often mixed and left implied, but black box views clearly indicate an innatism position – which, by contrast, are increasingly seen as impeding necessary exploration of micro-foundations (e.g. Abell et al., 2008, Foss, 2011, Felin & Foss, 2009, 2011).

^{xxxviii} The concept of “affordances” originates from ecological psychology (see Chemero (2003) and J. J. Gibson (1977)). As described in IS literature, affordances are the possibilities for goal-directed action provided by an object in relation to a goal-oriented actor (Markus & Silver, 2008; Zammuto et al., 2007).

Chapter 3: Developing the Analytical Lens

In this chapter, we turn our attention to the development of a theoretical framework to describe technology initiated disruption and renewal. In the following sections, we synthesize ideas from information technology research, organizational routines, and dialectical change theory to develop a framework through which to understand and analyze the process of technology initiated routine disruption and renewal.

3.1 Revisiting the Theoretical Foundation: Organizational Routines and Routine Change

Prior to our identification of gaps and limitations in the current routine lens, let us revisit and expand upon the dominant theory of routines found in our literature introduced within the collaborative works of Brian Pentland and Martha Feldman.

Feldman (2000) introduced what can be the first seminal work that viewed organizational routines as a source of continuous change. The significance of this work is that, through a performative model of routines (see Figure 5), the concept of routines was repositioned as source of organizational flexibility. To accomplish this, Feldman repurposed the concepts of ostensive and performative aspects from Latour (1986, 2005) social construction theories and Giddens' (1984) structuration theory. In this synthesis, an “ostensive routine” is positioned as a static routine, and in contrast, a performative routine is conceived of as a

source of variation and flexibility. Feldman (2000) posited that through individual exercise of agency, variation in the performance of a routine is introduced, and this variation serves as the generative mechanism of routine change.

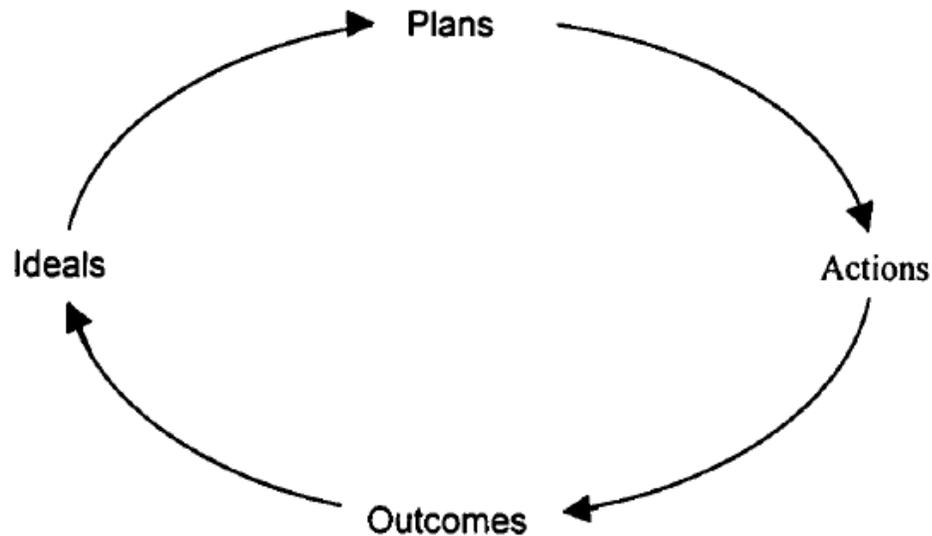


Figure 5. A performative model of routine: Organizational routines as a source of continuous change (M. Feldman, 2000, p. 623).

In a follow-up series of papers (Feldman & Pentland, 2003; Pentland & Feldman, 2008a; Pentland & Feldman, 2005), Pentland and Feldman significantly refine Feldman’s initial views on routines (Feldman, 2000) and introduce what has become the dominant ontological model of organizational routines. Expanding on Feldman’s (2000) previous work, Pentland and Feldman elaborate a tripartite view of organizational routines as consisting of two “internal” aspects of routines: the ostensive and the performative, with an additional third “external” aspect being that of the artefact (or artefacts) that interacts with the routine (see Figure 6).

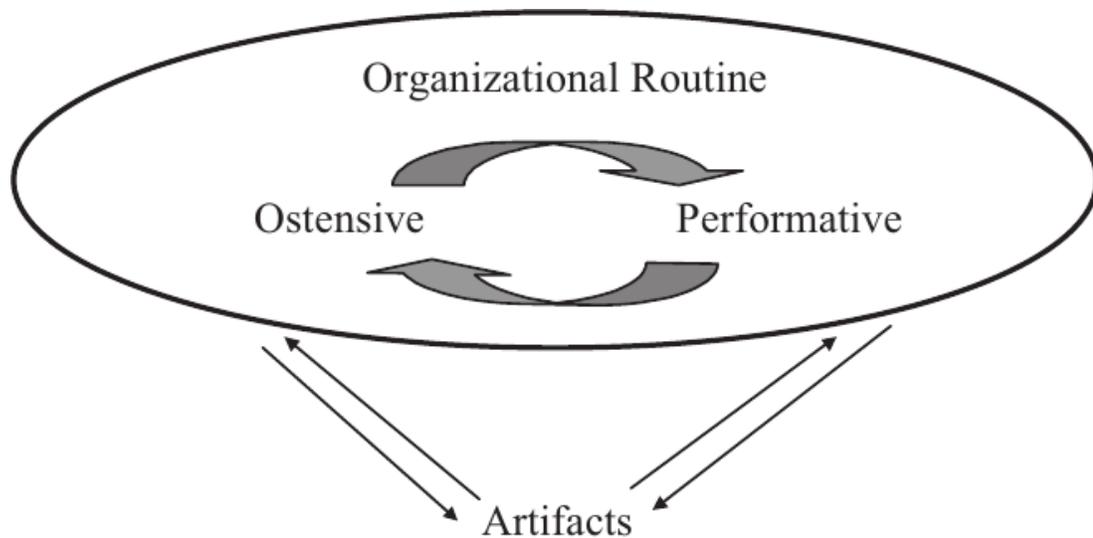


Figure 6. Organizational routines as a source of continuous change.

Pentland and Feldman (2003) define the ostensive aspect of routines as embodying “the abstract idea of the routine” (p. 95), and claim that, “the ostensive aspect is the ideal or schematic form of a routine.... [the] generalized idea of the routine, or the routine in principle” (p. 101). In a later article they add, “routines [are] characterized as abstract patterns that participants use to guide, account for and refer to specific performances of a routine” (Pentland & Feldman, 2005, p. 795). Through a process of ostension (“an act or process of showing, pointing out, or exhibiting” (<http://www.merriam-webster.com/dictionary/ostension>)); the ostensive aspect of a routine serves as a structure to which participants can “point to” as a definition of “what it is they do”. This has similarities with Ludwig Wittgenstein’s influential philosophical work on language, within which Wittgenstein notes that an ostensive definition of something conveys the meaning of it in terms of examples. Though this sort of thought predated Wittgenstein, Wittgenstein extended this to include meaning as its use in language itself - in this sense, the meaning

of a word is thus the historically accumulated usage of the term in a language context. Extending Wittgenstein's use of ostensive, we explain and define the ostensive aspect of routines as an outcome, or function, of the experience accumulated through previous actions engaged in the performance of a routine.

Pentland and Feldman's contributions also refine the previous concept of a "performative routine (Feldman, 2000, p. 622) to instead view this as an aspect of an organizational routine (rather than a class of routine), defining the performative as "consist[ing] of specific actions, by specific people, in specific places and times. It is the routine in practice" (Feldman & Pentland, 2003, p. 102). In this view, the performative represents the performance that routine participants instantiate while recreating the ostensive aspect of the routine. It is within the performative aspect that the specific, and interdependent, actions of organizational members "bring the routine to life" (Feldman & Pentland, 2003, p. 94).

With these two aspects defined, an organizational routine is viewed as a co-constituted "duality" of ostensive and performative aspects of routines. Without accumulated history, there is no referent for the ostensive, and without the ostensive, there is no persistent structure for participants to associate disparate actions into a cohesive whole. Through the interaction between the divergent nature of the performative, and the structural simplification of the ostensive, the routine acts as a generative mechanism of change - yet remains consistent with common understanding of what the routine is. ^{xxxixxl}

Especially pertinent to our thesis, Pentland and Feldman also attempt to include the role of “artefact” in their routines ontology. They conceive of artefacts as interacting with the routine as a whole, thus, positioning the artefact as an external exogenous influence. In their view, artefacts “take many different forms, from written rules, procedures and forms to the general physical setting (e.g. a cubical farm)” (p. 796, 2005). Using this view of routines as consisting of ostensive, performative, and artefact interaction, Feldman and Pentland (2003) argue that the co-constitutive interaction between the ostensive and performative explains how routines can be both flexible, and a generative source of organizational change, but that the routine as a whole is also influenced by the artefacts of the environment in which the routine is performed. Change, from this routines perspective, stems from their claim that each performance of a routine is, to some extent, an inexact copy of the ostensive, and thus unique. Since the ostensive only exists as a representational structure of the historical accumulation of performances, it is under constant change as variation is introduced in the performance of the routine.

3.2 Limitations of the Dominant Routines Theory

Despite the important theoretical insights that have been generated by Pentland and Feldman’s model of organizational routines, routines remain notoriously difficult to explore empirically (Becker et al., 2005; Becker, 2005; Gal & Hellman, 2010). This difficulty is thus limiting the theoretical impact this theoretical lens could have on generating further insight into and IT use behaviours by groups, and more generally, organizational change. From our analysis and synthesis of the literature we identify three

limitations which contribute to this difficulty: (1) “The Hobsonian Dilemma”, (2) “The Black Box Problem”, and (3) “The Ambiguous Artefact”.

3.2.1 The Hobsonian Dilemma

Though Pentland and Feldman’s model of routines makes a significant contribution to our understanding of routine change (Feldman et al., 2015; M. S. Feldman & Pentland, 2003; Kozika, Kaiser, & Friesl, 2014; Murray-Webster, 2010; Pentland et al., 2012), this view describes routine change in only the most general of terms. Influenced by Structural Theory, Actor Network Theory, and Practice Theory (Pentland & Feldman, 2007), the tripartite view sets the ontological foundation of routines as *duality* between the ostensive and performative aspects of routines, and external to this, are any influence from organizational artefacts. Similar to the criticism of structuration theory as exhibiting “fallacy of central conflation” (Archer, 1996), the ostensive/performative duality forming the ontological basis for this dominant theory of routines does not present the aspects of routines as analytically distinct, and thus presents a dilemma whenever researchers attempt to operationalize any internal aspects of routines.

Archer (1996) criticizes such “dualities” for positioning structure as so closely to practice that “the constituent components cannot be examined separately... in the absence of any degree of autonomy it becomes impossible to examine their interplay” (Archer, 1996, pp. 77–80). Relevant to our discussion, we add, that such dualities make it difficult to separately analyze the role and impact of technology on the internal aspects of the routine. Within a restricted ontological position of this duality, analyzing the relationship between

the ostensive and the performative aspects of a routine is like analyzing the front and back of a house, or the relationship between the head and tail sides of a coin. Though such “duality” models have generated discussion and enabled theorists to describe social units as having *sides* or *aspects*, the problem with this ontological framing is that it leaves no room to explore endogenous processes through which any internal aspects interact.

Reed (2003) refers to this as a “Hobsonian Choice”^{xli}, where dualities result in producing a conflationary ontology that erects a “brick wall” that blocks micro-analysis. Through this duality view of routines, the routine is conceived as an inseparable unit of co-constitutive aspects, and as such, we are not given the warrant to explore the interaction between these aspects nor how one without the other may interact with exogenous environmental facts. Change in this view is, at best, described only as random variation introduced through the imperfect performance of a routine’s ostensive aspect. This “duality” view thus relegates the processual interactions and influences through which such variation emerges as remaining outside of the duality. With this ontological “brick wall” erected, exploration of internal interactions that result in routine variation is severely limited.

3.2.2 The “black box” problem

Recent work in routines theory has tended to work around the aforementioned ontological “brick wall” by extending Nelson and Winter’s (1982) work. Nelson and Winter’s influential work associates routines as a product of evolutionary processes. In this view, routines are acted upon by evolutionary forces, and therefore, need not exhibit any internal endogenous interaction. Though Nelson and Winter’s “evolutionary view” is criticized as

being more metaphor than theory (Andersen, 2003; Cohen et al., 1996)^{xlii}, it, nonetheless, has spurred the expanded conception and application of evolutionary theory as a means of describing routine dynamics of change (Breslin, 2011; Hodgson & Knudsen, 2004b; Hodgson, 2003a; Knudsen, 2002; Salvato, 2006; Tennant, 2014). In this evolutionary view of organizational routine change, routines are considered to be like “genes” (reimagined as “replicators” in later literature (Breslin, 2012; Hodgson & Knudsen, 2006; Knudsen, 2004; Nooteboom, 2006). Such genetic views present routines as “black box” units that are acted upon by external evolutionary forces of random variation, selection and retention (see Figure 7).

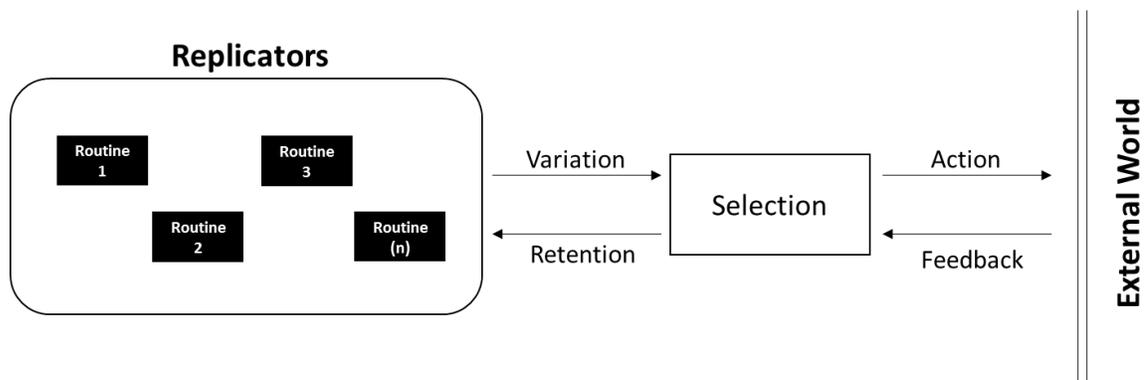


Figure 7. Evolutionary view of routine change (adapted from Breslin (2011a).

Rerup & Feldman (2011) argue that, despite the promise of the tripartite view of routines, how actions taken by those individuals performing the routine become either a source of change or a source of consistency is not well established and requires further theorizing. Since the evolutionary perspective is limited to describing change at the population level, the evolutionary theoretical view of routines necessarily subjugates the source of

organizational routine change to random variation. This perspective, when applied to routines, introduces ontological restrictions that limit the development of insights into the internal dynamics of routine change. Somewhat ironically, though the ostensive-performative view was seen as an “opening” of the “black box” view of routines, it may have further contributed to the need for such “close box” views (i.e. Breslin, 2012; Tennant et al., 2014).

3.2.3 The role of artefact in relationship to the ostensive

As we have indicated previously, the ostensive aspect of an organizational routine is the idea and structure of the routine, which is acquired through the historical accumulation of performative experience (Feldman & Rafaeli, 2002; Feldman & Pentland, 2003; Feldman, 2003; Feldman, 2000; Pentland & Feldman, 2005). We observe that from this ontological position the material world in which routines are enacted can only affect the ostensive indirectly, through placing constraints and affordances on the performance of the routine. Through time, the alteration of the performance experience, from which the ostensive is established, results in renewing, reforming, or changing the ostensive aspect of the routine. Since the duality view of routines conflates the role of the ostensive and the performative, and thus leaves both aspects unavailable to analyze as distinct, the conception of the role of the artefact, and more generally, the environment in which the routines is enacted, remains an exceedingly difficult area to theorize. We find evidence of this problem manifest in the multiple views of the role of the artefact in routine theorizing (outside the routine, at the centre of the routine, or in absentia), and the noted difficulty in

operationalizing the routines concept (Becker, 2005; Betsch & Haberstroh, 2005; Gal & Hellman, 2010; Pluye, Potvin, Denis, & Pelletier, 2004; Sharapov, 2012)^{xliii}. It is clear to us that this duality view creates an ontological dilemma that must be resolved if we are to make further progress.

3.3 Our Response: A Dialectical Model of Routine Change

We respond to each of the three identified limitations of routines research by (1) introducing routine as a dualism (rather than a duality), (2) clarifying the role of artefact in routine dynamics as operating through the performative, and (3) introducing a “dialectical change” alternative to the dominant evolutionary “engine” of routine change found within the contemporary literature.

3.3.1 From dualities to dualisms: Breaking the Hobsonian Dilemma

To address the Hobsonian Dilemma introduced previously, we incorporate recent extensions to structuration theory (which occurred after Feldman and Pentland’s seminal work), which introduce structure and agency as analytically distinct and separate. This form of “strong structuration” Stones (2005) addressed in the growing criticism of Giddens’s (1984) original version of structuration theory where it is argued that such theories are incompatible with empirical investigation (Reed, 2003) (and by extension, contributes to problems in exploring the internal structures of routines.)^{xliv} Stones addresses these criticisms by introducing a realist ontology in which the structure (ostensive aspect

in routines theory) is positioned as analytically distinct from agency (performative aspect in routines theory).

By applying this realist extension, the spirit of structural ontology is resurrected as a dualism rather than a duality, thus avoiding Hobsonian choice dilemma. This fundamental switch in ontology opens the doors to accommodating the exploration of the endogenous interaction between the performative and the ostensive aspects of routines by considering them ontologically distinct. Following this argument, we too introduce routines as a dualism, and thus open the opportunity to conceive of independent interaction between the artefact, and environmental context as a whole, and the individual aspects of routines.

3.3.1.1 The ostensive and performative dualism

In our ontological recasting of the Feldman and Pentland model (see Figure 8) as a dualism, we can now contemplate the interaction between the environmental conditions and the internal routines structure rather than as with the routine as a whole.

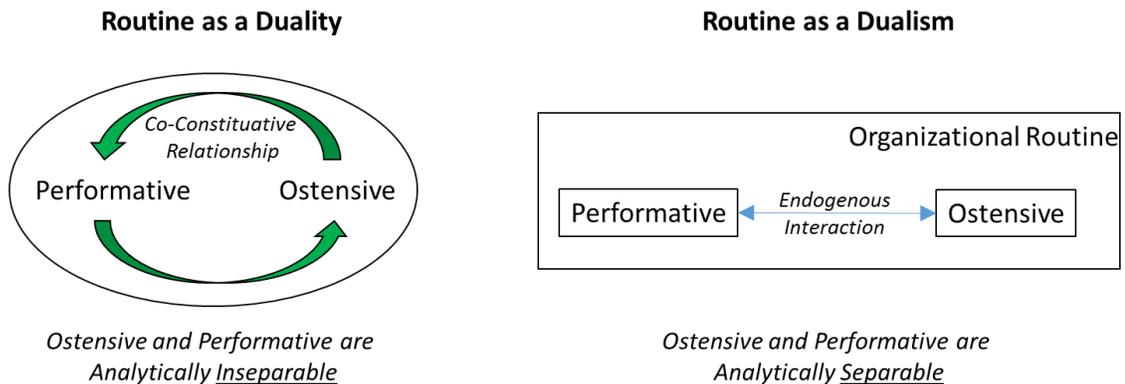


Figure 8. Moving from routines as a duality to a dualism.

Since the ostensive aspect of routines is a referent to the accumulation of patterns of action, such structure cannot exist unless it has been enacted. Therefore, any external influence on the ostensive must be proxied through the performance of the routine, and only through the historical accumulation of actions can the ostensive exist. With this in mind, we define the exogenous interaction between the environmental conditions and the routines as, necessarily, an interaction with the performative aspect of the routine. We offer an illustrative summary of this new ontology in Figure 9, “Realist modification to routines model”.

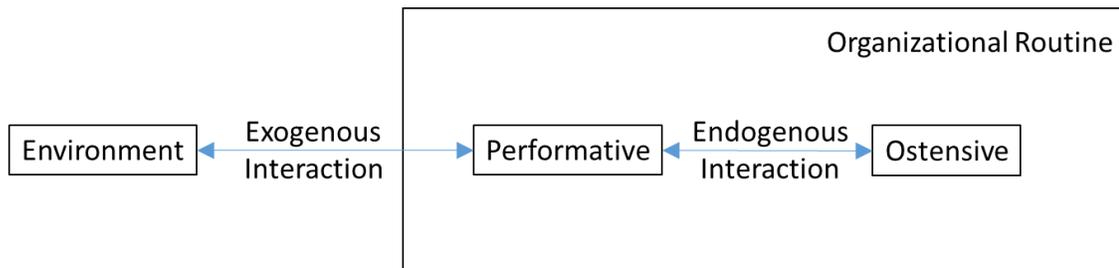


Figure 9. Realist modification to routines model.

Our ontological recasting of routines is a significant departure from existing routines theory in at least one key area, that is, the ostensive aspect of a routine necessarily requires experience, thus requires some historical accumulation of the performative enactment of action patterns. These enacted patterns of performative experience, if not associated with an ostensive structure, are by their nature simply disparate actions and non-routine. Until group level patterns are established, despite any artefactual representation of the routine, no routine exists. By incorporating this dualism view, we position the ostensive as the outcome from an accumulated experience. The transfer of any knowledge from artefacts,

therefore, necessitates the exploration of new patterns of action generated through the enactment of work, in-situ, with the artefacts.

3.3.2 Opening the “black box” - From evolutionary to dialectic engines of change

With the necessary ontological extension of routines established, we now turn our attention to exploring an appropriate “engine” of change through which technology initiated routine disruption and renewal can be understood. Using Van de Ven & Poole's (2005) typology of organizational change engines, we position the dominant “change motor” (p. 511) for our investigation as being that of a dialectic change engine. This is a novel view of routine change that contrasts the dominant view of organizational routines changes as an evolutionary process.

3.3.2.1 Engines of change

Van de Ven & Poole (1995) define for basic types of process theories used to explain how and why change unfolds within organizations, and thus by extension, organizational routine change: 1) Life Cycle, 2) Teleological, 3) Dialectical, and 4) Evolutionary. We organize these theories along two dimensions –the level at which the change is made (single entity or multiple entities), and the mode of change (prescribed or constructive.)^{xlv}

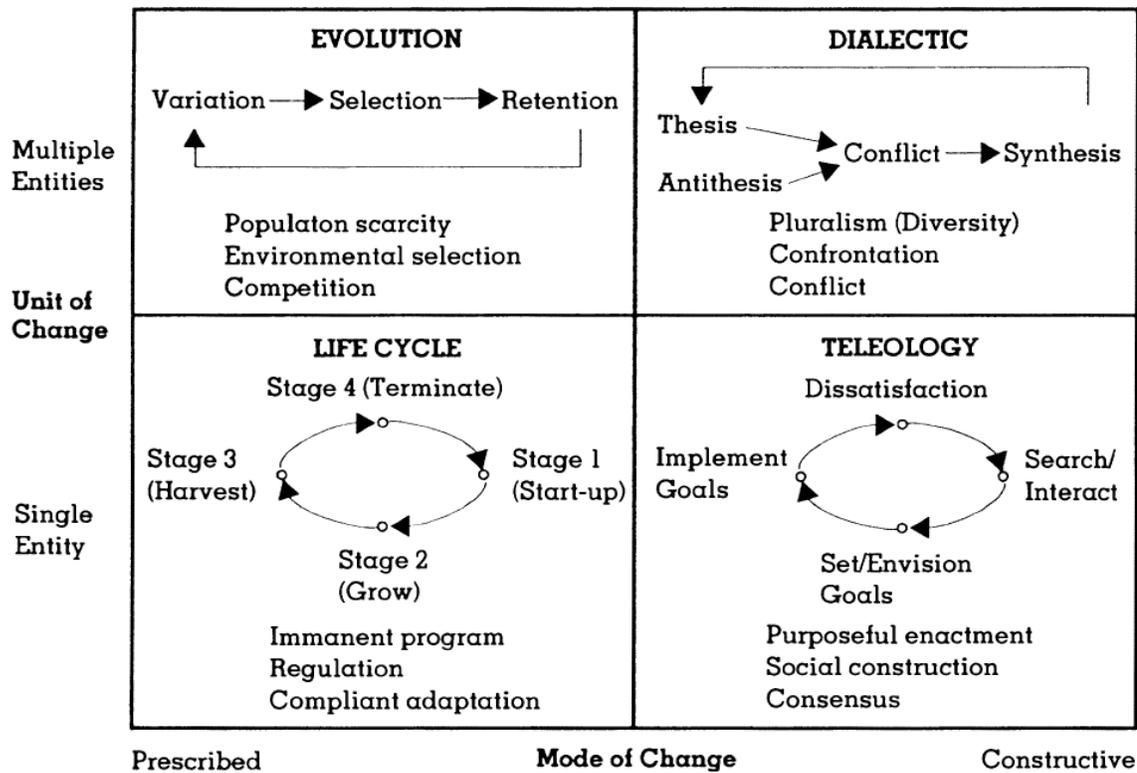


Figure 10. Process theories of organizational development and change (Van de Ven & Poole, 1995, p. 520).

Dominant View: Routine Change as “Evolutionary”

As already indicated in the literature review, the dominant view of organizational routine change views routines as replicators, or genes, that undergo an evolutionary process of change. Using Van de Ven & Poole (1995), we identify this approach as focusing on a prescribed, versus a constructive, mode of change at multi-entity level. As indicated in the introduction and elsewhere, a key problem that motivates this thesis is that deterministic and prescribed change associated with IT introduction is generally not achieved and most often generates unintended and unexpected outcomes. To understand why such deterministic approaches fail to deliver anticipated outcomes and what potential governance and interventions practices might be more appropriate, we must first

understand the emergent processes that generated these unintended consequences. The “black box” view afforded by the evolutionary view offers little insight into the micro-foundational dynamics through which technology initiated routine disruption and renewal outcomes are produced.

To address this gap, this thesis shifts focus from viewing organizational routine change as an evolutionary process, to one which views routine change as a multi-entity social constructivist mode of change. Using Van de Ven and Poole’s typology, we identify dialectics as a more appropriate position from which to investigate emergent technology initiated disruption and renewal outcomes and organizational change in general.

3.3.2.2 Alternative view: Routine change engine as “dialectical”

Astley & Van de Ven (1983) define dialectic change as “reciprocal relations between structural forms and personnel actions that make tension and conflict a pervasive characteristic of organizational life” (p. 267).

Relating this to routines, Gomberg (1964) argues that the very concept of organization implies conflict. We also find parallels with aforementioned conceptions of routines as an ongoing truce, and negotiated order (Day & Day, 1977; Nelson & Winter, 1982; van Raak et al., 2007). A number of organizational change theorist have argued that such conflict can be interpreted in terms of Hegelian dialectic, in which existing structural forms provide the thesis, and the in-situ individual actions the antithesis (Astley & Van de Ven, 1983; Bhaskar, 2014; Chanin & Shapiro, 1985). Other works of organizational theory have repurposed the concept of Hegelian dialectic as an explicit discursive synthesis, to one that

includes the implicit discourse between interacting actions, and thus permeates much of everyday efforts for organizational members to accomplish work (Mason, 1996; Nielsen, 1996; Putnam, 2015).

Benson (1977) offers that the dialectical perspective of organizational change “opens up the analysis to the processes through which actors carve out and stabilize a sphere of rationality” (p. 2):

The social world is in a continuous state of becoming—social arrangements which seem fixed and permanent are temporary, arbitrary patterns and any observable social pattern is regarded as one among many possibilities. [In the dialectical view] Theoretical attention is focused upon the transformation through which one set of arrangements gives way to another. (p. 3)

Dialectical analysis involves a search for fundamental principles that account for the emergence, disruption, and dissolution of specific social orders. In the dialectical view, theoretical attention is focused on the transformation through which one set of social arrangement gives way to another, or not (Carlo, Lyytinen, & Boland Jr, 2012). Carlo et al., 2012 asserts that the key principles of dialectic theory include:

1. Social construction: Social reality is produced and maintained through situated action and is influenced by actors’ histories, interests, environmental constraints, and power bases

2. Totality: Social reality forms a whole, with multiple, interpenetrating levels and components that affect the emergence of its system-level qualities
3. Contradictions: Social reality is permeated with contradictions, which consist of two opposites and their struggling relationship

Figure 11. Key principles of dialectic theory (Carlo et al., 2012, p.1084).

Revisiting the overarching research question about how technology initiated routine disruption and renewal occurs, this paper approaches the question not from a prescriptive outside/in view of routines, but rather, asks this question from an emergent constructivist perspective – through what process do groups repair a structure of work (routine) that was itself originally a product of this same social construction? This constructivist position is found within much of the literature (see Leonardi & Barley (2010)).^{xlvi} By using the typology of Van de Ven & Poole (1995), we conclude that a more appropriate change theory for organizational routines is based on a dialectic theory of change.

3.3.3 On the role of the artefact

The body of literature on technology interaction with organizations has acknowledged the importance of emergent relationships between technology and local practices embodied in routines (see “intertwining” Robey, Schwaig, & Jin (2003) and “imbrication” Leonardi (2008, 2011) for illustrative examples). Shared in these views is that, at least initially, technology is seen as an exogenous force placed upon the existing routine dynamics. We

propose that the interaction between the routine and this environmental change initiates the potential for routine disruption and renewal - a necessary but not sufficient condition for routine change. Building from our proposed dialectical view of routines, the introduction of technology causes changes in the environmental context within which the routine is performed. Significant changes to the environment in which routines are performed create a dialectic tension that must be either addressed, or endured, by the organizational unit. Overtime, as the routine is enacted, dialectic tension motivates agents to find ways to appropriate the artefact in their work (technology in use), and thus, embed these changes within the ostensive structure of the routine.

To elaborate further on these ideas, the physical material properties of artefacts (and the context in which routines are performed) are generally considered to lie outside human agency influence (“we can’t easily walk through walls” (Leonardi, 2011, p. 150))^{xlvii}. Furthermore, appropriate use and associated behaviours by groups performing routines is very much contextualized by the social structure in which they are used (Leonardi & Barley, 2008; Orlikowski, 2007). For instance, consider a simple chair. The physical material properties of that chair set limitations on its possible uses (i.e. how much weight can it hold, how many people can it fit), but the possible uses given these physical limitations still far exceeds the socially entrained usage patterns defining what is deemed normal or appropriate. For instance, though the tendency is to think of the appropriate use of a chair as for sitting, its material properties allow it to be used to break a window or to store books on. In the latter two cases, either the object ceases to be a chair, or if this form of “chairness” is still held by the observer, its use as “chair” is considered unusual or

inappropriate. In this sense, the “chairness” of an object is not a natural physical material property; it is a form applied to the chair given the social structure and context from which the evaluation is made. Such social context constrains possible material use via the more restrictive formation of appropriate use, which emerges from the historically accumulated patterns of the artefact in use. Leonardi (2011) refers to this as a process of imbrication, where the material properties and the social context (in our case, the organizational routine) become imbricated – where the material properties of a technology artefact afford and constrain actions, and the organizational routine defines actions that are considered appropriate. In this view, the artefact is exogenous to the routine, and the organizational routine appropriates the artefact in the execution of group tasks.

This view aligns closely with D’Adderio’s (2011) attempt to view the artefact as “the centre of the routine” (p. 202). In her words, this “Copernican Revolution” in routines theory is made by introducing artefacts as key, and at the centre of, routine change and stability. D’Adderio’s (2011) goal is to “show how the combined influence of human agents and material artefacts shapes the course of routines” (p. 199), and that routines formation creates patterns of use that are a subset of all possible uses.

3.4 Formulating the Analytical Frame

This paper adopts a synthesis of behaviourist (i.e. Cohen et al., 1996) and contingency (i.e. Bergeron & Raymond, 1995) views of organizational routines. From the behaviourist perspective, the performance of a routine tends to remain consistent with the ostensive

structure of the routine, which is the essence of the repeatable property of routines. From the contingency perspective, the performance of routine is contingent on environmental conditions in the space and time in which it is performed. The introduction of technology changes these environmental conditions, thus initiating two dialectic tensions.

The first dialectic is one of *internal ostensive consistency*, and stems from the organizational routine property of repetition. This is the dialectic between novelty and consistency that emerges from the tension between tendencies to remain consistent with the structural representation of the routine, and allowance for novel performances of the routine.

The second dialectic is one of external consistency, and stems from the need for the environmental fit. This is the dialect between *fit* and *misfit* that generates tension between the performance of the routine and the environmental conditions within which the routine is performed. Since the environment is a mix of affordances and constraints within which the artefact resides, this dialectic is between the exogenous changes in environmental conditions that lie outside the routine structure and the internal structure of the routine.

In the following sections, we elaborate further on these two dialectics.

3.4.1.1 Ostensive alignment: A dialectic between consistency and divergence

Deliberate planning or rational decision-making cannot always control complex organizational behaviour. As Herbert Simon (1947) argued, when faced with familiar situations, it is not always rational to waste time re-assessing the situation; it is generally

more efficient to simply resort to repeating known responses that have worked in the past. Researchers on organizational routines have noted that repetitiveness is a key property of routines, and a natural result of individuals navigating their work within the bounds of human rationality. Betsch, Haberstroh, & Hohle (2002) note that a routine is as “an option [with an associated sequence of appropriate action] that comes to mind as a solution when the decision maker recognizes a particular decision problem” (p. 456). Repetition, therefore, can be conceived as a process of fitting previous known solutions to current contingencies. Not doing so requires extra effort, and cognitive cost, generating a certain amount of tension in the performance of tasks.

Note, also, that the repetitiveness property of routines is not equivalent to habituated behaviour. Though an individual may limit the scope of available options due to having developed a routine response, this does not necessarily denote that such responses become automatic or mindless. The repetitive property stems from individuals having developed a repertoire of known, and thus experienced, options they can select from when enacting their work. In this sense, habit is “a special case of a routine” (Betsch et al., 2002, p. 456), where long term repeated performance of the routine results in eliminating, or narrowing, the decision process preceding the selection of pre-established response behaviour.

This property of repetition and internal consistency of routines locates the internal consistency dialectic of routine change – represented in the tension between novelty (divergence from the norm) and consistency. Individuals tend to repeat known solutions to current problems, remaining consistent in their behaviour: a fact of routines (Cyert et al., 1963). Using our previously established “dualism” ontology (see Figure 12), a consistency

is presented when the performance of the routine closely aligns with the ostensive structure, or representation, of the routine. Though individuals always “have the choice to do otherwise” (Giddens, 1993; Orlikowski, 2000), doing so requires engaging in a process of expanded option identification and selection. The tendency, therefore, is for the performance of the routine to match the ostensive structure of the routine (thesis); however, under certain conditions, novelty (anti-thesis) can, or must, be chosen over consistency. Novelty creates dialectic tension by introducing an anti-thesis against the thesis represented in the ostensive structure. Group praxis, either explicit or implied through the choice of actions enacted, must develop a synthesis of ostensive consistency and ostensive divergence by either rejecting a novel performance or synthesizing such performances into a renewed, or updated ostensive structure that serves as the new ostensive thesis.

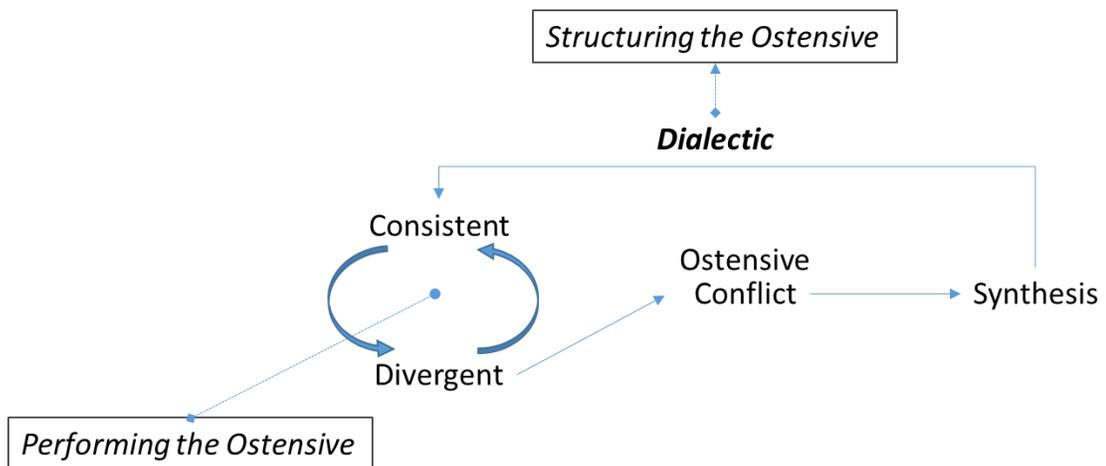


Figure 12. Internal consistencies: A dialectic between consistency and novelty (divergence).

3.4.1.2 Environmental alignment: A dialectic between environmental fit and misfit

Actions and behaviour are not always at the discretion of the individuals performing work. Complex environment conditions present contingencies and affordances that shape the actions that are enacted in the performance of work. Under stable environmental conditions, routines develop a fit with the environment. When such an environment undergoes significant changes, this results in the availability of new and better options or the elimination of tried and true options that no longer are convenient, or even possible. More generally, changing environmental conditions alter the contingencies expressed by the environment, and thus presents new opportunities, challenges, and possible eliminations of old patterns of action represented in existing routines. Since the performative aspect of the routine must be both possible and reasonable in the current environment, the performance of a routine interacts with the conditions within the environment in which the routine is enacted – within which the artefact resides. The performative aspect of a routine, and associated actions patterns performed in the instantiation/enactment of that routine are held in tension against current, and often changing, environmental conditions.

This position is consistent with the contingency theory perspective, where routines require a fit with the environment in which they are enacted (Miller, 1992). This introduces the second key dialectic: the fit of the performance with the environmental (fit and misfit). As seen with the Feldman and Pentland model, the performance of the routine is the generation of actions, and such actions necessarily interact with the environment. Though the ostensive aspect of an existing routine may not “fit” current environmental conditions, as

we have discussed in our dualism view of routine, the ostensive exists as a referent to experienced performances. Therefore, the ostensive adjusts to “fit” the environment once a new set of action patterns has been established through exploratory performances that establish new knowledge of the environment. As such, the ostensive interacts solely with the performative (via the internal consistency dialectic) and only indirectly with the environment.

The introduction of technology, both in the direct material effects or associated managerial interventions and governance structure changes, results in changes to the environmental context within which established routines are performed (Jensen, 2007). Within these contextual changes, certain established patterns of action may not be possible, some are more difficult, and some not as efficient as they once were. Thus, the introduction of technology results in creating a tension between the performative aspect of routines and the current environmental conditions. This tension must be resolved through a synthesis that either fits the new environment or alters the environment in such a way as to return the environment to its previous state. The resolution of this environmental fit lies in group performative dialectic between environmental fit.

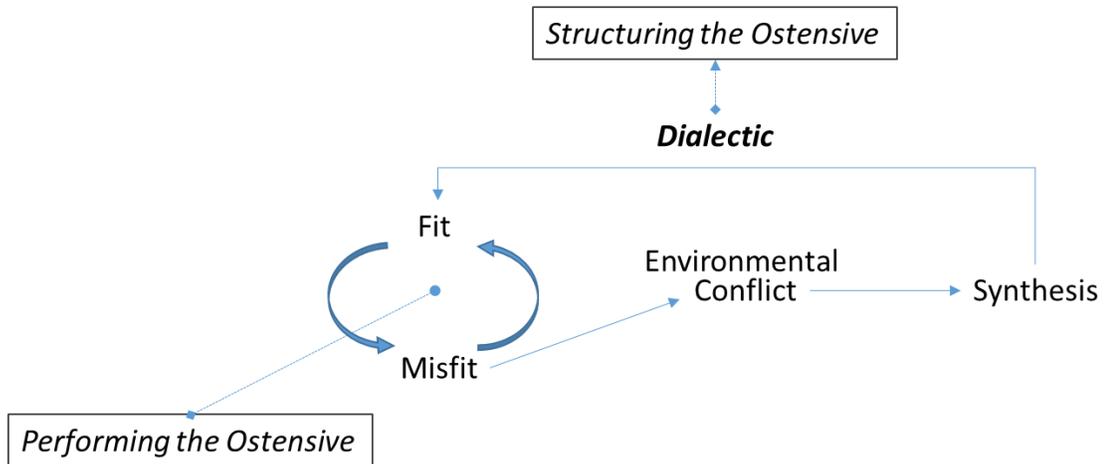


Figure 13. External consistencies: A dialectic between environmental fit and misfit.

3.4.1.3 Dialectic interaction: A two-dimensional model of routine as an ongoing accomplishment

Neither of the two dialectics we have introduced is mutually exclusive. Each performance of a routine can remain consistent with the ostensive structure, or be novel to it. Simultaneously and independently, each performance can fit the environmental conditions in which it is performed, or it be misaligned, or in a state of misfit with the current conditions. As these two dialectic processes operate, each performance of a routine can therefore be classified as aligned or misaligned with the environment, while also being consistent or novel with respect to the ostensive structure of the routine. This observation forms the basis for our proposal typology of performative fit (see Figure 14).

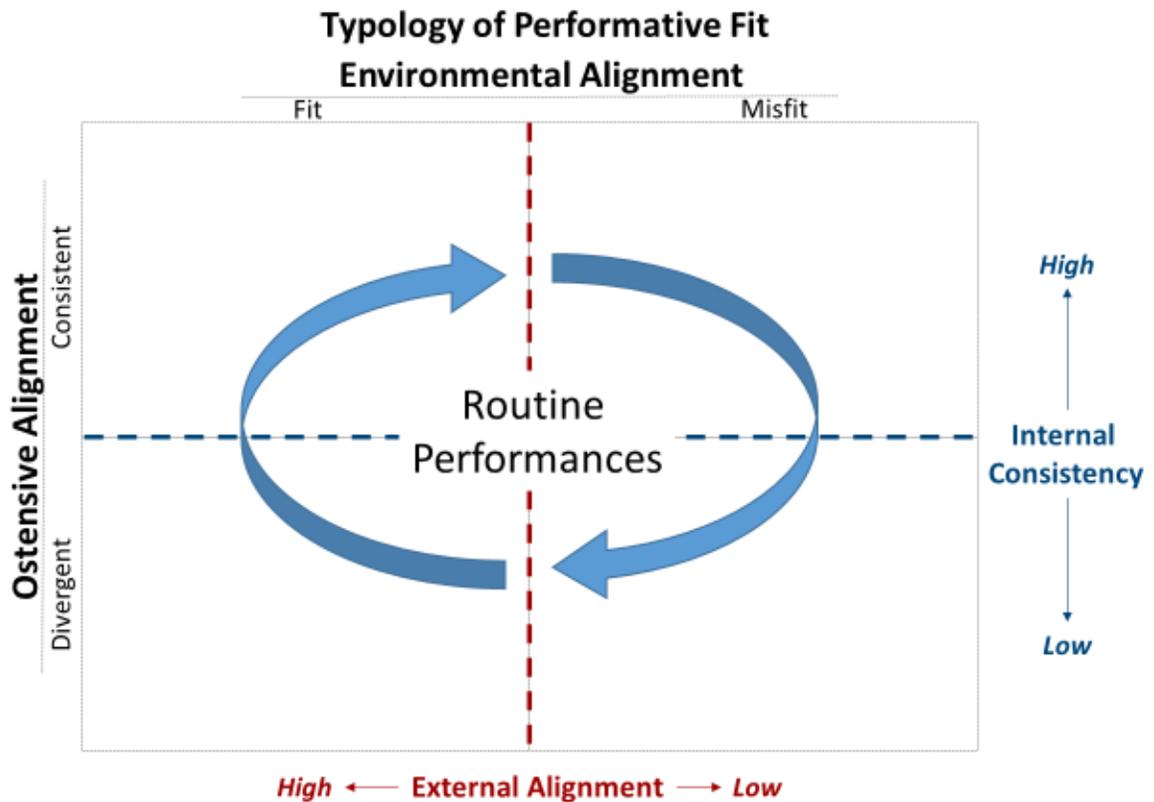


Figure 14. Typology of performative alignment.

Using our typology, the performance of a routine can be classified into one of four quadrants. Each quadrant is situated within a two-dimensional representation of the internal and external consistency dialects we introduced above:

- Performance Pattern I – Within this quadrant, performances of the routine exhibit a high degree of consistency with the ostensive structure of the routine (consistent) and a high level of alignment with the current environmental conditions (fit)
- Performance Pattern II – Within this quadrant, performances of the routine exhibit a high degree of consistency with the ostensive structure of the routine (consistent)

but exhibit a low level of alignment with the current environmental conditions (misfit)

- Performance Pattern III – Performances within this quadrant exhibit a low degree of consistency with the ostensive structure of the routine (divergent) and a low level of alignment with the current environmental conditions (misfit)
- Performance Pattern IV – Performances within this quadrant exhibit a low degree of consistency with the ostensive structure of the routine (divergent), but a high degree of alignment with the current environmental conditions (fit)

We now illustrate the level of ostensive and environmental fit exhibited within each of the quadrants within the following diagram:

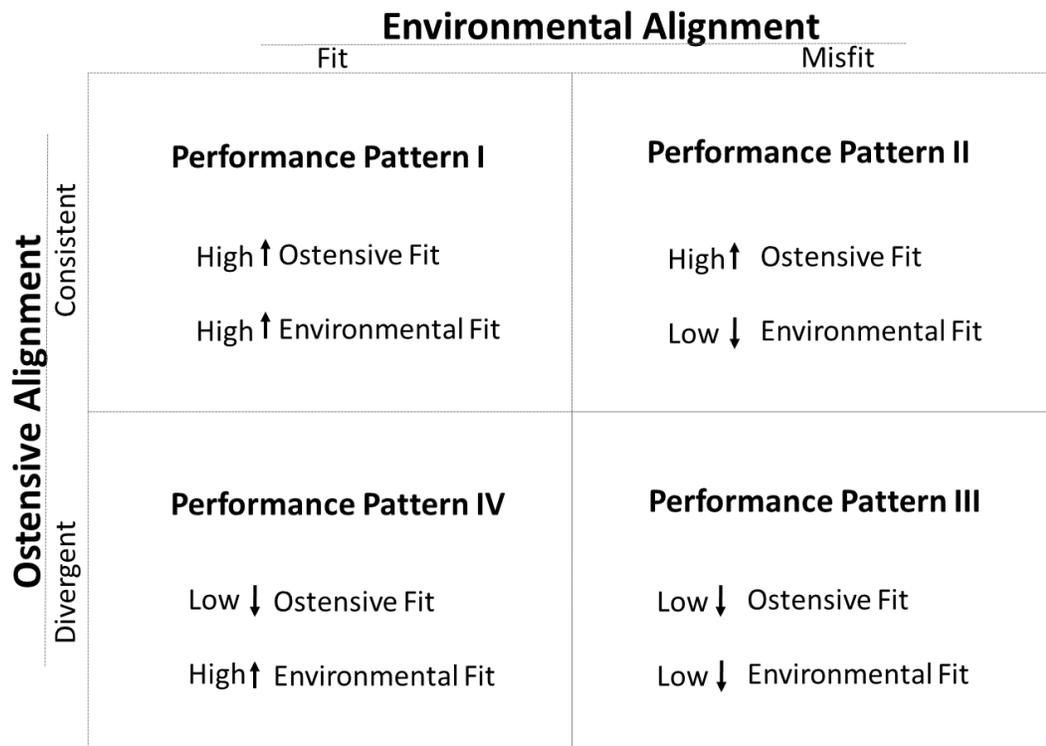


Figure 15. Performative, ostensive and environmental fit.

3.4.2 Modalities of conflict and associated moves

“Simplification is a necessary part of modeling, so models represent isolated aspects of real-world phenomena, not the complete phenomena” (Miller, 2015, p. 177).

From performative typology of ostensive and environmental fit (see Figure 15), we now identify four distinct routine modalities and an associated repertoire of behavioural moves within each modality. We first provide an illustration of these modalities and then proceed to elaborate on each.

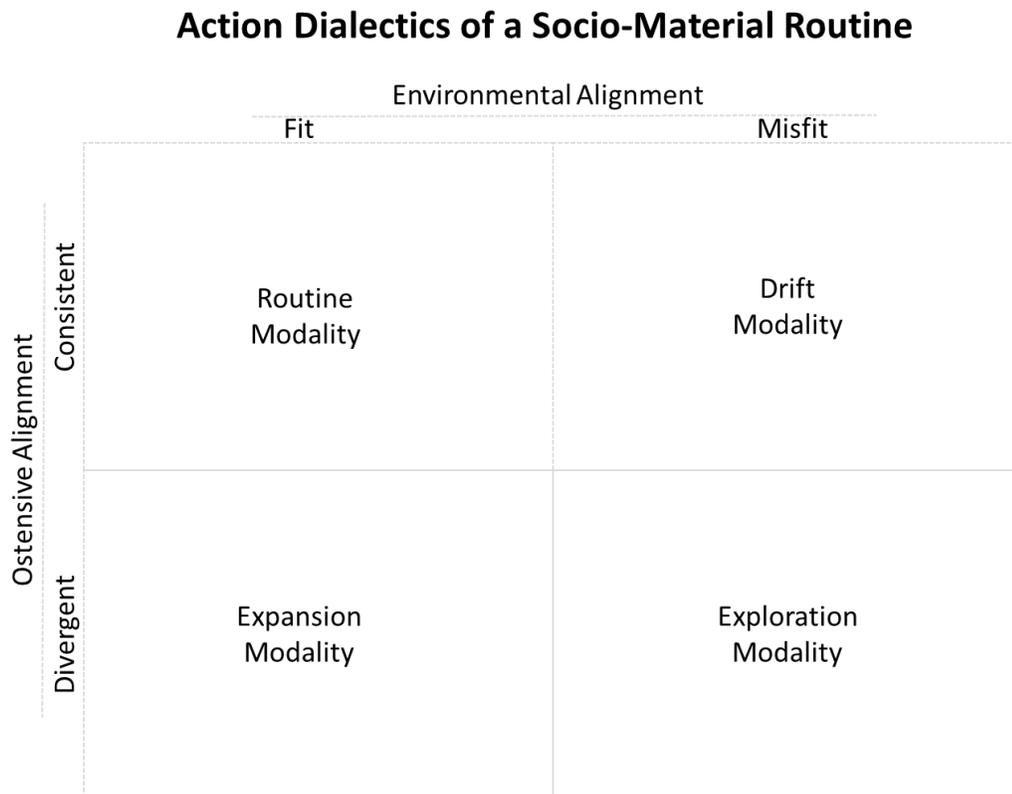


Figure 16. Four modalities of routine disruption and renewal.

Drift Modality

It is commonly held that organizations must achieve fit both with their external environments and among their elements of structure and process (Burns and Stalker, 1961; Lawrence and Lorsch, 1967; Thompson, 1967). These ends are often not compatible. Miller (1992) argues that the act of achieving fit with the environment often destroys internal consistencies. The environment changes, while the performance of the routines, either briefly or indefinitely, remains internally consistent; the routine becomes misaligned from the current environment. We introduce the term “drift” to denote the inherent tension of misalignment between the environment and the routine performance. During periods of drift, internal consistencies are in tension with current environmental conditions. This represents what we define as a drifted modality within which three general “moves” are possible:

- (1) Stasis -> *Maintain Internal Consistency*: In this move, the routine remains in this state in order to maintain internal consistencies despite lack of fit with the current environment
- (2) Forward Move -> *Disrupt Routine*: In this move, the internal consistencies of the routine are disrupted in order to introduce new performance patterns that are novel (divergent) to the group thus having no previously established precedent
- (3) Backward Move -> *Environmental Reversion*: In this move, the environment changes to match internal consistencies. Though this is not often possible, it can be possible in situations where new technology introduction is the source of the environmental shift. In this case, environmental reversion is manifest in the

rejection and removal of the technology in order to restore environmental conditions in which past routine ostensive structure “better” fit

Performative Dialectic – Drift Modality

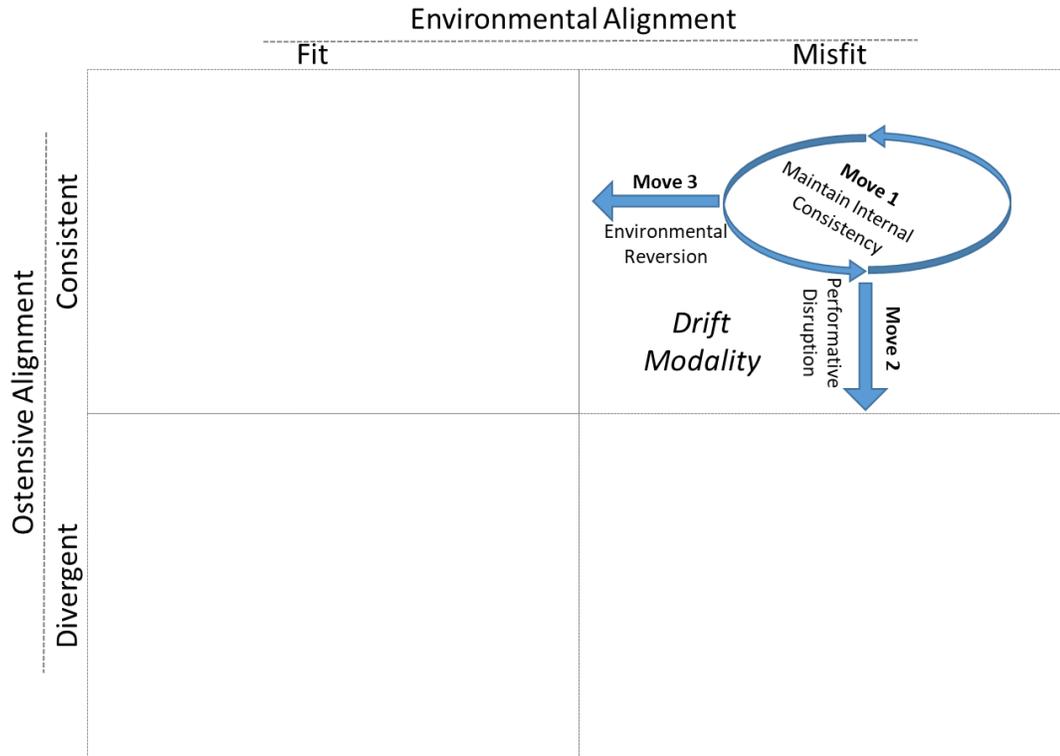


Figure 17. Moves within the Drift Modality.

3.4.2.1 Exploration Modality

Disruption of existing organizational routines is a necessary part of change, as over time “stable teams may become slaves to routine and fail to respond to changing conditions” (Edmondson et al., 2001, p. 689). Routines in a disrupted, or “exploratory modality” operate under uncertain conditions since no performance has been tested or experienced by members engaging in the routine; therefore, no performative repertoire exists for which the

performance of the routine can be vetted. This results in generating a period of uncertainty where each performative variation is an exploration of the environment to identify appropriate patterns to enact it. As noted previously, routines tend to form in situations of uncertainty (Simon, 1947), but the emergence of a new routine, or reversion to the old, depends on the willingness of participants to explore new ways of achieving goals/tasks that disrupt existing patterns of work. “Moving forward” thus requires group willingness to venture into uncertain territory; unadventurous groups can easily revert to old known ways that no longer fit the environment but fit their existing patterns of work.

Though technology initiated routine disruption has been explored from the habit perspective (Polites & Karahanna, 2013), as noted previously, habits are only a special form of routine. More generally, routine disruption results in a period when the number of choices available to individual’s increases, and due to the lack of accumulated experience in exercising this choice, confidence in success is lowered. During this period of uncertainty, the organization has three potential moves:

1. Stasis: *Maintained uncertainty (confusion)*. This move can result from the organizations inability to collectively identify appropriate new performances that fit the environment
2. Forward Move: *Appropriation*. This move is to identify new patterns of performance that have an appropriate fit with the environment. This requires some group praxis that identifies what is an appropriate fit for the environment
3. Backward Move: *Consistency Reversion*. Routines form to address uncertain environments. If collective appropriate new patterns of action cannot be found to

renew and revise the established routine, then organizations can revert to known performances to re-establish internal consistency, at the expense of environmental fit

Performative Dialectic – Exploration Modality

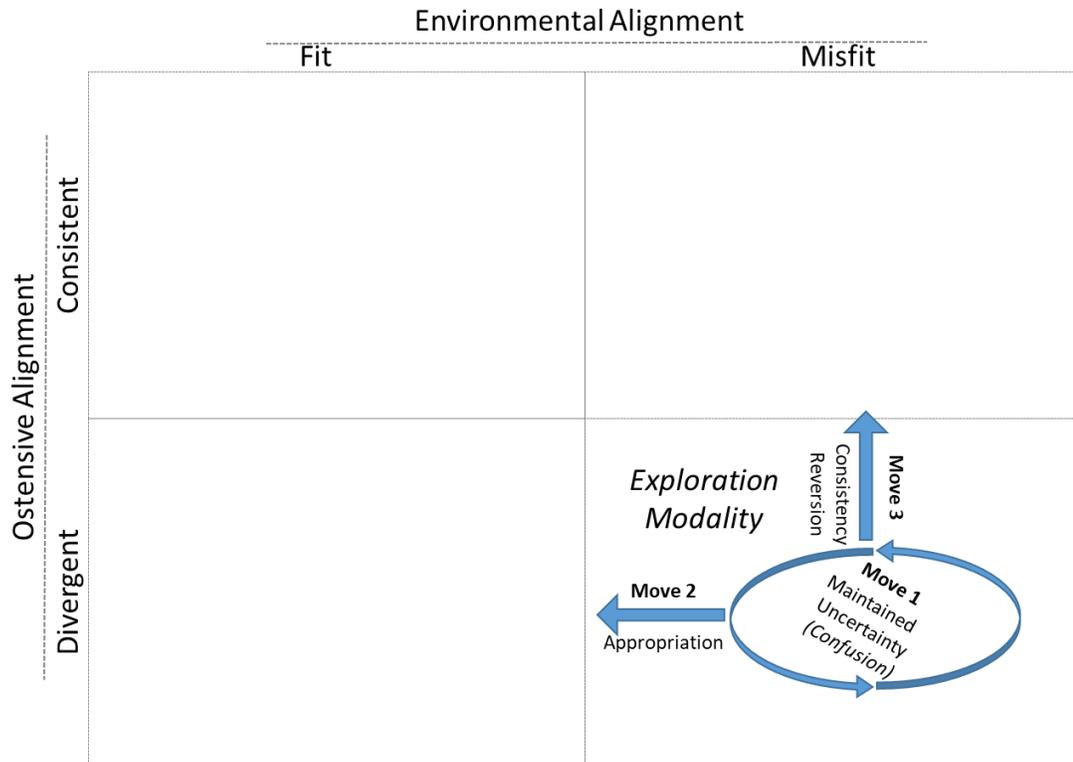


Figure 18. Moves within the Exploration Modality.

3.4.2.2 Expansion Modality

Expansion of the existing routine is a necessary part of initiating renewal and change within routines (Labatut et al., 2012). In this mode of expansion, new patterns of the performative are identified as appropriate but have not yet been fully established in the ostensive

structure of the routine. Through repeated performances, these patterns over time become part of the ostensive structure of the routine.

Within this expansion modality, the organization has three potential moves:

1. Stasis -> *Remain in a State of Expansion (divergence)*: This is a phase of identifying patterns of the performative that fit the environment, but are not yet embedded in the routine. If the organization remains in this state, new patterns of action continue to be identified as having fit with the environment, but are not significantly repeated
2. Forward Move -> *Patterning & Culling*: In this move, the ostensive structure of the routine is re-established through the patterning and repetition of identified appropriate performances. As noted by Salvato (2006), this process of patterning (imitation) is often associated with contraction of the repertoire of patterns
3. Backward Move -> *Confusion Reversion*: Due to conflict within the group, appropriate new patterns may be disputed. This will result in reverting to confusion, or uncertainty modality

Performative Dialectic – Expansion Modality

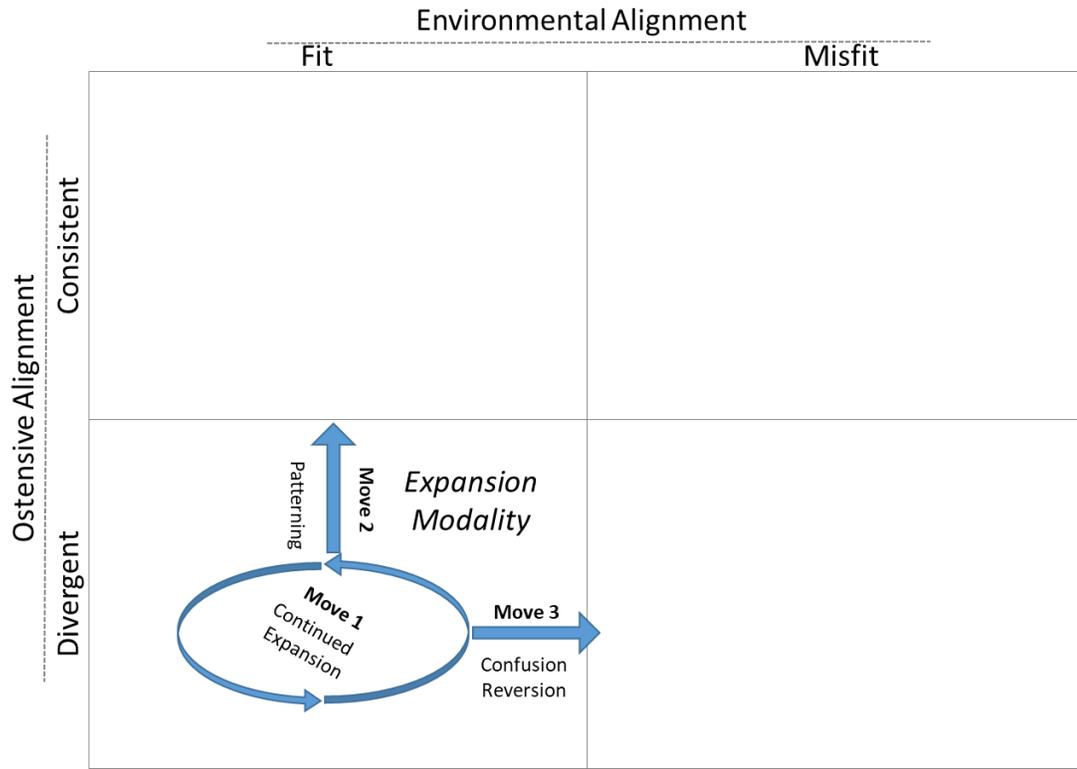


Figure 19. Moves within the Expansion Modality.

3.4.2.3 Routine Modality

In this modality, all the properties of a “healthy” routine are present - internal consistency along with external consistency - and as such, stasis in the modality offers the least dialectic tension. Within this modality, there are three moves – one of which is exogenous to the model, and therefore, not in the purest sense *a possible move* as it requires some external intervention of change that is not subject to the dialectic forces identified within the model:

1. Stasis -> *Reinforcing*: In this move, the routine is repeated with little variation. If the routine stays in this state, the routine will become increasingly habitual and automated, and thus, increasingly difficult to change
2. Forward (initiating) Move -> *Exogenous Intervention*: To drift the routine and environmental alignment, an exogenous move is required. That is, the environment changes. Such a change, by definition of being exogenous, is not influenced by the dialectic forces identified within our model
3. Backward Move -> *Conflicted Expansion*: In this move, the choice set from which performances are derived is expanded to known, or reasoned, performances. Such a move is divergent from the common patterns, based on prior exploratory work/experiences

Performative Dialectic – Routine Modality

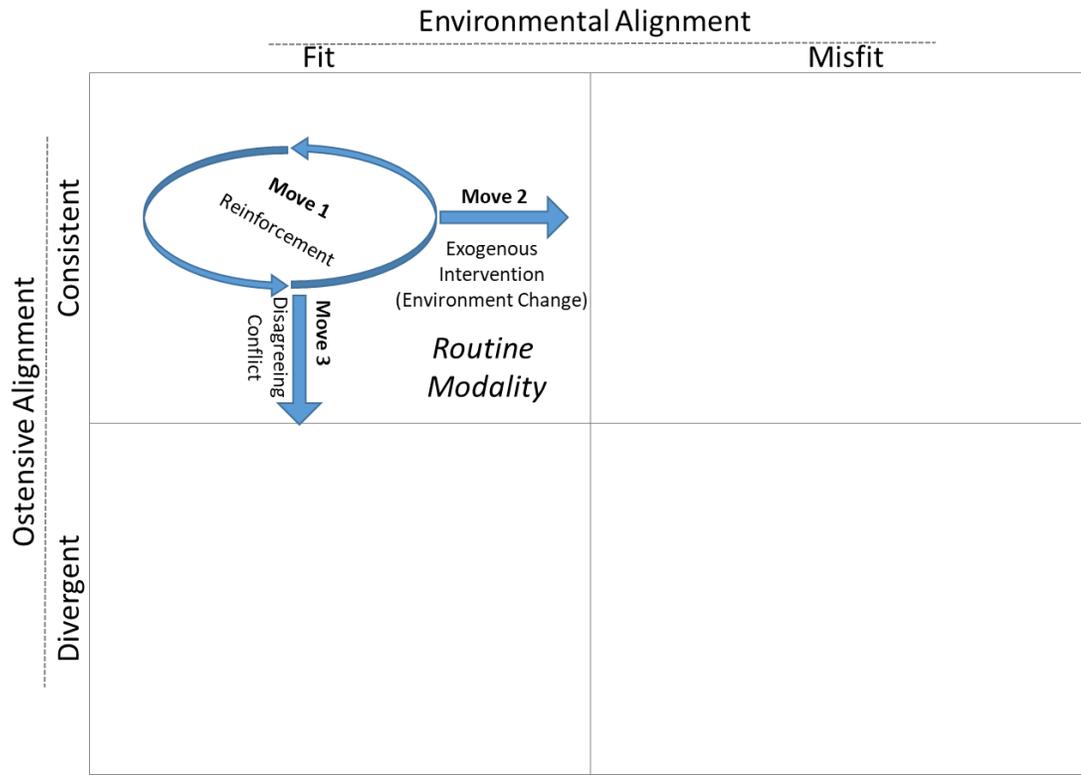


Figure 20. Moves within the Routine Modality.

3.5 Applying the Performative Modality Typology as a Conceptual Framework: Revisiting our Research Question

“[Frames (metaphors, perspectives, lenses, schemata, etc.) are] windows on the world and lenses that bring the world into focus”
 (Boalman & Deal, 1991, p. 11).

Fundamental to our thesis is the assertion that digital technology introduction disrupts established routines and that our understanding of the process through which such

disruptions are resolved to produce renewed routines is not well understood. A framework through which to understand that interaction between organizational routine disruption and renewal processes will advance our ability analyze IT impacts on organizational effectiveness and performance. To date, we are aware of no research that directly addresses this line of thought. Therefore, we look to produce a work of exploration.

Building theory about the relationship between information technology and forms of organizing, such as we have with routines, inevitably leads to contemplating the relationship between the material and the social (Leonardi & Barley, 2008). As indicated previously, it is well established that technology, as a material effect, does not fully determine behavioural outcomes. Many authors have highlighted that, despite the materiality of technology, their use is emergent from social processes (Burton-Jones, 2005; Jaspersen et al., 2005; Saga & Zmud, 1993; Tennant et al., 2013). Various subgenres of this view exist, such as those focusing on negotiation (Constantinides & Barrett, 2006; Howcroft & Wilson, 2003), human agency (Boudreau & Robey, 2005; Vaast & Walsham, 2005), and personal interest (Kling, 1992; Markus & Benjamin, 1996).

... there is general agreement that information technology and organizations both arise at the intersection of social and material phenomena. What remains unresolved, however, is the epistemological and ontological nature of the relationship between the material and the social and, hence, how information technologies and organizing are tied.” (Leonardi & Barley, 2008, p. 160)

By using the organizational routine lens and theory, we focus on a specific instance of social phenomena, that of the ostensive structure of routine and the environmental conditions in which the ostensive is performed. By viewing routine change as a progression through various moves between dialectic modalities, we explore the introduction of technology from the perspective of routine disruption and renewal.

Revisiting our objective of investigating how organizational routines change in response to technology initiated disruption and renewal, we utilize our four dialectic modalities and associated moves to frame the introduction of technology and resulting organizational routines response.

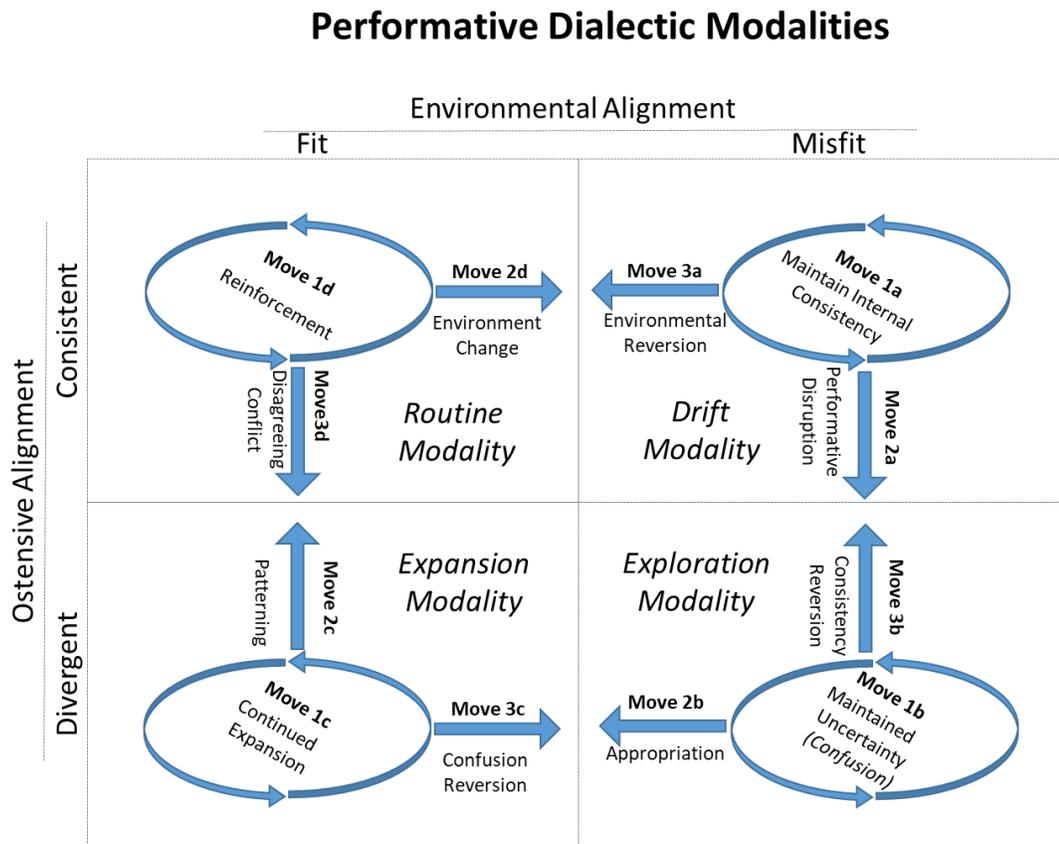


Figure 21. Summary Typology of Dialectic Modalities and Moves.

Building from conceptions of usage as a negotiation, we now view IT usage as the negotiated order between the ostensive, the performative, and the material. Arranging our topological framework as a temporal model of moves between dialectic modalities, we find the following progression:

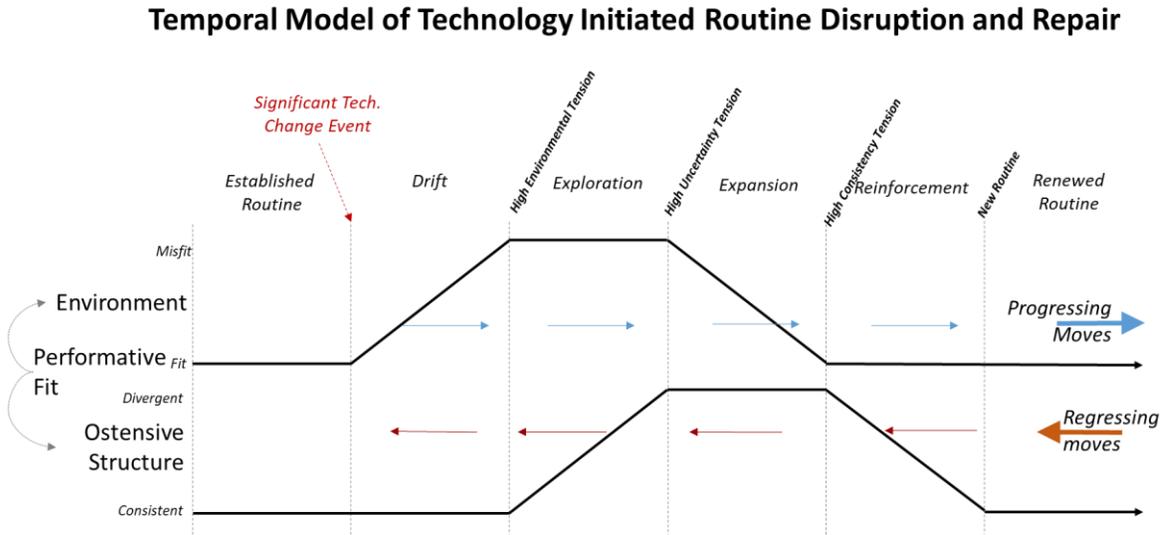


Figure 22. Temporal model of technology initiated routine disruption and renewal.

We describe progress, or resistance, to a technology introduction using a routine change lens. Using this framework, technology initiated routine disruption and renewal of established routines requires a progression through four necessary dialectic modalities. Starting from an established routine, the exogenous introduction of technology changes the environment within which the established routine is performed, initiates a move into the “drift” dialectic modality. In this modality, a lack of fit between the routine performativity and the environment creates dialectic tension that must be endured or resolved. Options to resolve include changing the environment to better fit the existing routine structure, holding

this drift, or disrupting existing routine patterns. Once disrupted, the routine enters the “disrupted” modality. In this modality, routine performances are divergent from the ostensive structure and thus routine performances are by definition non-routine. This results in generating uncertainty as dialectic tensions rise between both the environmental fit, and the need for consistency with established routine ostensive structure. At this stage, the routine can either remain unresolved, fall back to “old ways”, or to develop and recognize new appropriate new patterns of action. Moving “forward” from uncertainty requires group praxis to identify new appropriate behaviour, and from this, re-establish experience that becomes the new foundation for an updated ostensive structure. This results in a move into the “expanded” modality. Over time, as newly appropriated patterns continue to be enacted, the ostensive structure is updated and strengthened, and, thus, results in the establishment of a renewed routine, and move to the “routine” modality.

3.6 Revisiting our Research Questions

The relationship between technological and social change is fundamentally indeterminate. The designers and promoters of a technology cannot completely predict or control its final uses. There are always unintended consequences and unanticipated possibilities.

(Wajcman, 1995, p. 199)

With increasingly flexible technologies, the possibilities for usage patterns afforded by the technology exceeds actual patterns of usage seen in practice (Leonardi, 2011). There are

often many different ways to accomplish the same task, all with relatively equal efficiency, and the interpretation of both the effectiveness and appropriateness of these different options is a product of group dialectics between consistency with past actions and interpretation of environmental fit.

As our discussion has indicated, though routines were initially conceived of a static patterning of work, contemporary theories of organizational routines conceive of routines as dynamic and generative (Feldman et al., 2015; Parmigiani & Howard-Grenville, 2011; Pentland et al., 2012; Pentland et al., 2011; Pentland & Feldman, 2005; Rerup & Feldman, 2011). An important, and underexplored aspect of technology value generation is in our understanding of group *use* in response to technology introduction and change. In our framework, we view such changes disrupting the structures embedded within existing organizational routines (Feldman et al., 2015; Slaghuis, Strating, Bal, & Nieboer, 2011). Through investigation of the theoretical underpinnings of technology initiated routine disruption and renewal, we generate new understanding surrounding the conception of group-level IT use, and resulting value generation. Although some exploration of routine disruption can be found within the literature (i.e. as workforce downsizing (Brauer & Laamanen, 2014), loss of individual skillsets and knowledge (Bloodgood, 2012), external agent influence (Hansen, n.d.), shopping behaviour (Ong, 2006), and mergers and acquisitions (Safavi, 2013)), little exploration into technology initiated routine has been found within the literature^{xlviii}. Our theoretical framework addresses what we see as significant gaps in contemporary routines theory and within our theoretical understanding of IT use.

Our point of departure from the typical “evolutionary view” of routines is to develop a framework that describes routines as a phenomenon of an ongoing dialectic truce, or synthesis, between consistency and environmental contingencies. We extend Van de Ven and Poole’s “dialectic change” to introduce a model of four modalities of dialectic routine change, and use this to develop a theoretical frame through which to model and describe technology initiated routine disruption and renewal.

Revisiting our questions identified in the initial introduction of this thesis:

- How do organizational routines respond to technology initiated organizational routine disruption?
- How can we best describe and model the process through which organizational routines renew/reform after such disruptions?

Viewed as a set of dialectic tensions and moves, rather than a state, we posit that further exploration of IT usage behaviours by groups will be illuminated through further inquiry into the dialectic processes through which groups create new actions and vet these actions against past actions and the current environmental conditions.

3.7 Summary

In this chapter, we build upon our critique of the literature (Chapter 2) and develop a dialectic view of organizational routine change. Moreover, we identify two key dialectics;

the environmental dialectic (between performance and environmental fit, or misfit) and the ostensive dialectic (between performance and ostensive consistency, or novelty).

In the following chapters, we elaborate our research design and method (Chapter 4), detail the organizational content from which our data is collected (Chapter 5), review the data collection process and summarize our data (Chapter 6), present our analysis and findings (Chapter 7 & 8), discuss our findings (Chapter 9), and conclude with future research, contributions, and limitations (Chapter 10).

^{xxxix} “No man ever steps in the same river twice, for it is not the same river, he is not the same man” Heraclitus of Ephesus, *On the Universe*, Fragment 41, quoted in Plato, *Cratylus*.

^{xl} “All things are wearisome, more than one can say. The eye never has enough of seeing, nor the ear its fill of hearing. What has been will be again, what has been done will be done again; there is nothing new under the sun” *Ecclesiastes 1:8-9* (The Bible: New International Version).

^{xli} A “Hobsonian Choice” is an allusion of choice between multiple options, when only one option is real. A famous example is the Ford’s model T car, where “You may pick a color, so long as it is black”. Thus, in the context of routines, the analytical choice of ostensive or performative is an allusion, and the only real option is to accept the routines as an inseparable whole, or choose another unit of analysis.

^{xlii} Even in Nelson and Winter’s work, which introduced the evolutionary theory of routines, we find caution in applying it as an ontological stance on social organization: “We emphatically disavow any intention to pursue biological analogies for their own sake, or even for the sake of progress toward an abstract, higher-level evolutionary theory that would incorporate a range of existing theories. We are pleased to exploit any idea from biology that seems helpful in the understanding of economic problems, but we are equally prepared to pass over anything that seems awkward, or to modify accepted biological theories radically in the interest of getting better economic theory” (Nelson & Winter, 1982, p. 11).

^{xliii} Betsch, Fiedler, & Brinkmann (1998) operationalize routines as a repertoire of behavioural options individuals draw upon when faced with decisions.

^{xliv} Archer (1982) criticizes structuration as “ever a process and never a product”(p. 457).

^{xlv} Early versions of this typology used the related terms of deterministic versus voluntarist (Astley & Van de Ven, 1983).

^{xlvi} “Social constructivists [...] generally hold that organizational change emerges out of an ongoing stream of social action in which people respond to [...] constraints and affordances, as well as to each other” (Leonardi & Barley, 2010, p. 5).

^{xlvii} Such a material world is part of the ‘totality’ (see Bhaskar (2008), Archer, Bhaskar, Collier, Lawson, & Norrie (2013), and Feenberg (2002)) in which the routine is performed. Similarly, though the macro social influences within which a routine are performed can be argued as somewhat affected by the formation of routine, these affects are so far removed from such actions as to be considered exogenous, and also part of the totality in which a routine is performed.

^{xlviii} This sparse literature indicates only one recent investigation into technology initiated disruption (Garfield & Dennis, 2012), but this work focuses specifically on group development.

Chapter 4: Research Design

The guiding objective of the research is to expand our understanding of the problems and difficulties organizations have in achieving anticipated outcomes from technology investment through exploring the emergent process of technology initiated routine disruption and renewal. Given the established importance of routines in supporting organizational success (Becker, 2004; Cohen et al., 1996; Gong, Baker, & Miner, 2005; Lewin et al., 2011; Pentland & Feldman, 2008a), the lack of prior research in this area represents a significant gap in our current understanding. We are motivated by this paucity to develop a novel explanatory framework through which we can establish new lines of investigation into this problem. In response, as indicated in the previous chapter, we look to establish an interpretive frame (Typology of Dialectic Modalities of Routine Change) and an associated temporal process through which we can generate new understanding about how technology initiated routine disruption and renewal occurs, or is impeded (Temporal model of technology initiated routine disruption and renewal). The purpose of this study, therefore, is the development of lenses to serve as a “theory for analysis and description” (Gregor, 2006, p. 619) technology initiated routine disruption specifically through the lens of dialectic discourse.

In this chapter, we detail our approach and objectives, discuss the research design and methodological choices that guides our investigation, and discuss data collection, sampling and analysis. Finally, we conclude with a reflection on research challenges and limitations.

4.1 Overall Approach

Following Yin (2013) and Creswell (2002), we employ a qualitative inductive case design to explore a recent real-world case of technology initiated routine disruption and renewal. The context for this study is The Ottawa Hospital (TOH); a large teaching and research hospital that recently introduced a new information system that has generated disruption and renewal of deeply embedded organizational routines. The specific routine under investigation is the blood specimen collection order processing conducted by nurses.

Following a theoretical sampling approach (Eisenhardt, 1989; Müller & Olbrich, 2012; Pennink, 2010), we selected this setting for its interest, significance, accessibility, and potential to generate new theoretical insights. Theoretical sampling is appropriate for our research, as the purpose of our research is to develop new theoretical insights, and not to test theory (Eisenhardt & Graebner, 2007). Furthermore, with respect to the subject chosen, the prevalence of hierarchical structures found in hospital work practices facilitates the strong expression of dialectical tension and discourse and thus provides valuable empirical evidence to support an expanded understanding of technology initiated organizational routine's renewal and change. We posit that healthcare routines are particularly interesting due to their visibility in practice, and for the escalating forces of change being placed on these routines due to the expanded use of technology in the performance of healthcare work (Wachter, 2015). The hospital setting, arguably, represents one of the strongest expression of the contrast between the need for consistent, standardized, execution of work coupled with the need for novelty and insights generated in the moment and context in which the

work is performed (Park, Chen, & Rudkin, 2015). This context represents an almost ideal empirical embodiment of current modern conceptions of routines, conceived as both consistent and under constant change (see the Ecclesiastes vs. Heraclitus reference used in Pentland et al., (2011), Dosi & Egedi, (1991), Cohen, (2007), Turner & Rindova, (2012), Birnholtz, Cohen, & Hoch, (2007), Cohen, (1999)).

Using thirty-one semi-structured interviews, the primary data collected is narrative accounts of the disruption and renewal of established work patterns in response to a recently deployed Computerized Physician Order Entry (CPOE) system. Such narrative accounts capture evidence of group-level processes through which the “flux” (Weick et al., 2005, p. 411) of change events are structured and processed by organizational groups.

Guided by thematic analysis (Riessman, 2008), and narrative network analysis (Pentland & Feldman, 2007), individual narrative accounts are analyzed to explore theoretical explanations as to the process through routines are disrupted and renewed in the face of significant technology-induced change. These interviews are transcribed and analyzed using qualitative coding methods defined by (Saldana, 2012) and Pentland & Feldman, (2007). Using semi-structured interviews as the primary data collection instrument, participants of our selected routine of study are prompted to explain and account for the disruption in their routines in response to recently introduced technology. This interview data includes details of their experience with (1) performing past routines, (2) performing new routines, and (3) the experience of moving between these two routines. The data derived from this narrative analysis is augmented where necessary in order to help achieve

theoretical saturation. This data includes archival data (CPOE event logging), system design documentation, and project documentation.

We offer that following schematic of our overall approach (Figure 23).

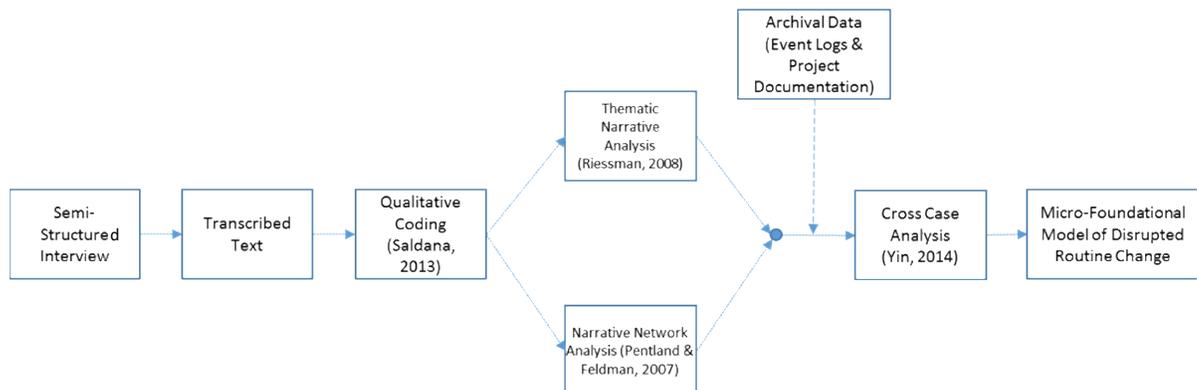


Figure 23: Summary model of research process

A key premise underlying our selection of an individual-level focus for our research design is that routines represent structure in both individual conception (ostensive) and in the performance of work activities (performative), and that effortful change in routines necessarily results from individual participants *choosing to do otherwise*^{xlix} but doing so under the constraints and influence of routine structure, accumulated behaviour, and environmental influence. As per the interpretive framing found within our Typology of Dialectic Modalities of Routine Change, we look to investigate the shaping of group behaviour as expressed through key dialectics and discourse.

4.2 Exploratory Research Design

We utilize an exploratory case design to support our objective of developing a theoretical understanding of technology initiated routine disruption and renewal. An exploratory case study is an empirical inquiry that investigates a phenomenon within its real-life context (Yin, 2013). Exploratory case studies are considered appropriate for the theoretical exploration if there is little currently known about the phenomena (Eisenhardt, 1989). As indicated in our literature review, though the problem of technology deployment is well researched, there has been very little investigation into the role, and response, of organizational routines in this process. Due to the lack of research identified in the area of technology initiated routine disruption and renewal, the exploratory case study research design approach is most appropriate.

To initiate this exploration, we use an initial theoretical framing device through which to analyze and describe routine disruption and renewal. Such a priori modeling approaches are supported by Dubé & Paré (2003), and offer a number of identified benefits; which include clearer identification of key causal structures (Eisenhardt, 1989) and a reduction of a superfluous, or extraneous, description (Yin, 1981). We look to set the foundation for future work on technology initiated routines disruption by providing a theoretical framework, or lens, through which to extend current routines theory and provide a new path of investigation into IT processual-based research on IT usage and impact. The organizational routines literature is also well established and seeks further refinement at the microfoundational level.

4.3 Field Setting

In late 2011, The Ottawa Hospital introduced significant changes to a number of their key operating routines. The primary focus of this effort was surrounding a set of technologies that support a computerized physician order entry (CPOE) system. Despite a substantial investment, and considerable focus and engagement with all levels of the organization, emerging anecdotal information indicates that many of the typical negative outcomes of large IT projects are, and have been, experienced by TOH. Such outcomes include unintended and unexpected outcomes, pockets of resistance, errors, and localized instances of diminished performance.

The negative outcomes experienced by TOH are similar to those documented in IS implementation within general organizational settings. As has been indicated previously, our specific focus is to generate insights into the underlying dynamics involved in the process of technology initiated routine disruption and renewal. The organizational routine chosen for this investigation is that of the specimen collection routine. We selected this routine due to its well-established role in TOH work practice, and its importance to the overall healthcare delivery process. Such a routine is thus both highly visible, important, and can be expected to generate significant dialectic tension with regard to any technology induced disruption¹.

This research contributes to a larger research initiative directed at exploring the impact of integrated digital care management systems deployment and use in healthcare delivery. This large research project is the result of a partnership between The Ottawa Hospital and

the Sprott School of Business. The Ottawa Hospital’s large investment in new digital healthcare management systems, specifically in their computerized order entry system, serves as a rich field setting through to study the impact technology introduction has on established organizational routines.

The “Value Realization Cycle” (Grant & Collins, 2016) provided coordination between the disparate research efforts from a number of Sprott Researchers working independently on this larger initiative.

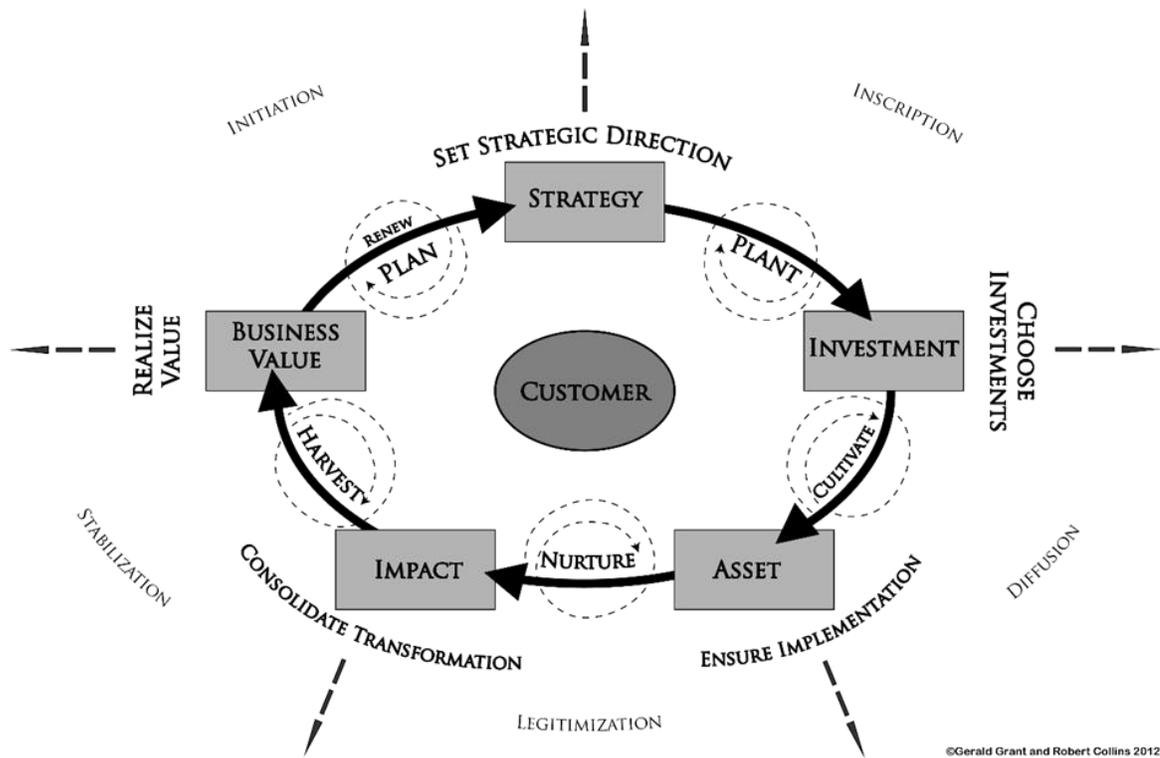


Figure 24. Value Realizing Cycle (Grant & Collins, 2016).

This thesis specifically focuses on generative insights into our understanding of the transformation from asset through to impact (specifically, the micro-foundational analysis

of the “nurture” process as indicated within the Value Realization Cycle). As indicated in Chapter 1, CPOE systems are deployed within hospitals under the expectation of improved quality of information, decreased response time for orders, removal of information sharing obstacles, and reduced overall costs for service healthcare delivery. However, in order for CPOE system to be effective, its *use* must be incorporated into established work patterns (Soh & Markus, 1995). Such an incorporation process necessitates the disruption and renewal of established organizational routines. A failure to accomplish both disruption and renewal of these routines can be expected to result in diminished performance, quality of work outcomes, and, in some instances, an outright rejection of the technology.

The specific participant roles which we sample are that of nurses. We have chosen to target this role both for convenience of access, and more significantly, the impact this technology deployment has had on this particular role relative to the specimen collection routine – for which this role has had substantial experience in both prior to, and after, the introduction of the deployed CPOE system. An initial high-level workflow documenting this process has been supplied by TOH (Appendix F). Orders within the CPOE system are handled and transferred between a number of internal information systems. Nurses engaged in the blood collection routine are responsible for the scheduling, collection, and documenting within the system the details of a blood collection event.^{li} Further information on the routine under investigation will be outlined in Chapter 5.

4.4 Data Collection

Data was collected through interviews with thirty-one nurses, three doctors, and one interview each with a lab administrator, a clerk, and a nurse manager. A total of 864 minutes of recorded audio was collected (see Table 1).

	Minutes	Words Transcribed
Nurse Interviews	661.00	125,242
Doctor Interviews	81.00	13,766
Clerk	23.00	4,788
Lab	20.00	3,252
Nurse Manager/Administrator	15.00	2,626
Observational Notes	64.00	10,432
Total	864.00	160,106

Table 1: Summary of interview minutes and word counts

The primary empirical approach adopted in this study is similar to what Cohen et al. (1996) define as longitudinal empirical study, that is:

Thus, while field observation will always be of major value, the high costs there suggest that some effort should go into other approaches. An alternative is what were called longitudinal empirical studies: work on routine elements of action in an organization over years—or, even decades—of existence. Here the research method is not direct observation, but rather reconstruction from the organization's written and oral histories. (Cohen et al., 1996, p. 681)

The focus of this study is directed at identifying “oral histories” through the collection of participant narrative accounts of the blood collection both prior to the introduction of CPOE technology, through to the 2+ year use within practice. Since our approach utilizing more than one level of analysis (the ward, the specimen collection routine, and individual members of the nurse team commonly engaging in the specimen collection routine performance, and environmental forces which may be included to help explain observed behaviour), our research design can be best describe as “embedded” (Yin, 2013, p. 39).

The unit of analysis for this study is that of the specimen collection routine. As addressed in Chapter 3, organizational routines are the result of emergent social constructive processes and environmental influence. Our goal is to understand and present an analytical lens to describe and investigate the disruptive effects of technology introduction on existing established routines. The specimen collection routine is both well established and deeply impacted by the introduction of CPOE systems. This routine, therefore, represents both an appropriate and rich empirical unit from which to explore the disruption and renewal process through which such strong routines proceed in response to significant technology introduction.

Following Geoff Walsham (1993), our methodological approach uses an initial model as a theoretical framework to guide data collection and analysis. To assist in achieving analytical validity, we included interview participants from a number of shifts. Though each shift exists as an organizational unit within a single organization, they represent a separate social setting with different environmental characteristics. Though sampling from

multiple shifts assists in analytical validity, we classify our approach as single-embedded case (Paré, 2004).

The establishment of our empirical evidence involves the capture of individual narrative accounts of user experiences during the introduction and subsequent long term (3+ years) use of a newly introduced CPOE system. Participants selected for interviews included those nurses that have experienced the pre-technology introduction routine for at least one-year prior to the introduction, and have continued with the routine for at least one-year post introduction. Thus, sampled individuals had both considerable experience in pre-technology introduction forms of the routine, and significant experience with the emergent construction of new routine work patterns.

Typically, in quantitative statistical research, sampling is the process of selecting a small number of units of observation to draw conclusions about the entire population (Sreejesh, Mohapatra, & Anusree, 2014). In the case of theoretical sampling, the goal is to instead achieve sufficient theoretical saturation (Eisenhardt, 1989). Such sampling approaches are iterative and are considered sufficient when the marginal improvement, or contribution, to the theory being developed becomes small (Maimbo & Pervan, 2005). Our initial expectation for this study was to achieve theoretical saturation within twenty interviews. Our request to TOH is to make available twenty nurses who meet our experience criteria, and as we discuss in Chapter 5, the actual number of nurse participants was thirty-one.

Field data was collected using the field protocol outlined in Appendix C. Narrative accounts of Nurses' experience are collected via semi-structured interviews as detailed in

Appendix D. Interviews were recorded using Zoom H2 recording device and Samsung Note 4. The use of two recording devices helped to eliminate technical issues with recording, and allow for an alternative microphone placement to offer a different auditory perspective to assist in transcribing any difficult to hear content. Consistent with the ethics approval, and as outlined in the interview protocol, all audio recordings are securely stored for the period necessary to complete this research, and will be destroyed thereafter.

All electronic documentation, including both transcribed interview data, and relevant system and project documentation, and field notes are loaded into the NVivo computer-assisted qualitative data analysis software (CAQDAS). NVivo was used to support all coding and analysis conducted. Each narrative account was categorized based on both “tombstone”^{lii} information in initial assessment of perspective towards the system. Such categorization can allow for intergroup comparison if further identification of such contextual factors is deemed necessary to achieve saturation. Each of the interview subjects is stored as a unique node within NVivo. All peripheral information such as system documentation and field notes is included as sources in the NVivo project.

4.5 Evaluative Criteria: Validity and Reliability

The achievement of objectivity in qualitative data analysis requires a focus on two aspects: reliability and validity. Objectivity is therefore achieved through realizing as much reliability and validity as possible (Kirk & Miller, 1986). Reliability involves

demonstration that the steps of the study can be repeated with the same results (Yin, 2003, p. 24), and thus yield consistent answers independent of any varying circumstances in research context (Kirk & Miller, 1986).

Validity, by contrast, is not concerned with repeatability but instead requires the valid matching between measurements and the target of measurement. If a measurement is valid, it must be a true representation of the phenomena measured. To illustrate, we can imagine a bathroom scale that, over multiple sample measurements of a given weight, remains consistent in its reading. Since the bathroom scale produces consistent measurements, we can say that it is a reliable weight measuring device. But, if the calibration adjustment of the scale is off by 5kgs too high, the measurement results are not valid.

The literature segments validity into two aspects, internal and external validity (Yin, 2013). Internal validity (aka “logical validity”) is what Yin (2003) refers to the validity of the relationships between observations. To achieve internal validity “the researcher provides a plausible causal argument, [and] logical reasoning that is powerful and compelling enough to defend the research conclusions” (Ruigrok, Wicki, & Gibbert, 2008, p. 4). Such validity occurs not only in the initial argument for theoretical framing, but also in the rigorous analysis and development of conclusions from empirical results. This can be achieved through iterative refinement of an initial research framework in response to findings (Miles & Huberman, 1994) and by presenting documentation of a rich case descriptions prior to presenting analysis and conclusions (Shenton, 2004, and Yin, 2013). Responding the literature guidance, we address internal validity by presenting a rigorous (and possibly pedantic) discussion on the derivation of the initial model in Chapter 3, provide a detailed

case description (Chapter 5), detail the enacted data collection process and context (Chapter 6), and provide a detailed analysis and refined model based on data collected (Chapter 7 &8). This collective documentation will demonstrate the necessary application of a rigorous approach to our analysis (Saldaña, 2016).

With regard to external validity, our goal is not to achieve empirical generalization but rather to achieve “analytic generalization” (Yin, 2013, p. 11), contextual generalization (Tsang & Williams, 2012) and to move from empirical description to theoretical framing (Lee & Baskerville, 2003). This approach represents an acceptable method of generalization within case-base qualitative exploratory studies with the field information systems research (Klein & Myers, 1999; Paré & Elam, 1995, 1997; Tsang & Williams, 2012; Walsham, 1995).

Our objective is to develop a theoretical framework that can serve as an analytic lens to adequately describes routine disruption and renewal, and such approach (by contrast to typical confirmatory analysis) does not involve, or require, the enumeration of frequencies to achieve statistical generalization. Though our goal is not to prove generalizability, nevertheless, we do offer assistance to future researchers. To assist future researchers in evaluating the analytical generalization afforded by this study, we will provide a detailed case review (see Chapter 5), details surrounding data collection results (see Chapter 6) and analysis with a detailed description of the process through which conclusions were drawn (see Chapter 7). These three chapters, adequately documented, fulfill the goal of “analytic generalization” as described by Yin (2013).

4.6 Summary

In this chapter, we have outlined our research design and methodological approach and its implication to our study context. We utilize an exploratory case study design to support the development of a novel theoretical orientation. Our primary instrument for data collection are semi-structured interviews, and augmenting data includes press clippings, white papers, design documents, training documents and internal presentations and communication. Analysis of data will include narrative network analysis and thematic narrative analysis. The sampling method is theoretical, and it is estimated that we will require a minimum of twenty narrative accounts to reach saturation.

In the following chapters, we will provide a detailed case overview (Chapter 5), data collection process and experience (Chapter 6), write up of qualitative analysis and results (Chapter 7 & 8), discussion of results and implications (Chapter 9), and finally research conclusions and indications for future research (Chapter 10).

^{xlix} See Anthony Giddens's (1984) comment that, despite the structural properties of society that influence individual behaviour, people (or agents) can always choose to do otherwise.

ⁱ Details about this routine are fully elaborated in the following chapters.

ⁱⁱ As part of the data collection process, further details surrounding TOH's process documentation and system design will be collected. The provided documentation in Appendix F was designated a "high level design", supplied to us by TOH.

ⁱⁱⁱ To help anonymity, the use of "tombstone" data will be restricted to one of three categories representing experience, along with any details surrounding shift and location generally worked.

Chapter 5: Research Setting/Case Background &

Description

The purpose of this chapter is to elaborate on the case that serves as the empirical context for our investigation. Qualitative research requires the reader's engagement in the process of interpretation (Riessman, 2008), and therefore, to provide context for this analysis we elicit key features of the environment within which the routine under investigation is enacted. We accomplish this by outlining the contextual details surrounding the technology initiated routine disruption event using micro-, meso-, and macro-sociological research classifications to frame the contextual setting.

5.1 Routine Under Investigation

The specific case under investigation is that of a technology initiated routine disruption event initiated by the introduction of a new Computerized Provider Order Entry (CPOE) system at The Ottawa Hospital (TOH) – specifically, a blood specimen collection routine enacted by nurses within the Hematology-Oncology Unit of the TOH (Unit 5 West). This empirical context is used to generate insights into the general challenges of group practice change from an organizational routine perspective. Moreover, we apply our proposed dialectic modalities lens to generate new understanding of the dynamic nature of routine change in response to technology introduction and adoption within a large organization.

The blood collection routine enacted by nurses of the 5-West Unit serves as a representative instance of the more general phenomenon of technology-led change. We assert that this empirical context exhibits common processual characteristics found in general information technology initiated disruption events. This research is expected to open significant new opportunities to better understand issues of technology adoption and acceptance (Agarwal, 2000; Burton-Jones & Hubona, 2005; Davis et al., 1989; Venkatesh et al., 2003), value generation and success (Chan, 2000; DeLone & McLean, 1992, 2003), technology use (Burton-Jones & Straub, 2006; Andrew Burton-Jones, 2005; DeSanctis & Poole, 1994), project failure (Aldarbesti et al., 2015; Markus & Robey, 1988; Markus, 1983), and unexpected results (Orlikowski, 2000; Tenner, 1997).

5.2 The Embedded Context: Introduction to Macro, Meso, and Micro Levels

In Chapter 6 and 7, our analysis will work to open the “black box” of organizational routines, but for this chapter, we will further elaborate on the embedded context within which the blood collection routines were enacted by nurses of 5-West unit.

Using social ontology, we situate the 5-West blood collection routine within three contextual levels: the micro, meso, and macro levels. The micro level represents the local organizational context within which nurses perform their blood collection routine, in this case, the Hematology-Oncology Unit, 5-West. We further situate this local context within

the larger organizational context of TOH and situate this organizational context as embedded within the more expansive socio-economic context of Canadian healthcare.

Following the perspective of critical realism (i.e. Bhaskar, 2008, and Archer et al, 2013), we organize the identified contextual structures as an interrelated social construction; however, as assumed by critical realism (versus “pure” social construction theory), there exist structures that are relatively immutable from the perspective of lower contexts. With the aid of a model of concentric circles (see Figure 25), we define the micro context as the one most affected by, and most influential on, the routines which they are enacted within. As we move further out from this local context, meso structures and macro structures are those increasingly immutable fixtures of the contextual environment – i.e., relatively unaffected by divergences in the performance of the isolated routine within a local or micro context – but nonetheless influential on the localized routine disruption and renewal processes.

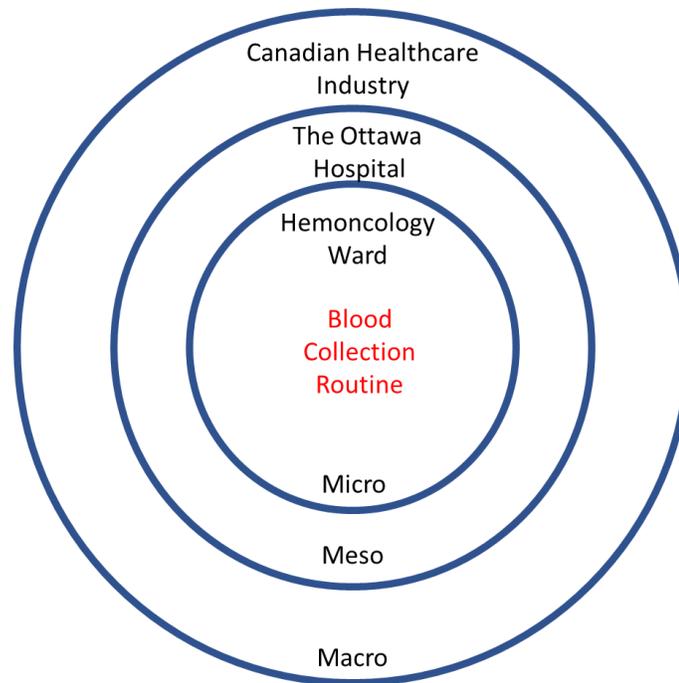


Figure 25. Micro^{liii}, meso, macro contexts.

5.3 Macro-Context: Canadian Healthcare

The Canadian healthcare industry must continually adapt to a rapidly changing context, and challenges including both an increasing frequency of healthcare use and the need for continued expansion of diagnosis and treatment procedures. In response to these and other related challenges, many healthcare organizations deploy integrated health information technology solutions to help increase overall healthcare process efficiencies. These efforts have resulted in a new classification of information technology, which is often referred to as Health Information Systems (HIS) ^{liv}.

Canadian healthcare is funded at both the provincial and federal levels. The financing of Canadian healthcare investment is provided via personal and corporate income taxes, and

in some provinces, revenue from sales tax and lottery proceeds. Federal funding is provided directly to the provinces via Canadian Health and Social Transfer payments. The federally allocated healthcare funds are administered by the provinces but federal funds also include various stipulations on spending to help facilitate national healthcare policies. Friction between provincial administration of health care spending and national policies often occur and are often leveraged in larger political agendas (“Health Care and Politics”, n.d.).

One of the key challenges at this level is the increasing cost of delivering healthcare. In 2016, total health expenditures in Canada were estimated at \$228 billion, or \$6,299 per person. This represents approximately 11% of Canada’s GDP (“Canadian Institute for Health Information: Health Spending”, n.d.). By contrast, total healthcare spending in 2001 was \$3,300 and represented just 9.5% of GDP. As we can see in Figure 26, “Total Canadian health expenditures as a percentage of GDP, 1975 to 2016,” the growth of healthcare spending as a portion of GDP is alarming.

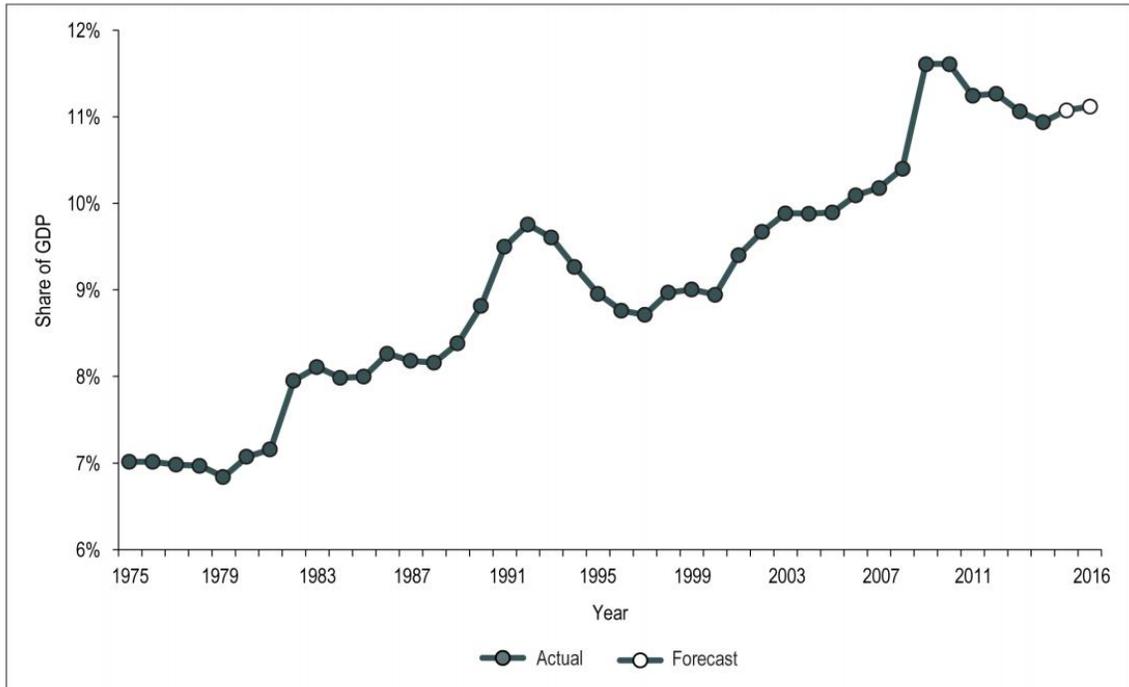


Figure 26. Total Canadian health expenditures as a percentage of GDP, 1975 to 2016. (Source: National Health Expenditure Trends, 1975 to 2016, 2016).

In response to these increasing costs, policy-makers have been struggling to identify new efficiencies. Various organizations, such as the Canada Health Infoway (CHI)^{iv}, have been formed to deliver on policy directives and to ensure greater use of information technology in healthcare. Under this the policy umbrella of “Digital Health”, defined by CHI as the use of “ICT to deliver healthcare services or facilitate better health” (“What is Digital Health”, n.d.), CHI administers a program that encourages the deployment of electronic healthcare record systems by healthcare providers across Canada.

Within this macro context, we find investment policies which assume technology as a tool through which performance and quality can be improved within the national healthcare sector. Over time, as exhibited by the many digital health initiative challenges, it is clear

that the execution of these policies requires much more than investment in infrastructure. As current United States President Donald Trump was recently quoted, “Nobody knew health care was so complicated”, and the implementation of such policies has proven to be exceeding complex.

Despite the expectations that HIS/HIT will help alleviate growing healthcare costs, a key impediment to achieving results has been the slow adoption of this technology by Canadian healthcare institutions. Despite substantial federal investment in HIT through CHI, Canada continues to lag behind other countries in the adoption of public electronic health information systems.

5.4 Meso-Context: The Ottawa Hospital and CPOE Project

Within this large macro context of Canadian Healthcare, we situate The Ottawa Hospital (TOH). This meso-level context consists of the organizational and system levels – and includes relevant organizational features and systems within which the micro context is embedded.

5.4.1 The Ottawa Hospital

TOH is a 1,200-bed hospital facility located in Ottawa, Canada. Formed in 1998 through the merger of five different health institutions, TOH is also one of the largest academic teaching hospitals in Canada. The hospital employs over 12,000 people, including over

1,500 physicians across three campuses (see Figure 28), Civic, General, and Riverside, and one cancer center (The Irving Greenberg Family Cancer Centre).

As indicated in the infographic found in Figure 27 – TOH Overview, TOH uses a number of key metrics and comparisons to indicate overall organizational performance. Interestingly, as well, is the great focus TOH seems to place on publishing project and performance success. Promoting such success would seem to be a key aspect of maintaining and reinforcing the overall organizational identity and image of TOH as a leading Canadian Research Hospital.^{lvi} Such public reporting can be seen as increasing the institution's legitimacy in the digital healthcare space, which in turn affords the organization the resources necessary to continue to invest in such technologies.



Figure 27. TOH Overview (Source: www.ottawahospital.on.ca, accessed February 20th, 2017)

 CIVIC	 RIVERSIDE	 GENERAL
Civic Campus	Riverside Campus	General Campus
Cardiology Emergency Department Family Health Team Mohs Surgery Clinic Neurosciences Regional Geriatric Program for Eastern Ontario Spinal Surgery Trauma Services University of Ottawa Skills and Simulation Centre (uOSSC) Vascular Surgery Weight Management Clinic – Bariatric Centre of Excellence The Ottawa Hospital Breast Health Centre	Arthritis Centre Eye Care Centre Family Health Team Foustanelas Endocrine and Diabetes Centre Nephrology Shirley E. Greenberg Women's Health Centre	Bone Marrow Transplant Chest Diseases Centre Emergency Department Regional Cancer Program Rehabilitation Centre Robotic Surgery Thoracic Surgery Total Joint Replacement University of Ottawa Eye Institute
Across the campuses		
High-risk obstetrics and prenatal services Mental health Minimally invasive surgery P.A.R.T.Y. (Prevent Alcohol and Risk-Related Trauma in Youth)		

Figure 28. TOH Campus Specialties and Services (Source: www.ottawahospital.on.ca, accessed February 20th, 2017))

5.4.2 Mission and identity

TOH is a teaching and research hospital, and their tag line is “Inspired by Research. Driven by compassion”. Their vision is stated “to provide each patient with the world-class care, exceptional service and compassion we would want for our loved ones”. Within the official TOH mission statement (“The Ottawa Hospital: Our Vision”, n.d.), we also find a focus on “technology in the delivery of patient care”, illustrated in their following mission statement:

- *“The Ottawa Hospital is a compassionate provider of patient-centered care with an emphasis on tertiary-level and specialty care, primarily for residents of Eastern Ontario;*
- *The Ottawa Hospital educates future health-care professionals in partnership with the University of Ottawa and other affiliated universities, community colleges, and training organizations; and*
- *The Ottawa Hospital develops, shares and applies new knowledge and technology in the delivery of patient care through world-leading research programs in partnership with the Ottawa Hospital Research Institute (OHRI).”*

TOH entered the early planning stages of CPOE in late 2010. A scaled deployment began in mid-2012 and was rolled-out to individual wards through to mid-2013.

During the planning and deployment stages of the CPOE project, a number of articles and videos were released detailing the CPOE project and TOH’s larger plans and vision surrounding their expanded use of Health Information Systems (HIS). We found throughout this material indications that TOH projects itself as a leader and innovator in the adoption of health information technology. In some of the material targeting a more general population and audience (published in outlets such as the *Globe and Mail*, local news websites, and YouTube), we find a focus on quality of care, innovation, and leadership. In the material directed to more selective audiences, such as specific industry

and government publications, we find material highlighting TOH's focus on topics such as cost savings, error reduction, and streamlining processes to find general efficiencies in their operations. This material indicates two key identities being maintained: that of innovative leader, and that of prudent and competent deployer of new health information technology.

5.4.2.1 Theme one: Innovation and quality focused

Prior to, and during, TOH's CPOE deployment, communications and articles highlighted the project by focusing on themes of innovation and quality. The quotation provided, an excerpt from one of these articles, exemplifies what could be considered an "over-exuberant" positioning of the scope and impact of this technology investment^{lvii} and the technological innovation demonstrated by TOH:

TOH has been one of the boldest health care institutions in North America... spend time at the Ottawa Hospital, and it likely won't take long to catch a glimpse of an e-health digital revolution taking shape... Doctors use iPads for interactive bedside checkups, explaining a diagnosis with digital images of X-Rays, MRIs or other test results. ...Nurses might be spied managing a patient roster on an iPod touch. And even janitors and other support staff members can be seen poking at a small screen as part of their work. (Oliveira, 2011).

Early press on TOH's investment in technology indicates that their pre-deployment infrastructure did not match the organizational identity as an innovative and quality focused

institution. For example, these are some early comments from TOH president and CEO, Dr. Jack Kitts, which indicate this dissonance:

The Ottawa Hospital is in the middle of a five-year, \$100-million technology renewal aimed at turning the organization into one of the most advanced medical facilities in North America.

...

According to hospital chief executive Dr. Jack Kitts, it all started with his chance meeting in 2007 with a Harvard University researcher at a health-care conference. The researcher had presented a study in which he ranked 79 large academic hospitals in the U.S. based on quality of patient care.

Kitts invited the researcher to tour the Ottawa Hospital and rank the health-care facility with those in the U.S. When he was done, the answer was not what the hospital wanted to hear: It was merely an “average” institution.

“We didn’t want to be average,” said Kitts. “We didn’t aspire to be average and didn’t want to stay average.”

(<http://www.pressreader.com/canada/ottawa-citizen/20100502/textview>)

As the TOH's investment in new health information technology progressed to a later CPOE stage of the project, we find the parallel phenomenon of increasing public attention and interest on the potential for information technology to improve healthcare. During this time, the iPad was especially gaining attention among both the public and healthcare industries.^{lviii} TOH's project team seemed to have taken great steps to align this project with the growing enthusiasm surrounding the potential use of iPads in medical practice. This association with Apple's new and innovative device served the project well by helping to infuse their work with the same general interest, excitement, and innovation being generated by Apple for the iPad. This served to both reinforce TOH's image, and generate considerable access to resources to make the project a success:

In the end, the Ottawa Hospital became the **first hospital in the world**, to place an electronic order (CPOE) from a native iPad app on March 27th, 2012. The pilot program's initial problem was solved: physicians were now using CPOE and doing it at an astonishing rate. ("4000 iPads At Ottawa Hospital Drastically Increases Quality Of Patient Care", n.d.)

To accomplish this, TOH claims to have employed seventy iOS application developers – such a level of in-house development was unheard of in these initial stages of mobile CPOE. This, we believe, exemplifies the considerable number of resources that were made available by TOH to execute their vision, which aimed to move TOH from a laggard to a leader in HIT.

5.4.2.2 Theme two: Efficiency and productivity

Somewhat in contrast to the first theme, the TOH also positioned the CPOE as a project whereby higher productivity, frugality, and cost savings would be achieved. The focus here is on process change, and that a key motivation and outcome of the technology deployment is to form new efficient process flows. In Dr. Glen Geiger's – Chief Medical Information Officer at TOH and a key leader in the CPOE project – 2012 statements to a parliamentary committee on healthcare and technology investment, he exhibits this more process- and efficiency-oriented focus:

As time has passed, other industries have adopted strategies, technologies, and processes that have allowed them to prosper in ways that the health care system has not been able to do. Therefore, the gap, if anything, has grown wider over time.

...

In the work I'm doing at the hospital as well as work I've done elsewhere and talked about, we're trying to change the fundamental processes by which health care is delivered. Initiatives we have going on at the Ottawa Hospital include electronic ordering, which we don't see as a physician step. We see it as a process change inside the hospital. Our electronic ordering for diagnostic imaging at the Ottawa Hospital is paperless from end to end, from the creation of the order to receipt of the order inside the radiology department, to the execution of

the order, to the speech recognition of the report, to the return of the report to our information technology here on my iPad.

This is how what we're talking about is a process change inside the system. Our lab electronic ordering process is the same. We go from electronic ordering of a lab test to labeling of the blood sample at the bedside by positive identification of the patient, to transporting that sample to the lab, to processing it through the analyzer using the bar-coded information on the sample, to the return of the results to the physician the same way. This is about changes in health care delivery processes. (Glenn Geiger, 2012)

At another parliamentary committee meeting, then TOH CIO Dale Potter mirrored Dr. Geiger's theme of process efficiency and productivity:

[T]he basic step [in deploying HIT] is you need to do is eliminate variability and variation where you can: standardized processes where it's possible.

Once you've done that, you have a chance to use approaches, such as Lean or Six Sigma, or other approaches, to optimize how you do your work. ... Then you get up into behavioral, organizational, and cultural change challenges; performance measurement and performance management; and then managing processes. The ultimate goal is to

proactively manage your resources across the hospital in a predictive way.

We haven't paid much attention to ... eliminating variability in the processes in the hospital. (Potter, 2012)

As TOH's efforts to deploy HIT to generate efficiencies progressed, we see an increasingly "engineering"-like approach to the problem, which included return on investment calculations based on time savings. Dr. Geiger's more recent presentations, for instance, at his 2016 HIMS talk, demonstrates a greater focus on "hard numbers", time and cost savings. In his presentation, Dr. Geiger reviews for the audience the results of a time and motion study conducted on nurses (see Figure 29).

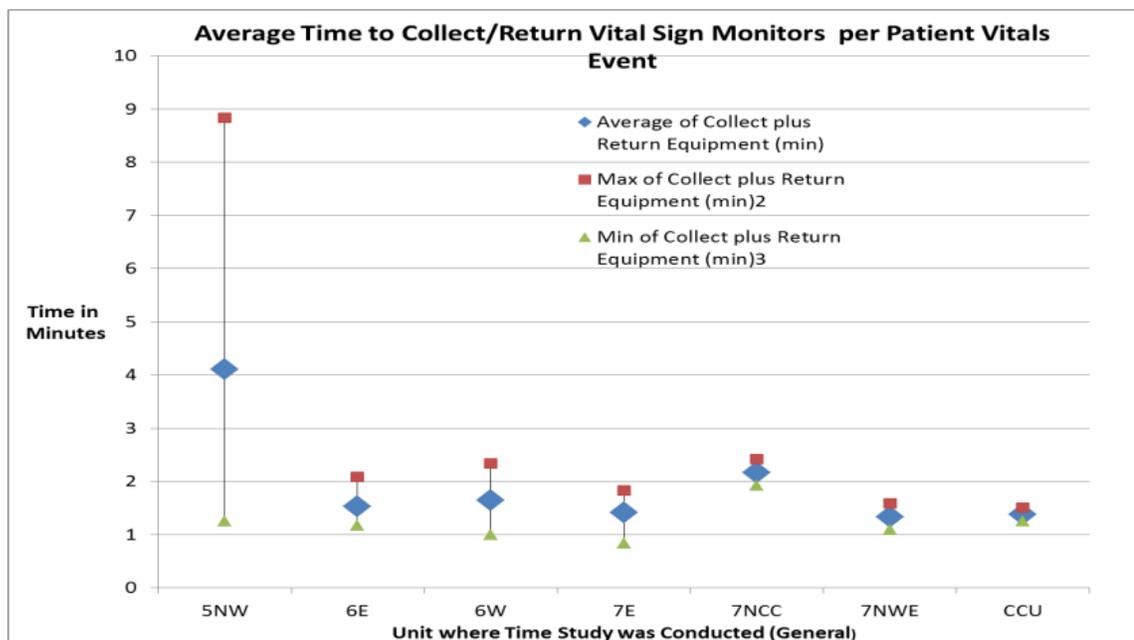


Figure 29. Time and motion study (Source: Geiger, 2016).

Using this time and motion data, Dr. Geiger then derives expected savings of 294,000 hours of nursing time, with an estimated cost savings of \$13.1 million per year. Interestingly, there is no mention of how exactly time savings would be captured as cost savings. Since there is no vision presented as part of this plan to describe how this time would be spent in other areas – for instance, used to expand capabilities and capacities in areas in which they are currently short – this leaves the audience to conclude these savings would be derived from staff reductions.^{lix}

5.4.3 The TOH challenge

The direct challenges that we see in the industry overall, and experienced specifically by TOH, include many of the factors already mentioned: i.e. quality of care, efficiency, and productivity, and a public expectation that large, publicly funded healthcare research institutions be leaders in innovation. As indicated in the many public documents associated with TOH, their organizational identity is partially defined as being a competent healthcare institution in each of these areas. The voluminous content in this area is also indicative of a second indirect challenge: to maintain their prescribed image by measuring and reporting on their success in each of these areas. TOH, therefore, entered the CPOE project with challenges on two key fronts: 1) that of the complex execution of this vision; and 2) that of finding and reporting their success to reinforce and maintain their image.

We further segment and summarize these themes into the following four key areas:

- Funding Pressures (Find cost savings)

- Canadian healthcare institutes are under constant funding pressure and are therefore challenged to find areas in which allocated budgets can be reduced
- Capacity Pressures (Do more)
 - As indicated in the introductory Chapter of this document (Section 1.5), factors such as aging populations and the expanding number of treatment options available to patients are challenging healthcare organizations to “do more”
- Quality Pressures (Make fewer mistakes)
 - As discussed previously, there is a long history of iatrogenic risk within health care. Hospitals are especially under pressure to reduce error rates and improve the overall safety of their delivery processes
- Image Pressures (Report success)
 - Though this may not be directly stated by administration at TOH, the large volume of material directed towards the public promotion of the hospital is indicative of a need, and challenge, for the TOH to reinforce and maintain a consistent image for its stakeholders – that of innovation, leadership, and quality of care as outlined in their organizational vision and mission

5.4.4 The TOH CPOE system architecture and initiative

A common health information technology is a CPOE (computerized provider order entry)^{lx} system, and prior to their CPOE project, TOH had implemented an EMR (Electronic Medical Record^{lxi}) system. Their EMR capabilities are enabled using the OACIS software,

which was customized by the manufacturer specifically for TOH. This system was deployed for two-three years before the launch of CPOE, and serves as the central repository of patient records and transactions of the healthcare process.

Though the OACIS EMR system was a huge step forward for the hospital, orders placed in the system were not directly entered or managed by physicians or nurses. The ordering process primarily remained paper-based, with the transition from paper to the EMR system managed by ward clerks and other support staff.

It is within the EMR context that in 2011 TOH began the second phase of their development, which they referred to as a “hybrid” CPOE system. Though this term^{lxii} is not widely used within the healthcare industry, this architecture and approach is common among many CPOE deployments, whereby new system components are integrated into existing legacy systems, some of which may be non-computerized.^{lxiii} This approach addresses problems in both the complexity of transitioning legacy systems, and the need to continue leveraging specialized information systems such as laboratory information systems, picture archival systems, and scheduling management and billing systems that are widely adopted (Wachter, 2015).

To really understand why a hospital needs a mobility solution, you need to know a bit of history of Western healthcare. Back in the day, nurses and doctors came and met around the patient and talked about the patient’s health. This was incredibly inefficient and the workflow needed to be improved by automation, computers and better systems.

These technological improvements have no doubt helped patients tremendously, but the negative impact is that it has largely moved nurses and doctors to computers and boardrooms, instead of beside patients who are now largely unaware of what's going on and what's wrong with them. ("4000 iPads At Ottawa Hospital Drastically Increases Quality Of Patient Care", n.d.)

The hospital now has 70 IOS developers and the number continues to grow. Concludes Potter: "We recognize that we are entering a new era of IT. The goal is to put data to the point of action." Dale Potter (Greengard, 2011)

The Ottawa Hospital set out to deploy a form of CPOE that incorporated mobile interfaces, and their system was designed to allow certain health professionals, such as doctors, to access the system through devices such as the iPad. TOH started their mobile CPOE system with the objective of integrating the many disparate systems and processes involved in the processing of orders.

To accomplish this integration, TOH required some level of interoperability and integration with **six** key systems:

OACIS

The central system for managing EMRs, OACIS is a proprietary system sold and supported by Telus Health (<https://www.telushealth.co/>), a Canadian subsidiary of the Telus Communications. TOH uses OACIS as an electronic database of patient

information and clinical documentation association with their patients – including computerized orders:

OACIS is a Clinical Information System that provides a consolidated patient history, leveraging existing health infrastructures in a way that gives clinicians access to the most timely, accurate data right at their fingertips. The flawless integration of data from existing systems into OACIS increases efficiency and productivity to deliver better healthcare. (na, 2017)

Cerner (aka Lab Information System (LIS))

The lab information system is a commercial off-the-shelf system (COTS) developed by Cerner (<https://www.cerner.com/solutions/laboratory>), used by the laboratory department to manage the receipt and processing of test materials and results. The LIS is only accessible by lab staff, and any information loaded into the system from processing of specimens must be copied into OACIS in order to be accessible by nurses and doctors.

Picture Archiving Communication System (PACS)

PACS serves as TOH's electronic store of digital images related to patient diagnosis and care, including images associated with patients' x-rays and magnetic resonance imaging (MRI) results. Information within PACS is made accessible to clinical providers such as nurses, residents, specialists, and physicians to assist in the

delivery of patient care. Doctors often access this information using their iPads, while nurses are required to access via shared computers.

Bridge

The “Bridge” is an “add-on” peripheral system developed to integrate into OACIS and assist nurses in documenting and managing specimen collection. The system consists of a wireless hand-held scanner and a wireless portable printer. The scanner is used to log in and identify the nurse, receive orders from the CPOE system, scan patient wrist bands for patient identification, and print labeling required for further specimen processing.

SMS (Scheduling Management System)

SMS is a system for patient scheduling (i.e. outpatient visits, x-ray and MRI appointments) and billing. These systems are used extensively by ward clerks and others involved in the handling of patient admittance, scheduling, and release.

Radiology Information System (RIS)

This is a subsystem of the SMS (Schedule Management System) specifically used for scheduling of Radiology Patients.

5.4.5 The mobile vision

The Ottawa Hospital’s unique take on the traditional CPOE system is based on their vision of a mobile, fluid, and frictionless EMR system, accessible by doctors and residents (Glen

Geiger, 2013). Prior CPOE deployments by other institutions were often mired by the limitations of “Computers on Wheels” (COWs), which hindered CPOE adoption and use (Goh et al., 2011; Koppel, Wetterneck, Telles, & Karsh, 2008). TOH saw mobile devices such as the iPad as a means through which to eliminate some of these factors that impeded other CPOE deployments. With an easier, “frictionless” interface, this system was expected to expand the breadth and depth of diagnostic processes, thus improving the quality and efficiency of patient care.

To execute this vision, over three thousand iPad devices (Glen Geiger, 2013, see 17:31 min mark) were put into the hands of doctors, fellows, and residents at TOH. These devices deliver both a means to more easily enter physician orders (versus traditional COWs) and be a central source of diagnostic information.

A key challenge for the deployment of this mobile CPOE system was the integration with upstream processes that receive orders, provide test results, and return patients’ medical information. Specific to the specimen collection ordering process, doctors would use an iPad application, customized for TOH to enter an order. The entered order would then be sent to the OACIS system and LIS (lab information system). After order processing, the physician can then view the test results on the iPad device.

Though much of the discussion and focus of the CPOE deployment was on the iPad devices and software introduced to doctors, nurses also experienced a significant introduction of technology to support their existing blood collection routine. To support blood collection processes, TOH deployed a new “Bridge” system that consisted of a handheld device,

printer, and associated software. The Bridge system supported a new paperless process that was designed to create a more fully integrated order processing workflow.^{lxiv}

The overall approach to the digitization of medical records and order processing can be characterized as an attempt to reduce information asymmetries. The delivery of products and services (such as healthcare) requires the coordination of value chains, or as Grant & Collins (2016) have conceptualized, “Customer-Centric Value Cycles” (p. 22). These systems are deployed under the expectation that they will free up information and have it flow more freely between groups and departments, thus reducing information asymmetries that can impede quality and productivity.

Though the benefits of a freer flow of information seem intuitively obvious, it is important to note that such technologies can also accentuate and highlight group differences. After years of adaptation, many localized work contexts such as departments and teams developed their own localized set of knowledge and vocabulary. This process results in creating knowledge asymmetries that, when faced with increasingly freer flows of data, become more visible and transparent (Leonardi & Barley, 2010, p. 30). To help avoid such problems, TOH engaged in a multi-group representation and deliberation process that attempted to develop local adaptations for the system to better fit localized departmental knowledge – and include appropriate translations required for a freer flow of information. One example of this was between the 5-West unit and the lab. 5-West used differing nomenclature to identify tests than the lab did, and other departments experienced similar issues. To alleviate this issue, various local catalogs were developed, with mapping between the localized catalogs and lab being codified into the system.

Despite attempts by TOH's CPOE deployment team to engage in a collaborative design and rollout of the system, many of those participating from the healthcare side, especially doctors, felt their approach was not flexible enough, nor sufficiently customized for their own practice settings. One of the doctors interviewed for this study (Dr1) described such approaches as stemming from an engineering mindset supported by the underlying premise that the environment can be adequately controlled. This doctor said that such approaches do not work well in biological processes, and healthcare practices require a much more fluid and organic approach – as they are dealing with biological systems that are notoriously unpredictable. Similarly, another doctor (Dr2) recounted his first experience with CPOE, where he paused and reflected on the alternative meaning of the “submit” button.^{lxv}

Based on findings from interviews, though engineered approaches are standard fare in any project management process (Project Management Institute, 2004), in healthcare, they cannot alone be expected to solve organizational “silos” unless they properly address the knowledge asymmetry problem.^{lxvi} Such asymmetries become increasingly problematic, as the fluid data exchange between specialized healthcare groups can result in increasing translation problems due to variable localized practices and knowledge. More generally, Smets, Morris, & Greenwood (2012) characterize such dynamics as a “collision of local practice” (p. 884),^{lxvii} and can often be a source of under-appreciated or under-identified causes of system adoption and deployment failures.

5.5 Micro-Context

5.5.1 The Ward

The department of interest for this study is the 5-West unit of The Ottawa Hospital, the malignant hematology oncology unit of The Ottawa Hospital system that started in the 1980s. It primarily treats acute leukemia, lymphoma, and myeloma patients. This unit administers treatments that include bone marrow transplantation, chemotherapy, and stem cell collections and infusions (both donor and autologous).^{lxviii} The unit consists of two sub-units: a day-patient section (nine beds), and an in-patient section (twenty beds).

The entire unit is secured by a main set of doors, and you must use a security badge or be escorted by staff to enter the ward. Upon entering the unit, you find the day-patient area, and to enter the in-patient area, you proceed through another set of secured doors to a much larger area that consists of a nursing station, a few offices and utility closets, and twenty patient rooms. Each patient room holds a single patient,^{lxix} and rooms are organized into pairs with a shared alcove area that you must pass through to enter either room. Each of these alcoves contains a computer, a cabinet, and small work area consisting of a counter, sink, and storage cupboards (see Figure 30).

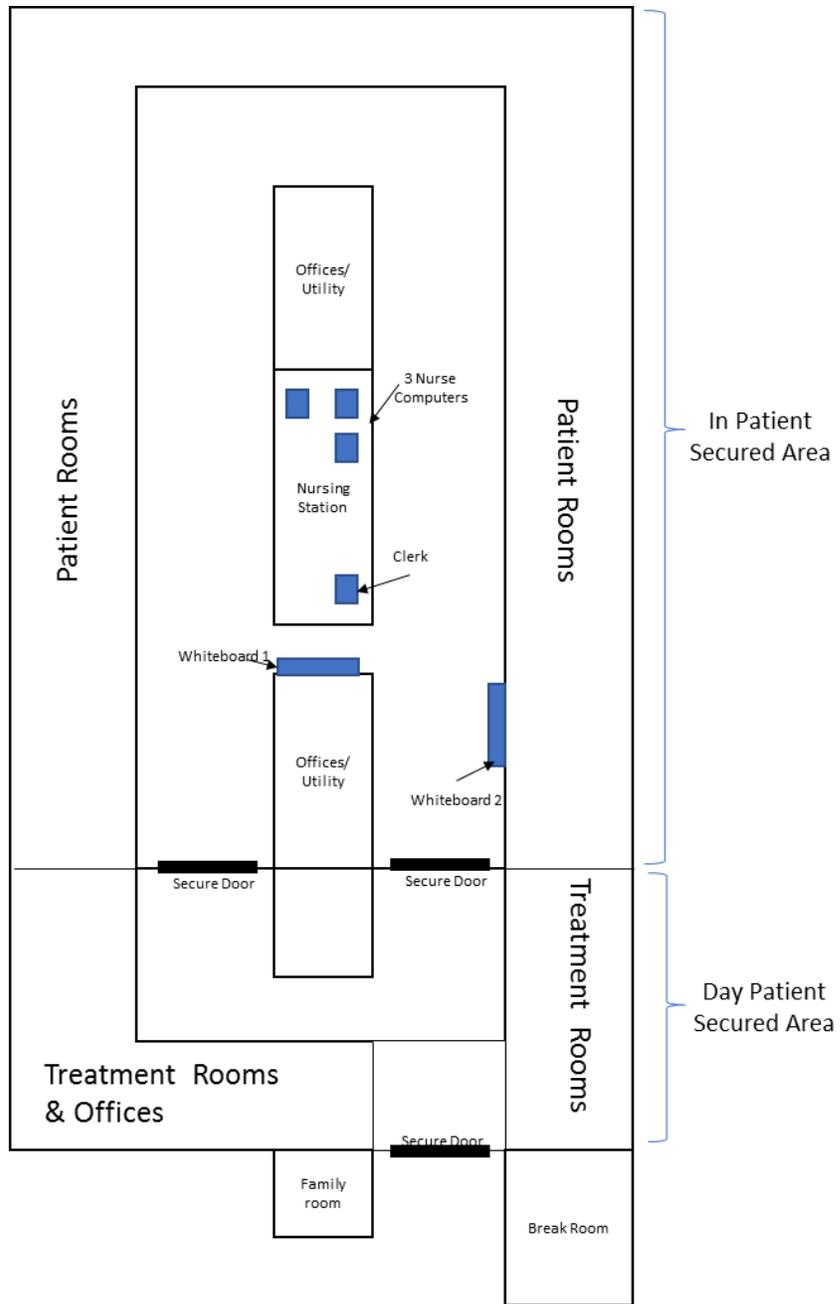


Figure 30. 5-West Unit: Representation of physical layout.

5.5.1.1 Patient flow and treatment

A patient diagnosed with leukemia will typically follow a flow from initial visit with a family physician, to another with a hematology specialist, and then as an out-patient of TOH, and finally to an admitted patient in the Hematology-Oncology unit. Of those admitted to the unit, initial treatment begins in the day-patient area of the ward, with some eventually admitted to the in-patient area of the ward.

Though day-patients are under doctor care and often quite ill, they can go home to eat and sleep in their own bed. These patients receive daily treatments that can include chemotherapy, blood transfusions, and blood tests to gauge blood count, electrolytes, CDCs, liver enzymes, and blood cultures. Day-patient visitation time ranges from approximately two hours for routine chemotherapy to an entire day if they are under a more complex treatment regime.

In-patients are day-patients that have become acute, either by developing complications or showing a lack of positive response to the standard treatment regime. Common complicating conditions that trigger a movement include fever, infection, dehydration, uncontrolled nausea, diarrhea, and uncontrolled bleeding. Others include conditions of self-care, including psychological stress, not coping well or not eating. Patients who do not respond positively to treatment will be admitted to the in-patient area for the delivery of a more complex treatment protocol.

5.5.1.2 Staffing and work shifts

Staffing is separate for both the in-patient and day-patient sub-units. Hours of operations for day-patient sub-unit are from 7:30 AM to 7:30 PM daily, 365 days a year. The in-patient sub-unit operates 24 hours a day, 365 days a year. Each subunit has a dedicated hospitalist, administrator, and nursing staff.

Staffing in the day-patient area is typically consistent throughout the day, with one hospitalist, three nurses, and possibly a fellow and two or three interns. Staffing in the in-patient area varies by shift. Day shifts are from 7:30 AM to 7:30 PM and staffed by six nurses. Evening shifts have reduced staff, with five nurses from 7:30 PM to 11:30 PM, and four nurses and an aid worker from 11:30 PM to 7:30 AM.

During the evening, the ward is dimly lit, with little activity. At around 4:30 AM, the in-patient area begins to be more active as nurses begin their collection rounds and check the vitals of their patients. This activity continues to increase as other staff begin to arrive at 7:30 AM. A full contingent of day staff includes the six nurses, three doctors (including two fellows), a dietitian, pharmacist, physiotherapist, interns, and often a social worker. The day shift is a much more busy and dynamic working environment.

5.5.2 Order processing

The blood collection routine under investigation for this study is embedded within the larger physician ordering processing. This entire process has undergone significant changes as a result of the CPOE deployment.

5.5.2.1 Pre-CPOE

Before the deployment of the CPOE system, TOH had an electronic medical record system (OACIS) and lab information system (Cerner) in place. This system served as the main tool for coordinating patient care, order management, and patient information. A considerable amount of paper was required by this process to coordinate the in-unit activity. Nurses, doctors, and clerks would manage a system that utilized paper requisitions as the means for coordinating orders and associated order processing and requisitioning.

To initialize our discussion, we need to clarify a few common terms that are used while discussing these processes. The first is the definition of an order, which is a communication from the treating physician/practitioner requesting that a diagnostic test be performed for a beneficiary. This order can be received by a clerk, a nurse, or with the introduction of CPOE – a computer interface that appropriately processes such an order. Every order becomes part of the medical record for the patient, and order communications can be hand-delivered, mailed, sent by a phone call, or via email. In contrast to an order, though, we often find in practice the term used synonymously with a “requisition”. More accurately, a requisition is the actual paperwork provided to a clinical diagnostic laboratory to identify the test or tests to be performed for a patient.^{lxx}

The standard admission process for patients entering 5-West includes the creation of physician orders that define a pattern of tests. Such orders were often given verbally or written as notes to the ward clerk. These initial orders are then classified as routine, and this would typically result in a generated sequence of appropriate requisitions scheduled at

periodic intervals. The management and timing of the creation of the associated requisition would be shared by lab personnel and the ward clerk.

Each requisition associated with a physician order represents a requested test. Most tests occur every day, but others can have more complicated schedules. Doctors may also provide standing orders^{lxxi} that can be used by nurses at their discretion,^{lxxii} based on changing patient conditions. Moreover, doctors may also issue “STAT,” or next-day orders in response to changing patient conditions or treatments. Clerks play a central role in the processing of orders into requisitions; more generally, in this original process, they receive orders and produce requisitions for the entire unit.

Nurses also play a key role in processing orders and resulting requisitions. Nurses are ultimately responsible for the correctness of the requisitions – ensuring they conform to the associated order and care plan, and accurately communicate the necessary tests to the lab for processing. Nurses, therefore, will double- and triple-check the requisitions produced by the clerk for their assigned patients. Nurses are also responsible for maintaining an accurate patient care plan for their patients, along with any of the orders and requisitions required to execute this plan. Nurses will refer to, and when necessary, update patient information to ensure that requisitions are appropriate and that the patient chart accurately reflects the intended patient care plan.^{lxxiii}

As noted, in the pre-CPOE order process, clerks played a significant role in maintaining and transcribing all order information. At the start of each shift, a clerk would review the care plan for each patient, and determine the set of tests required that day for each patient;

for each order, they would create a paper requisition.^{lxxiv} The lab would also assist in this process by sending a daily package of routine “order stickers” for certain blood tests planned for that day. The ward clerk would be responsible for collating this information and placing all daily requisitions in a patient order receiving box. Nurses would review these requisitions for accuracy against the care plan, which then, in turn, may involve the clerk to make corrections, create additional orders, or communicate with the lab surrounding any issues with the daily routine orders.

5.5.2.2 Post-CPOE deployment

The introduction of CPOE altered the communication of orders and the production of associated requisitions for specimen collection and lab testing. CPOE was deployed as a means to simplify many aspects of the process, create efficiencies, and improve quality and safety.

The original vision for the specific TOH CPOE espoused in many publically available articles, whitepapers, and cases was that doctors could use an iPad device to place orders and to receive and view the results from any test associated with those ordered. This design was touted as an easier, more flexible, and more accurate method for physician order entry that would eliminate much of the error-prone verbal and paper communication found in the old process.

As indicated within the healthcare trade journals at the time of deployment, the TOH CPOE deployment was seen as quite innovative. Prior deployments of CPOE at other institutions were mired by the use of COWs. Some noted project failures (i.e. at Cedar Sinai referenced

in Bhattacharjee & Hikmen, 2007) indicated that doctors considered such devices far too inconvenient and time-consuming to use in their daily practice and would resist using them. Riding a wave of excitement within the healthcare industry for the potential application of new mobile devices, TOH generated much interest and support for their project, including the critical key support of doctors involved in the delivery of healthcare there.

Another key interface deployed as part of this rollout was called “Bridge,”^{lxxv} the system nurses and clerks use to produce the necessary requisitions from doctor’s orders. This process and vision was detailed in a presentation by one of the lead physicians responsible for the rollout of this system – Dr. Glen Geiger (see Figure 31).

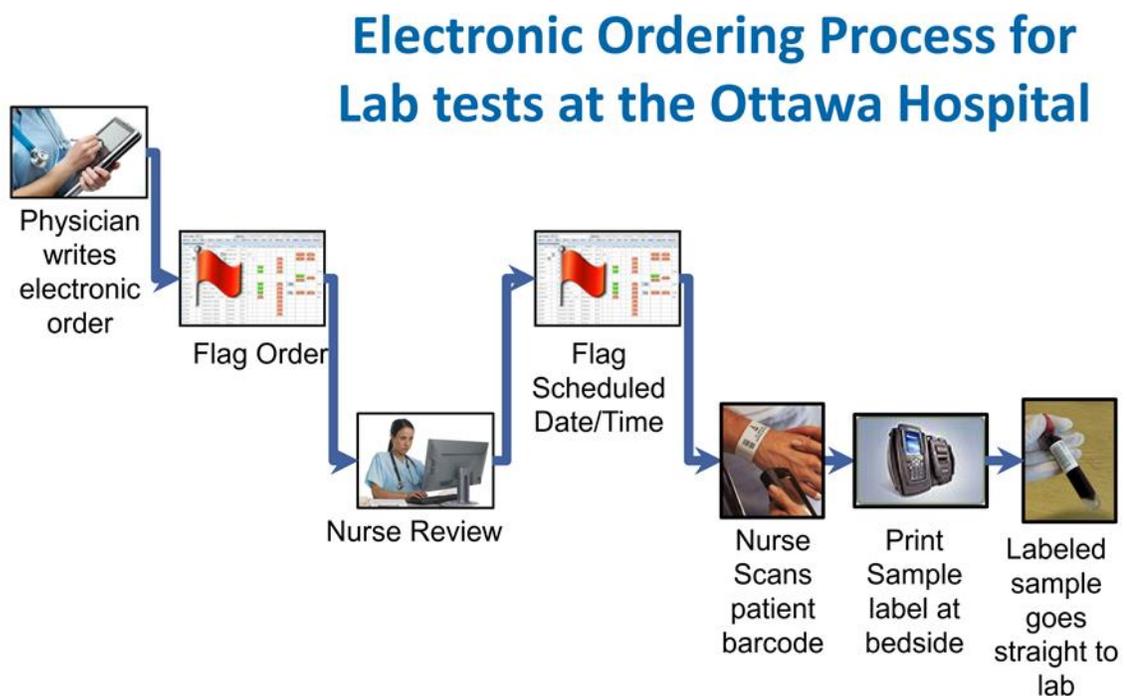


Figure 31. Electronic ordering process for lab tests at The Ottawa Hospital (source: “e-Requests for Services: The Ottawa Hospital CPOE”, Dr. Glen Geiger, 2015)

By using “Bridge,” nurses would no longer receive a stack of daily requisitions produced by a clerk; instead, nurses would log into the CPOE system and view all the orders flagged for a patient that day. To process an order, nurses would log into the OACIS system and release these orders to a handheld device. Nurses would then log into the handheld device, search for and find their test requisitions on the system, and take the handheld device into the patient rooms. They would then use it to scan the patient’s bracelet (to confirm that they are drawing a specimen from the correct patient), send the requisition to a handheld portable printer that would print out a bar code label which they would then attach to the collected sample. The nurse would then physically place the collected blood sample in a sealed bag that is in turn transported via pneumatic tube system directly to the lab for processing.

Front-line staff in the lab receive incoming samples, then scan and place them on the appropriate conveyor for processing by one of the three lab units (hematology, microbiology, or biochemistry). Some of these tests, particularly those processed by the hematology unit, are processed automatically by devices that conduct the test and automatically load the results into the LIS (Lab information system). Results posted to LIS are then transferred into the OACIS system, where they are accessible by physicians and nurses.

The clerk plays much less of a central role in this new process than they had before the CPOE deployment. The new CPOE system now generates appropriate daily “electronic” requisitions from doctor’s orders, and nurses directly access this information via one of three nurse computers located at the nurse station. The flow of data from doctors to nurses

and the lab is now handled electronically, thus eliminating the need for the clerks to manage the daily requisitions.

5.5.3 The nurse blood collection routine of 5-West

Embedded within the CPOE process for 5-West is the blood specimen collection routine, an integral part of the healthcare service provided by the unit. This routine coordinates the efforts of nearly forty staff nurses collectively managing twenty patients, across three shifts, 365 days a year. This routine is an essential component of the larger CPOE order process involved in handling medical orders for patients – in this particular case, monitoring and providing essential information as to the status of patient health and responses to the treatments provided while under the care of a physician.

Blood specimen collection is done by nurses and phlebotomists^{lxxvi}. Within other TOH units, phlebotomists handle much of the routine blood routine required during normal day-shift hours. Phlebotomists only handle a specific type of blood collection, called a peripheral blood draw. Within 5-West, most patients are on central lines – that is, they have a tube that remains inserted in their body to allow for a more direct and immediate administration of required drugs. This central line also serves as a means to collect blood specimens. Though there are instances when phlebotomists draw blood from patients in 5-West, it is much less frequent than in other wards due to the prevalence of such central line draws.

This blood collection routine can be characterized as somewhere between a well regimented, documented process and an organic, flexible, process that has locally evolved over time. From an engineering perspective, processes are designed to be responsive and repeatable with little ambiguity and error. From a more organic and emergent perspective, many aspects of the process are unstructured and locally created to support intuitive reactions to unexpected and unplanned emergent factors and situations. These aspects of healthcare processes are common across many healthcare environments.

These two aspects are often in conflict with each other. Doctors and nurses constantly engage in work that involves the handling of unexpected events, and thus often argue that they require more immediate and “in-the-moment” process flexibility. From a governance perspective, administrators attempt to reduce the occurrence of unexpected events. This delicate balance between regimentation and in-situ responsiveness is not unique to healthcare but is arguably much more prominent and important than in average or general processual contexts. As one of the doctors interviewed in this study noted (Dr3), there is a human side to healthcare delivery that is still very much based on intuition and tacit knowledge, and such knowledge is notoriously difficult to codify and make explicit in a manner that fits with engineered processual structures that attempt to respond appropriately to all situations.

5.5.4 Local motivations for the introduction of CPOE

The paper-based blood collection processes were notoriously error-prone and labour-intensive. As indicated in a number of interviews during this study, one such error included

placking the wrong patient identification card. Such an incident would result in a patient not having a required test, and another would be scheduled to receive an unnecessary test.

As noted in interviews with both nurses and clerks, nurses are ultimately responsible for any requisition errors. Over time, they devised varied methods for tracking information and double-checking the accuracy of the requisitions they received from the clerk. They would often check requisitions against artifacts such as patient care plans and charts, and would often write information out on their personal “cheat sheet” for the day.^{lxxvii} However, such variations in information management can result in decisions being made based on inaccurate information.

Each doctor may have an individual approach to communicating orders. Before CPOE, such communication would be directed at nurses and ward clerks, who would interpret these orders and document the cadences of specific doctors. Nurses would ultimately be responsible for the execution of these orders and would use clerks as an essential resource to manage the paperwork surrounding the documentation of these orders. Such a high degree of unstructured communication, over time, naturally evolved to develop various localized structures and “shorthand” lingo. For instance, a doctor would tell a clerk to “order blood counts”, and the clerk would translate this into a daily routine of creating a blood collection and test order for blood count – which the nurses may interpret and also aggregate with a previous blood work order.^{lxxviii} Over time, such “shorthand” communication can develop efficiencies, but also requires considerable local experience to navigate properly; slight changes in staff would result in an elevated risk for error. Furthermore, such unstructured communication can break down. Such multi-step, open-

ended communication creates the risk of miscommunication concerning an order, or the possibility an order may be lost or improperly handled.

5.6 Summary

In this chapter, we have contextualized the blood collection routine under investigation, using a multi-context (macro, meso, and micro) model to introduce key features of the organization, project, and process within which the routine is embedded.

In the following chapters, we discuss the data collection processes and results (Chapter 6), offer a qualitative analysis and findings (Chapter 7 & 8), present a discussion of results (Chapter 9), and finally the research contributions, limitations, and recommendations for future research (Chapter 10).

^{liii} The micro context is that of the Hematology (study of blood) and Oncology (study of cancer) Unit 5-West. Staff of 5-West refer to themselves as the Hemoncology Unit, Hematology-Oncology Unit, or “Hemong”.

^{liv} Following Chiasson & Davidson, 2013 – we use the term health information systems to reference a multidisciplinary body of knowledge related to the design, development, implementation and use of information-intensive technologies in healthcare settings.

^{lv} A 1997 report from the National Forum on health recommended the establishment of a nationwide health information system (“Canada Health Action: Building on the Legacy - Volume I - The Final Report”, n.d.). The report was endorsed by multiple levels of government and was the impetus for the 2001 establishment of CHI as means to fulfill this mission. The mandate of CHI was to accelerate the implementation of a national electronic health record system. The \$500 million seed capital required to establish this organization was supplied by the federal government. CHI has since received an additional \$1.5 billion in federal funding (Zinszer, Tamblyn, Bates, & Buckeridge, 2013).

^{lvi} Over 20 artifacts – press releases, articles, whitepapers, and other documents – were found directly related to extolling TOH’s reputation for innovation, research, and success.

^{lvii} This quoted article should have placed much more emphasis on the word “might” in the opening sentence, as even three years later, nurses have not yet received iPad touches or any similar device. And though I

admittedly did not observe all janitors and other support staff, of those that I did observe, I did not see these devices being used.

^{lviii} See <https://www.theguardian.com/technology/2010/jan/27/apple-ipad-tablet-reactions>.

^{lix} As we will demonstrate in the later narrative analysis of nurses lived experiences through HIT introduction in 5-West, such an environmental context – one in which time savings and RIO figures become more dominant –resulted in the development of counter narratives in which initiatives are seen as resulting in staff reductions, and a diminishing level of care.

^{lx} Initially, this term was derived as an acronym of computerized physician order entry, but is often now applied to a more general term of “Computerized Provider Order Entry” system to reflect the diversity of roles engaged in the process of order entry and healthcare delivery. This term now includes nurses, clerks, lab technicians, administration, and other roles that interact with (often more frequently than physicians) with the technology enabled order entry systems.

^{lxi} TOH staff will frequently refer to their OACIS-based system as an HER (Electronic Health Record), but this may not be an appropriate use of the term. EHR’s refer to an extra-institutional health record system that allows patients to move their health records to other healthcare providers (source: <https://www.healthit.gov/providers-professionals/electronic-medical-records-emr>). The TOH OACIS based system is only an intra-intuitional records system. Such systems are generally defined as EMR systems.

^{lxii} CPOE term is used widely, it’s the “hybrid” term that is not.

^{lxiii} “Hybrid” CPOE, is not only in reference to the integration of CPOE with many existing computerized systems, but also the integration with existing paper systems that continue to be maintained by TOH.

^{lxiv} As indicated in many captured interviews, this system was justified as a means to improve the quality or care by reducing incidents of error generated from the mishandling of paper requisitions and test results.

^{lxv} Dr2 used the double entendre of “submit” (submit a request, or submit to the system) to make a strong case for more organized and fluid processes that can better fit within a local milieu of a ward or unit.

^{lxvi} Prior to the introduction of increased information flows, each localized practice acted as an island of knowledge, to some degree. Communication among groups was limited and systematic. As data flows more freely, the knowledge used to extract information from this data can vary across differing groups. This variation can greatly increase the complexity of information flows – data flows are relatively easy, but information flows require a certain shared contextualized set of knowledge (Nelson & Coopriider, 1996).

^{lxvii} This concept and effect will be revisited in the analysis and conclusions chapter.

^{lxviii} Autologous transplantation is a transplant procedure that uses the person’s own stem cells. The process begins by giving patients a drug that encourages the stem cell group, and doctors then use a device that similar to a dialysis machine to extract and collect these cells. These cells are frozen, and then injected into the patient in a later stage of their treatment regime.

^{lxix} The unit is rather unique in this regard, as most other units have multi-patient rooms.

^{lxx} See “The 2011 Medicare Physician Fee Schedule (MPFS) final rule”, <https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeeSched/PFS-Federal-Regulation-Notices-Items/CMS-1654-f.html>.

^{lxxi} Some nurses refer to these as conditional orders. This, and other examples, demonstrates a surprising divergence in terms used among nurses within the same ward.

^{lxxii} Often, there are imposed constraints on the discretion that needs to be accounted for. For instance, blood cultures (which are used when there is indication of an infection) have maximum collection frequency of once every 48 hours. A nurse cannot create a requisition from such a conditional order if it has been less than 48 hours since the last blood culture. In such cases, if warranted, nurses have the autonomy to create a new order in the system. This would later be reconciled with the doctor.

^{lxxiii} Despite asking pointed questions in this area (to detail how nurses manage their information surrounding this care plan), the information received from nurses was rather vague, and somewhat contradictory. This, we believe, is indicative of freedom that nurses once had to “manage their patients” through whatever means necessary. Despite the variation in how nurses maintain this information, a consistent ownership of the integrity of the information was exhibited through statements such as “it’s my patient, my responsibility” or “it is my responsibility [that the care plan is executed correctly]”.

^{lxxiv} Nurses refer to this as “placking a req”. Each patient in the ward would have a patient identification card. These identification cards are plastic cards with raised lettering. To process a requisition, the clerk would take one of three standard requisition forms, check-off appropriate boxes, and place the patient identification card and an imprint device that would copy the information on the card to the paper requisition in a specified square area at the top of the requisition form. This process ensures that all patient information is recorded correctly, and saves the clerk considerable time by not having to write out this information by hand.

^{lxxv} Interestingly, “Bridge” is not mentioned in any of the external documentation of the TOH CPOE deployment.

^{lxxvi} Phlebotomists support the blood collection process. During the day, once a day, they will draw routine bloodwork for a ward. Phlebotomists are only trained for peripheral blood draws (a blood draw from the arm, like you would typically see in a clinic). Many patients in the 5-West ward require blood drawn from a central line, which only nurses can do. Therefore, phlebotomists are less involved in the 5-West blood collection process.

^{lxxvii} Some nurses mention writing information down on a piece of paper they would carry with them. One nurse expressed concerns that such notes could be left around for others to see or be lost off-ward.

^{lxxviii} This information was captured from the interview with Clerk01. Dr02 and Dr03 also discussed such (unstructured) communication as a key part of the practice – and lamented the loss of such interaction as CPOE and other systems attempt to “engineer” such communication.

Chapter 6: Data Collection

The purpose of this chapter is to elaborate contextual details surrounding the data collection process and provide a summary of key aspects of the data collected. We first provide a summary of the interview data collected and the interview approach. We then help establish the readers immersion in the data by providing a 1st person narrative of the interviewers first day. Finally, we provide a summary of the data collected along with contextualizing floor plans.

6.1.1 Data Collection

There are approximately forty nurses employed within the 5-West Unit, of which thirty-one were interviewed (77.5%). The total recorded minutes for all nurse interviews was 661 minutes, and the total words transcribed from interviews was 125,242.

Interview ID	Minutes	Tran- scribed	Word Count
Nurse01	15.00	✓	2,650
Nurse02	18.00	✓	2,803
Nurse03	18.00	✓	3,537
Nurse04	19.00	✓	3,454
Nurse05	15.00	✓	2,671
Nurse06	13.00	✓	2,419
Nurse07	12.00	✓	1,973
Nurse08	15.00	✓	2,710
Nurse09	26.00	✓	4,891
Nurse10	23.00	✓	4,320
Nurse11	29.00	✓	4,910
Nurse12	16.00	✓	3,140
Nurse13	16.00	✓	3,215
Nurse14	20.00	✓	3,407
Nurse15	28.00	✓	5,617
Nurse16	22.00	✓	3,822
Nurse17	17.00	✓	2,926
Nurse18	19.00	✓	2,881
Nurse19	17.00	✓	2,962
Nurse20	19.00	✓	3,247
Nurse21	14.00	✓	1,695
Nurse22	19.00	✓	3,145
Nurse23	25.00	✓	4,745
Nurse24	22.00	✓	4,209
Nurse25	21.00	✓	4,236
Nurse26	24.00	✓	4,748
Nurse27	65.00	✓	9,367
Nurse28	15.00	✓	3,012
Nurse29	36.00	✓	5,826
Nurse30	23.00	✓	3,931
Nurse31	20.00	✓	2,773
Total	661.00		115,242
Average	21.32		3,717
Median	19.00		3,247
Max	65		9,367
Min	12.00		1,695

Table 2 Summary of Nurse Interview Data

The collected interviews ranged between twelve and sixty-five minutes and averaged 21.32 minutes in length (see Table 2). There was initial concern expressed by TOH’s management team that nurses would push back and not participate if the interviews exceeded 15 minutes in length. The basis for this concern was that interviews longer than fifteen minutes could result in nurses filing a grievance, asking for more paid time, or simply demanding that the project be stopped altogether. This concern by the administrator of 5-West was relaxed, as nurses seemed to respond well to the interviews, and seemed – in general – to view their participation as an opportunity to voice their concerns and experiences over the impact of this new system.

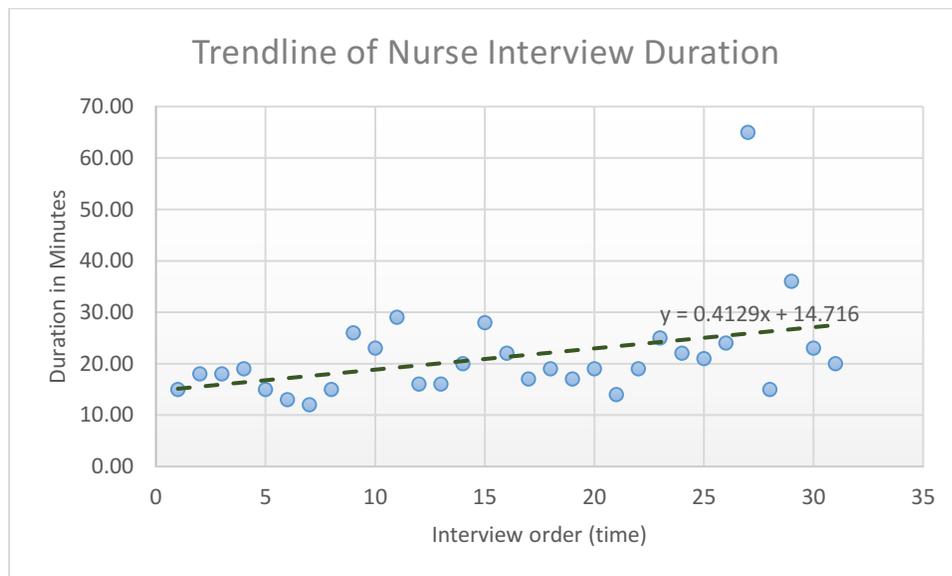


Figure 32: Trendline of Nurse Interview Duration^{lxxix}

6.1.2 Sample characteristics

Anonymity was a concern for nurse participants. Therefore, great care was taken not to record any identifying information, and only a limited amount of demographic data was collected. For each interview, nurse experience in the ward was recorded (<4 years=junior, 4-15 years=mid, and 15+ years =senior), as well as commonly worked shifts (most nurses worked a night and day shift rotation on an eight-day cycle, where nurses work for two nights shifts followed by two day shifts, and then four days off). Also, each narrative was given an overall assessment of the level of positive attitude toward the system (from positive to indifferent and negative). Of the thirty-one nurses interviewed, only one was male.

Interview ID	Minutes	Transcribed	Word Count	Common Shifts		Experience				Attitude Towards Sys.		
				Night	Day	Pre CPOE	Junior	Mid	Senior	Positive	Indifferent	Negative
Nurse01	15.00	✓	2,650	✓	✓	✓		✓				✓
Nurse02	18.00	✓	2,803		✓	✓			✓			✓
Nurse03	18.00	✓	3,537		✓	✓			✓			
Nurse04	19.00	✓	3,454	✓	✓	✓		✓				✓
Nurse05	15.00	✓	2,671	✓	✓	✓	✓					
Nurse06	13.00	✓	2,419	✓	✓	✓		✓			✓	
Nurse07	12.00	✓	1,973	✓	✓		✓				✓	
Nurse08	15.00	✓	2,710	✓	✓		✓					
Nurse09	26.00	✓	4,891	✓	✓	✓			✓			
Nurse10	23.00	✓	4,320	✓	✓		✓					
Nurse11	29.00	✓	4,910	✓	✓	✓			✓			✓
Nurse12	16.00	✓	3,140	✓	✓	✓			✓			✓
Nurse13	16.00	✓	3,215	✓	✓	✓	✓				✓	
Nurse14	20.00	✓	3,407	✓	✓	✓		✓				✓
Nurse15	28.00	✓	5,617	✓	✓	✓		✓		✓		
Nurse16	22.00	✓	3,822	✓	✓	✓		✓				✓
Nurse17	17.00	✓	2,926	✓	✓	✓		✓			✓	
Nurse18	19.00	✓	2,881	✓	✓	✓			✓			✓
Nurse19	17.00	✓	2,962	✓	✓	✓					✓	
Nurse20	19.00	✓	3,247	✓	✓	✓			✓			
Nurse21	14.00	✓	1,695	✓	✓	✓		✓			✓	
Nurse22	19.00	✓	3,145	✓	✓	✓		✓		✓		
Nurse23	25.00	✓	4,745	✓	✓	✓	✓					✓
Nurse24	22.00	✓	4,209	✓	✓	✓		✓			✓	
Nurse25	21.00	✓	4,236	✓	✓	✓		✓		✓		
Nurse26	24.00	✓	4,748	✓	✓	✓		✓				✓
Nurse27	65.00	✓	9,367	✓	✓	✓		✓				✓
Nurse28	15.00	✓	3,012	✓	✓	✓		✓			✓	
Nurse29	36.00	✓	5,826	✓	✓	✓		✓		✓		
Nurse30	23.00	✓	3,931	✓	✓	✓		✓			✓	
Nurse31	20.00	✓	2,773	✓	✓	✓		✓			✓	
Total	661.00		115,242	93.5%	100.0%	93.5%	19.4%	58.1%	22.6%	29.0%	35.5%	35.5%
Average	21.32		3,717									
Median	19.00		3,247									
Max	65		9,367									
Min	12.00		1,695									

Table 3: Nurse Narrative Sample Characteristics

6.1.3 Interview approach/instrument

An open-ended semi-structured interview process was used to collect nurse narratives. Before the start of the interview process, we prepared a number of guiding questions. Our intention was to use these questions sparingly. Our approach was to use these questions only when necessary to help stimulate nurses' narrative accounts and reflections on their

experiences rather than force a specific set of responses through overall structured interviewing.

To help set the context for interview participants, each participant was provided with a brief initial overview to the purpose of this study. The general form of this initial question was as follows:

“We are interested in your story, about how the introduction of CPOE has affected your work, and how have you and your fellow nurses developed ways to work with this system.”

Ideally, only one question would suffice, but all interviews required other questions to expand the conversation and help the nurses recount different dimensions of their experience. A sample of these questions is provided in Table 4, “4 Repertoire of Priming Questions Used in the Semi-Structured Interviews”.

- Are there times when you don't use the system?
- Can you describe the initial training you were taken through?
- Can you describe your initial introduction to the system?
- Can you think of a time that we attempted to do something with the system, but it couldn't do what you expected?
- Can you think of a time when you found some way of using the system in new useful ways?

- Do you have any comments on how your introduction to the system could have been improved?
- How much experience did you have with the old pre CPOE process?
- How much is CPOE used in your daily routine?
- How much of your learning process involved reaching out to other nurses for help, and in what ways may have you helped other nurses use the system?
- How often do you work in this ward and what shifts do you typically work?
- In what ways have you found the whiteboard useful?
- Under what circumstances and conditions does the system not work well for you?
- Under what circumstances or conditions do you find that the system works really well for you?
- What benefits have you received from using CPOE on this floor?
- What effects has CPOE on your planning of work, such as morning blood collection rounds?
- What incentives are there for you to use the system, versus paper?
- When do you use the system and when do you avoid using it?
- Who has benefited from the deployment of CPOE?

Table 4 Repertoire of Priming Questions Used in the Semi-Structured Interviews

6.1.4 Explicating the narrative

The interview approach used in this research was guided by Narrative Analysis techniques outlined by Riessman (2000), who notes:

[I]t is a common experience for investigators to carefully craft interview questions, only to have participants respond with lengthy accounts and stories that appear, on the surface to have little to do with the question. (p. 2)

As Riessman (2000) further reflects, such carefully crafted questioning approaches by researcher's attempt to "control meaning" often results in the interviewee's response to consist of long narratives that often go off topic as a form of resistance or expression of freedom in response to the structure being imposed by the interviewer.^{lxxx} Moreover, Riessman (2000) claims that the importance of such stories is often overlooked by interviewer – perceiving them as noise – but they are in fact rich with valuable information. Riessman (2000), along with others in this area, highlights the importance of analyzing divergent narratives to help researchers overcome confirmatory bias and identify a deeper sense of the reality being lived by the interviewee – not the reality imposed by the interviewer.

Consistent with the methodology outlined in Chapter 4, we have used Riessman's approach as a guide for this investigation. We approached each interview with the intention of encouraging the interviewee to "tell their story", not the researcher's. We did not use any prepared questions as an interrogation device, but rather only as a catalytic force to help

the interviewees further reflect upon and recall their experiences. Such an approach allows the interviewees to implicitly identify key events – either positive or negative – and any key aspects of the system and their practice that have undergone disruption and change.

6.2 Nurse Interviews

Planning for the interviews began in early April, 2016. As part of this process, we worked with the 5-West supervising nurse to identify a list of twenty-two nurses to be interviewed. The total nurses that work in 5-West can vary slightly, but the nurse supervisor indicated that the total number of full- and part-time nurses averaged around forty. A subset of twenty-two of these nurses was identified by the supervising nurse for the interview process. We were not asked to provide a list of questions, nor was any structure imposed, other than interview times and locations. We did not meet the supervising nurse until the day of the first scheduled interview.

6.2.1 Situating the reader

When faced with studying organizational processes and contexts, researchers inevitably face a varied collection of individual narratives and stories (Watson, 2003). The participants in any organizational practice will narrate their experience differently, placing themselves within a story of their own making (Boje, 2001). Our objective was to collect a rich diversity of nurse narratives to serve as the data for an analysis of a technologically initiated disruption to an organizational routine – in this case, the blood collection routine.

Guided by our theoretical framing of dialectic modalities, our objective was to identify the key event sequences indicating the dialectic change processes involved in the disruption and renewal of an organizational routine and ways we can model such processes^{lxxxii}.

We view a key goal of qualitative research as being to *bring the reader along* and to make him or her part of the story. Hyett, Kenny, & Dickson-Swift (2014) recommend two questions a reader should ask when assessing the quality of a qualitative research paper: 1) has the author provided a sense of story to the presentation, and 2) has the reader been provided some vicarious experience.^{lxxxiii} This approach also supports our approach to internal validity as discussed in chapter 4, where validity is supported by documenting a rich case descriptions prior to presenting analysis and conclusions (Shenton, 2004)

To help facilitate “bringing the reader along” and engaging them in the context of findings qualitative research, we feel it’s important to immerse the reader in the context in which the data was collected. To help instantiate this immersion, we provide the following first person narrative account of “the first day” (used in Section 6.2.2 only) of interviews and ascribe pseudonyms to the nurses interviewed. This first person approach and style, though somewhat unorthodox, has been used to great effect by past researchers such as Stephen Barley (Barley, 1986; Barley, 1984). The goal of this narration it to further contextualize the narrative analysis presented in the following Chapter 7.

6.2.2 First day: A researcher's narration

6.2.2.1 Entering the ward

Interviews began on the afternoon of May 20, 2016. I was scheduled to meet with the nurse manager at 3 pm. 5-West unit is located on the main campus of TOH on the fifth floor and contains a total of four units: 5-West, 5-East, 5-Northwest, and 5-Northeast.

As I exited the elevator on the fifth floor, after a momentary confusion in directions, I found the hall leading to the ward. Initially, I was surprised by the level of security at the ward. Affixed to the secured outer doors were two large red stop signs warning that this was a secure area for authorized persons only.



Figure 33. Secure doors to the 5-West Unit.

As per the nurse managers instructions which she provided during a previous phone conversation, I picked up the phone affixed to the right wall just outside the unit. The clerk answered in a rather quick “5-West,” and I was invited to come in – just as the doors to the unit began to open automatically.

After passing through these doors, I noticed that I was in smaller sub-area with another set of doors leading to the main floor of the unit. The area I was in, as I would later find out,

was their day-patient area. This area contained several treatment rooms with beds and others with only an examination table and chair.

Once I passed through the second set of doors, I entered the main area of the unit (inpatient sub-unit). Upon entering the in-patient ward, I was immediately impressed by how much more activity there was in this area. Doctors, nurses, and other staff were freely moving about the hallway. As I walked down the main hallway of the unit, I noticed along the left side of the hall, about twenty feet ahead of me, a reception desk where a clerk was sitting in front of a computer talking on the phone.

As I walked to the desk, I noticed some handheld devices and printers scattered about the unit. All but one of these units were lined up along the nurse counter, and the other just outside one of the patient rooms I passed on my way to the desk area.

With the bustle of working nurses and doctors around me, I approached the clerk and said that I had a meeting with the nurse manager. I was instructed by the clerk that she would be along shortly and that I should wait at the desk area. While waiting for the nurse supervisor, I had my first opportunity to observe staff activity. Due to the sensitive nature of healthcare practice, I was not given permission to conduct any observational research. During this waiting period, I tried to glean as much information as possible about 5-West facilities and general activities. On this occasion, I observed nurses moving around the nursing station, going to and fro from an area near the end of the station – which had a set of three computers that seemed to be central to their activities. I also observed a doctor

approaching the clerk and presenting her with a folder of information to be filed – possibly a patient record of some sort.

The mood among members of the unit seemed friendly and collegial; each communication was prefaced with a period of friendly banter about the weather and what adventures were recently had.

6.2.2.2 The nurse station area

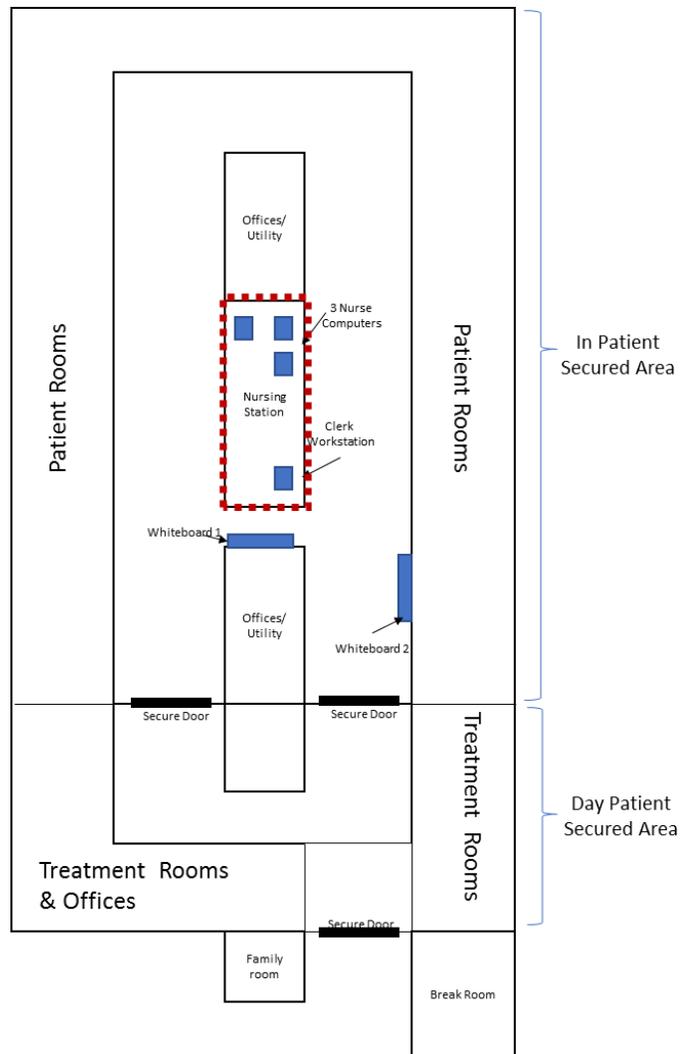


Figure 34. Nurse station area.

At the central nurse station, there were four computers, one of which was clearly the personal computer used exclusively by the floor clerk. The clerk sat in the first corner of the nurse station, just as you enter the unit. It was obvious that this area was at the center of all the hustle and bustle around the nursing station.

On the wall immediately across from the clerk hung a large LCD screen, the order whiteboard, which contained patient order information and status. Like an airport flight display, this LCD screen slowly rotated through a number of pages of patient information.

I noticed that the position of the whiteboard was obscured in such a way that it did not allow for easy viewing by the nurses sitting at their computers. The clerk and two nurses, who I could see sitting at computers on one the other side of the nurse station, were all separated from the whiteboard by a high counter where much of the doctor traffic seems centered. Nurses sitting at one of these computers would not be able to see much of the screen. This difficulty of viewing the whiteboard was compounded by the various folder hangers and other office supplies scattered about the counter. The whiteboard would only be visible to those who stood up and walked to the end of the nurse's station area.

As my gaze was affixed the whiteboard – the nurse manager, came up beside me. With a wide, beaming smile, she held out her hand and introduced herself, and escorted me to her small office.

The office was rather small – the space was made even smaller by the inclusion of a second desk in the corner. As we entered, nurse manager introduced me to the nurse supervisor^{lxxxiii}, the nurse supervisor for 5-West, and explained that she would be

coordinating nurse interviews. With a similar demeanor to the nurse manager, the nurse supervisor smiled and introduced herself. From here on, she was my primary contact for the unit.

After some quick introductions, the nurse manager reminded me that the interview length should be kept to under fifteen minutes. Both the nurse manager and nurse supervisor then engaged in a quick sidebar discussion concerning a list of nurses that the nurse manager had prepared – discussing who was available and when, who is out on leave, etc. The nurse supervisor then sat at her desk and edited the list that she had printed out on a piece of paper. She later made a copy and asked me to keep track of who had been interviewed.^{lxxxiv}

The nurse manager hadn't arranged for any rooms to be available for the interviews, so the nurse supervisor asked what I would need for my interview space. After a bit of discussion and contemplation, she suggested the “family room” located just outside the ward doors (see Figure 35).

On our short walk there, she pointed out various aspects of the unit, such as the difference between the in-patient and day-patient areas. I also noticed that there was a second LCD screen along the wall to our right as we exited the ward. The screen was dark, and it looked as if it was no longer used.^{lxxxv}

6.2.2.3 The main interview area: The family room

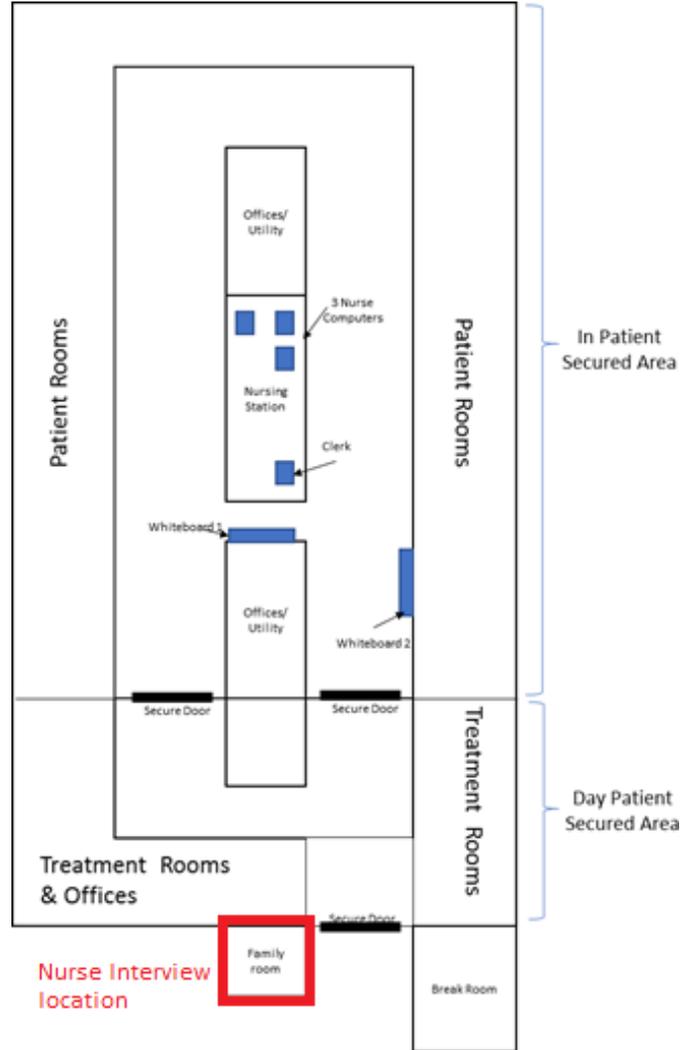


Figure 35. Nurse interview location.

The family room sits just outside main doors to 5-West, a secured space made available only to for the immediate family of patients in the unit. To enter this room, you must know the 4-digit security code. Nurses would not give this code to families, but rather open the room for them when needed. The nurse supervisor gave me the code so that I could come and go as I needed.

As I entered this family room, I was initially impressed by the warm incandescent lighting. Clearly, this room was designed to create a more soothing and friendlier atmosphere than the main unit area – which was in stark contrast to this space with its harsh fluorescent white light.

The room was comfortably appointed with a loveseat and couch containing a hospital blanket strewn across one of its arms. In one corner sat a bookshelf with many books and games. In the center area, along one of the walls, there was a small kitchen table with four chairs, and above this was wall mounted 32-inch LCD TV. This table would later serve as the area in which all but one^{lxxxvi} of the nurse interviews was conducted.



Figure 36. Family room used as the nurse interview room.

6.2.2.4 The first day of interviews

After showing me the room, the nurse supervisor left and said that there were three of the nurses on the interview list currently working on this shift. She said she would find who

among them might be available. The heavy, metal door to the family room automatically closed behind her as she left the room and I began my wait for the first nurse to arrive.

After further surveying the room, I began to be concerned that, since most of my interviewees are female, some nurses might not feel comfortable being in a closed room with a male stranger. So, while waiting, I explored ways to hold the door open. I eventually settled on a solution that involved moving the couch so that it would hold the door open. I could now see many nurses and other staff entering the secure area. I noticed that near the phone I used to contact the clerk when I first entered the ward there was a card reader and watched as authorized personnel entered the ward by waving their card and pressing a button to automatically open the doors to the ward.

After ten minutes – Nurse01 – the first participating nurse arrived. She was in her early thirties and moved with a quick confidence that was also mirrored in the cadence of her speech. Almost as if too busy for the interview, she moved quickly to the furthest chair from the door and plopped her arms down on the table.^{lxxxvii} With a friendly smile, I shook her hand and began to introduce the project as I reviewed the consent form.

After we had exchanged signed copies of the consent form, I suggested that it might be best if we closed the door – as I wanted to create an environment where she could speak freely without concern of being overheard. I asked if she was okay if I closed the door. To her, this seemed like a good idea, so I closed the door and sat back in my chair. Then I said, “OK, I’m recording now”:

6.2.2.4.1 Interview 1: Nurse01

Me: Thank you for your time here today. Thank you for signing the consent form. As I mentioned during the review of the consent form, we're researching the impacts of the introduction of CPOE.

Specifically, bridge, but also the broader use of CPOE and its effect on your work practice.

We are interested in hearing your story – how the system has affected your work, how it has affected your communication with co-workers or other departments – and how you've had to adjust.

Nurse01: [nods approvingly]

Me: Maybe you can start with discussing when you were first introduced to the system.

Nurse01: First introduction... I was lucky – I was not here for the rollout. I heard bad things about it. The first time I came back, since they only had two weeks of people being here to help during rollout, and I happen to be off during that time, when I came back I had no idea how to use the system. The training happened months before it actually got rolled out, which was super annoying.

And, then huge delays - as we would release blood work that needs to be done and it wouldn't show up into the handheld for like a half hour

to an hour, which is really annoying when you have a patient who is febrile^{lxxxviii lxxxix} and you need to get blood cultures^{xc} done. Nobody has got time for that.

During this initial exchange, it seemed that Nurse01 came prepared to tell me all the things that were wrong with the system. This theme continued throughout our interview:

Me: How would it have affected just your way you do your rounds, the way you manage your patients those type of things?

Nurse01: So time consuming! Like having to go back to the computer to verify that “what the handheld told me” wasn’t actually what the patient needed to be done. Electrolytes^{xc} weren’t getting done like they were supposed to. Tacrolimus^{xcii} limits levels weren’t showing up they were supposed to be. Then having such long waiting time for blood cultures to be released. **So then I said screw it and grabbed a paper req.**^{xciii} So time, lots of time, consumed - would normally take me two hours to do in the morning is now taking three hours to do in the morning.

Like all nurse interviews, this one was semi-structured. My goal was to speak as little as possible, and only when necessary ask questions to help stimulate the conversation. My objective was to maximize the narrative content of the nurse's experience.

I closed the interview by asking if there was anything else about the experience that she would like to discuss:

Nurse01: I would love the hospital to get iPad Nanos for nurses...

being a physician's order, a routine test, or blood work, whatever, and we could do charting in there.

Me: Was it only the doctors that received these types of devices?

Nurse01: They have iPads, yeah. But I'd like to have access to e-charting because often, with CPOE, the flags will come up and I don't care about the flag. It sounds awful, but it's because I've already had that discussion with the doctors, so I know Bob is going for an x-ray, so that flag doesn't mean anything to me. Maybe at the end of the day, I will get back to the computer and clear that flag.

So currently, it's having a paper system and a paperless system at the same time....is [pause] you know, it's become like double paper work because doctors still write chest x-ray in the paper chart and then we still put in the CPOE.

Me: So, double entry - lots of data entry now.

Nurse01: Yeah. What started this problem was that at the beginning, CPOE was deleting orders and you needed to know if the doctor, in the middle of the night deleted that blood work order, or was it was lost by the system - And so, then you're second guessing everything, and you're doing [extra] paperwork to figure out if you need that or not.

Interview 1: Post interview reflections

After each interview, I generally had a few minutes to take notes and reflect on the effectiveness of my approach and of the interview themes and content. This reflection often included identifying consistent response patterns, which once identified I would look to slightly change the focus in an attempt to generate a richer narrative of the nurse experience collectively.

For the first interview, I noted that things were a bit too “question-and-answer” focused. Though this nurse was providing useful information, it was difficult to get her to produce rich narratives of her own experience. Despite multiple attempts to move the conversation to the effects on work practice she had experienced, all her comments tended to revert back to statements about how bad the system is. By the end of the interview, I got a distinct impression that she felt she was sending a message for the administration to hear.^{xciv}

6.2.2.4.2 Interview 2: Nurse 02

As the nurse from the first interview left, she asked if I wanted her to get another nurse. I told her to speak with the nurse supervisor and to let her know that we’re done with the first interview, and she can send the next nurse. After a very short wait, the second nurse, Nurse02, entered the room. Nurse02 was one of the senior nurses on the ward.

With a similar quickness and urgency as Nurse01, Nurse02 sat down, and her body language indicated she wanted to get through the interview as quickly as possible.^{xcv}

Me: Okay, so we signed the consent form. Like I mentioned in the introduction to the project while we reviewed the consent form, this research is about understanding how CPOE has affected your work practices. I just want to have you relate your story. Like how things moved from the way things used to be, to when you were introduced to the system. From what training, you went through to where you are today. Give me the story of your experience with this rollout.

Nurse02: With CPOE?

Me: Yes.

Nurse02: I'm not very computer friendly. They don't like me to begin with.

Me: Who are "they"?

Nurse02: The computers.

Me: {laughs} Okay.

Nurse02: Okay. So with these machines, trying to remember my password. I keep having to change it, and then I forget what it was. So getting into [these devices], is a problem for me.

First it's finding one that actually works. Sometimes I've gone through four or five [of the handheld devices] before I find one that actually

works. And then having to change all of the batteries on them drives me nuts too, and I [often can't] find batteries.

Me: You are responsible for those sorts of things?

Nurse02: Yeah. [The handheld devices] used to be outside the rooms and now they're all at the desk. I used to work nights, but I don't work nights anymore, and all the blood work is taken in the morning. So when I do blood work [during the day] it's because it's ordered STAT, or it's a drug level that needs to be sent. So in my frustration of working days, and just drawing blood work periodically - well I've worked in the outpatient area too, so one of the girls are very kind to me. The girls are usually very kind to me, and they'll print out the stickers, and I'll draw the blood; because it's just too painful [for me] and takes up too much time to find a machine, and then to find a printer that works; that's if I can actually get into the machine.

It's happened too many times, that okay, I get into the patient [record on the handheld] and there's no specimens. So I'm trying to do a drug level, and no one's ordered it in the computer or [pause] the blood work has not gone through. So for me now if I have to draw blood work I just ignore the machines and the printers, and I just "plack a rec" and then send them.

Me: So you fill out a paper form, is that what you're doing?

Nurse02: Yeah. That's what I've always done and continue to do because with the machine it's just too much frustration.

The interview had lasted a full 18 minutes before I began to close it off (this was my first attempt to test the boundaries of the 15-minute “rule”).

Like the first nurse interviewed, Nurse02’s narrative was quite negative towards the system. Despite my attempt to instigate more discussion on how the system had specifically affected her work practice, most of Betty’s comments focused solely on the problems created by it.

Me: Ok, I won't keep you much longer, but before we stop - do you have any general comments on how your experience could've been improved through this entire process?

Nurse02: I don't like it, I don't think the system is very good. I think it's just too time-consuming and too much work. There must have been an easier system out there, where I can print out my stickers a lot quicker [pause] you know. It's just too time-consuming. My time [is better spent] looking after patients and not fooling around with these machines... I don't like the system, never did. It is just too much computer work and not enough hands-on, which is what I do.

Interview 2: Post interview reflections

While I waited for nurse 3, I reflected on the first two interviews, and took the following notes:

To Self: Wow! I'm not getting the rich narratives - about how the system has impacted their work. Despite trying to get them to discuss how their work has changed, they keep focusing too much on system issues! Maybe this is still good narrative?

I need to find ways to get the nurses talking more impartially about how the project had affected them and their work.

Relating this back to what Riessman (2008) refers to as important narrative divergences, I started to consider that these divergences – nurse narrations that, in the moment of these interviews, did not seem to contain “sufficient” information to me – were, in fact, valuable narrative accounts. What I began to realize was that I was recording expressions of freedom and resistance. These nurses were using these interviews as a forum to “send a message” and voice concerns and provide feedback that they were never given the opportunity to provide during the design and deployment of the system. This observation became even more prescient when, in later interviews, nurses began to more directly recount that they did not have any input into the system design or roll out.

6.2.2.4.3 Interview 3: Nurse 03

The third nurse, Nurse03, entered the room, smiled, and shook my hand. I offered her the choice of chair, and like the first two, she chooses the one facing the door.

Nurse03 is another senior nurse on the floor:

Me: [random sounds as we sign the consent forms] Many nurses focus their comments on the system, and I want to hear about that, but I also want to understand how you were introduced to the system and the whole experience process you had with learning to work with it.

So maybe just to start - were you using the old system prior as you were here?

Nurse03: Yes.

Me: So can you maybe just talk through when you first heard about the system and the training they would put you through.

Nurse03: The training was done over a very short period of time. We had one of our nurses from the floor, doing a follow-up, so she was put on shifts to be that for as we needed some help and advice, then she would come in during the night shift, so she would arrive at four in the morning to support us while we were transitioning. But the actual training itself was done when we were on the floor and when we had

spare time. So you were often busy and then pulled away from what you were doing to get the training.

Me: Wow.

Nurse03: It wasn't like we were scheduled to come in for four hours to learn it, it was [learned live] during the shift. You're often not focused during that time because you're thinking about twenty other things you need to do, and the fact that you haven't eaten all day or whatever. So the training I found was very -- [pause, then sighs] it wasn't very comprehensive. And a lot of the questions couldn't be answered during it as well. So when we ask how is this going to work, [their response was] "just give it a go and see what happens." So I think [the nurses] all came in with a lot of fear and a lot of anxiety about how we were going to use the system, especially on night shifts.

Me: So "giving it a go" as a direction, that means that you nurses had to explore the system and try to make sense of it on your own.

Nurse03: Absolutely!

Me: Did you feel comfortable doing that?

Nurse03: Not particularly, no... I'd say most of the time I had no idea what I was doing with it, not a clue. I'd often just randomly hit buttons and hope that I was getting the right thing... If somebody asked you to

do a urine or a blood culture or C-diff and you're trying to find that, that was probably one of the hardest things in the initial stage.

Me: So as you experimented and learned to use the system.

Nurse03: Yeah

Me: Did you share your findings with others and did others help you as you found new ways of using it.

Nurse03: Yeah, absolutely.

Me: There was a lot of camaraderie and sharing?

Nurse03: That's the only way to do it, yeah, yeah, especially again on night shifts where it's a small team. You just often say "how did you do this," "how did you do that" and somebody would show you.

Probably one of the most valuable things we had was that nurse coming in on that night shift to help us out in the mornings when we were having trouble. I think if it hadn't been for that, I think people would have just said "we're not doing this".

Later in the interview, Nurse03 mentioned some of the benefits of the system. In contrast to the previously interviewed nurses, she demonstrated a much stronger willingness to explore and identify the benefits of the system.

Nurse03: We do run an outpatient leukemia clinic out here as well. And they are regarded as complete outpatients^{xcvi}, so they're not even in our system. So we cannot use [CPOE] for them, so we have to do a combination of both. But I still scan [patients] and print out a generic label because I feel it's a good safety thing.... I know I've got their right blood. So I think from a safety point of view, I think it is a very good system.

Interview 2: Post interview reflections

Nurse03 was the last interview on the first day. After we were done, I took a few minutes to record notes about my experience thus far. I noted that at one point during this last interview, I thought to myself “finally, I have a nurse who is generating narratives about the local process of changing their routine.” Like the other nurses, Nurse03 raised complaints about the system, but unlike them, she exhibited an awareness of how the system has benefited her work in certain ways.

I noted that in Nurse03's narrative, the system has, in some cases, been repurposed to help support processes that were not originally part of the CPOE deployment. Nurse03's narrative also expressed a much richer narrative account – introducing dimensions such as safety, information sharing, motivation, and a process of exploration to identify new patterns of system use.^{xcvii}

NOTE: We now switch back from using first person singular.

6.3 Beyond the first day

The richness of narratives captured in these first three interviews was encouraging. Up until this last interview, we had concerns that all interviews would degrade into a repetitive stream of complaints about the new system. Though such information could indicate important themes such as emancipation and expression of agency, we expected to extract much richer narrative accounts of the nurses' lived experiences with the system. We found this richness in the last illustrated interview, in which we begin to see narrative accounts that indicated that how nurses adapted their routines to incorporate, or work around, the new technology. We found themes of change through exploration, the need to have the confidence and space to do so, and shared experience and comradery.

We visited the ward and hospital on eighteen later occasions, conducting interviews in mornings, afternoons, and even one at midnight. Sometimes we would arrive, and there would be only one nurse available; other times we would get three interviews. Most of the following twenty-eight nurse interviews went beyond the initially suggested fifteen-minute maximum. Moreover, though the nurse manager originally only scheduled twenty-two nurses, we eventually interviewed a total of thirty-one. This is an especially positive result, considering the excessive concern the nurse manager exhibited during early discussions about the project that the nurses would push back and possibly shut the research project down if it was too disruptive to their work.

To continue this level of discussion for the remaining eighteen visits and thirty-five interviews would be an excessive burden for the reader. We have provided this detailed

account of our first day in order to introduce the context fully and immerse the reading in the data collection setting.

6.4 Data Summary

In addition to the nurse interview data already summarized, three other categories of data were collected.

6.4.1 Context interviews

Though the primary data are comprised of nurse narrative accounts, to help further contextualize these narratives we conducted a number of interviews with other key personnel often mentioned in the nurse narratives: 1) Doctors, 2) Floor Clerk, and 3) Lab Technicians.

Interview ID	Minutes	Transcribed	Word Count	Common Shifts		Experience				Attitude Towards Sys.			Gender Male
				Night	Day	Pre CPOE	Junior	Mid	Senior	Positive	Indifferent	Negative	
Nurse Supervisor	15.00	✓	2,626		✓	✓		✓			✓		
Clerk01	23.00	✓	4,788		✓	✓	✓			✓			
DR01	29.00		*partial		✓	✓			✓			✓	
DR02	24.00	✓	3,947		✓	✓		✓				✓	✓
DR03	28.00		4,348		✓	✓			✓			✓	✓
LAB01	20.00	✓	3,252		✓	✓			✓	✓			
Total	139.00		18,961	0.0%	100.0%	100.0%	16.7%	33.3%	50.0%	33.3%	16.7%	50.0%	33.3%
Average	23.17		3,792										
Median	23.50		3,947										
Max	29.00		4,788										
Min	15.00		2,626										

*NOTE: Partial transcriptions were short form transcriptions that captured the key ideas, questions and themes of the interview.

Table 5 Summary of context interview data

6.4.2 Personal notes

At periodic intervals, we recorded notes on my observations and progress. These observations helped to further contextualize the narratives recorded and was included in the analysis.

Note ID	Minutes	Tran- scribed	Word Count
NOTE01	1.00	✓	133
NOTE02	9.00	✓	1,360
NOTE03	7.00	✓	895
NOTE04	10.00	✓	1,140
NOTE05	2.00	✓	209
NOTE06	23.00		5,231
NOTE07	6.00	✓	777
NOTE08	1.00	✓	87
NOTE09	3.00	✓	377
NOTE10	2.00		223
Total	64.00		10,432

Figure 37. Observational notes.

6.4.3 Documentation

A number of documents and videos were collected, with a specific focus on design documentation and project detail. These were included in the analysis and findings found within Chapter 7.

	Bridge high level workflow
	Communication Strategy - CPOE Inpatient Unit Pilot and Rollout
	CPOE Change Management Strategy - Inpatient Lab and DI
	cpoe_pacs_process_flow
	High level future visio Nov 2010
	Implementation Workbook
	Inpatient CPOE workflow-Master
	TOH Information Systems Update - October 2016
	Training and Support Strategy - CPOE Inpatient Unit Pilot and Rollout
	Visio-Inpatient CPOE workflow-Master
	Adoption-Award-Recipient-Webinar-Slides-EN
	central line process flow
	Clinical_pathway_flow
	RN Bridge Workflow
	2013 W21C Innovation Forum Dr. Glen Geiger(1)
	2016-Geiger-The ROI for Electronic Vital Sign Equipment at Every Bedside - himss16 Dr Geiger Presentation
	bloodcollection_from_dr_geigers_presentation
	Health Matters~ Dale C. Potter - YouTube
	House of Commons Committees - HESA (41-1) - Evidence - Number 060
	Mobility transforms healthcare delivery at The Ottawa Hospital - YouTube
	Ottawa Hospital Research Institute
	Ottawa Hospital's CIO explains his iPad program ~ MobiHealthNews
	T10.016+++ConnectingOntario+Patient+Brochure+++October+2016

Table 6: Sample of collected documents

6.5 Summary

In this chapter, we have supplied details surrounding the data collection processes and provided an initial summary analysis of the interview data. In the following two chapters, we present our analysis of the collected narratives. In Chapter 9, we discuss our findings, and in Chapter 10 we conclude with a summary of contribution, limitations and recommendations for future research.

^{lxxxix} Note the outlier interview of Nurse27 of 65 minutes. This was the only interview conducted after midnight during the evening shift. This was a time least activity for nurses, and thus, allowed for a more time to conduct a more in-depth interview. The interviewee was also very interested in the system and the research, and was willing to participate in a lengthy interview.

^{lxxx} It's interesting to note that parallels with this behaviour are also found in nurses' active responses to the introduction of the system. Much like the phenomenon of interviewee resistance expressed as digressions from the interviewers intended framing, nurses responded to the introduction of CPOE by enacting somewhat divergent usage patterns from what was initially planned or designed. A common narrative is that these changes were imposed upon them without any input, and in response, it would seem that nurses responded by finding ways to express their freedom through somewhat resistant responses and actions. This fundamental dialectic of control and freedom (constraint and agency, death and life) underlies much of what was observed in these narrative accounts.

^{lxxxix} The results of which are outlined in great detail in Chapter 7.

^{lxxxii} In this use of the term "vicarious experience", Hyett et. al. (2014) infer the phenomenon of observing another and feeling what they feel.

^{lxxxiii} The Nurse Supervisor reported to the Nurse Manager. The Nurse Supervisor worked closely with the unit nurses and managed scheduling.

^{lxxxiv} Initially, the nurse manager and supervisor expressed concern about the excessive time the interviews would take. As the interviews progressed, the constraint of only interviewing who was on the list was relaxed, and the 15-minute time allotted for interviews was expanded.

^{lxxxv} I later found out that the second LCD is no longer used, and as one nurse mentioned (Nurse14) the LCD works better as a place to stick announcements.

^{lxxxvi} The one exception was an interview conducted in a vacant patient room in the in-patient area of the unit. It was interesting to note the different demeanor and attitude of this interview compared to the previous interviews conducted within the family room. Though this difference could have been attributed to a unique personality, it seemed like the room itself – that of being a patient treatment area – brought out a more professional and guarded demeanor. This was a domain that the nurses, in a sense, owned.

^{lxxxvii} For all interviews, I sat with my back to the door, while the nurse sat in the seat facing the door (see Figure 36). For the first three interviews, I offered nurses the choice of where to sit, and all chose the seat facing the door. From all interviews thereafter, I simply directed the nurse to that chair. For every nurse though, I offered to close the door to ensure that they were fully comfortable in speaking freely, all but one nurse quickly agreed and showed no concern. One nurse said she would be more comfortable with the door open – and that since it was evening (around 9:30pm), there wouldn't be anyone around to hear anything she said.

^{lxxxviii} There are many medical terms and references to medical equipment made during interviews. Also, there are various terms that seemed to be local – and used as a means of shorthand communication between the healthcare providers on the ward. For an accurate portrayal of the data, I have chosen to retain technical terms and any "lingo" that I captured. For any terms not commonly known, I will add a definition or explanation as a footnote.

^{lxxxix} Febrile – to show indications of a fever.

^{xc} Blood cultures are test for bacteria, and are ordered at first signs of any indications of a bacterial infection. There are a number of blood culture sets that can be ordered.

^{xcⁱ} Electrolytes include sodium (Na⁺), potassium (K⁺), calcium (Ca²⁺), bicarbonate (HCO₃⁻), magnesium (Mg²⁺), chloride (Cl⁻), and hydrogen phosphate (HPO₄²⁻).

^{xcⁱⁱ} Tacrolimus (5-W nurses often refer to this as “Tac” or “Tacro”) is an immunosuppressant used as anti-rejection drug for bone marrow patients. It is a strong drug that can cause liver and kidney damage. Patients on tacrolimus receive a daily blood test to determine the level of this drug in the patient’s system so that the dosage is adjusted to an appropriate level for the patient.

^{xcⁱⁱⁱ} Paper requisition. In certain circumstances, the updated CPOE process allows for the use of the old paper requisitions. As will be elaborated on later, this allowance is often abused. In one extreme case (NURSE02), this allowance is used to bypass using the system entirely.

^{xc^{iv}} I took note of this observation, and in future interviews, I added to my introductory speech a discussion about judgement – that I’m not looking to identify if the system is good or bad, nor am I representing the administration or providing the administration and management of TOH any report on my findings.

^{xc^v} As with the first nurse, though, as the interview progressed, the apparent urgency to “get this over with” disappeared. For the first couple of interviews, I even purposely tried to shut down the conversation at the 15-minute mark. After the first three or four interviews, however, it was becoming clear that nurses didn’t have any problem with speaking longer – and I slowly began letting interviews go a bit longer. Since no concerns were raised, I even let some later interview go past the 30-minute mark, with one nurse interview being 65 minutes in length.

^{xc^{vi}} As I found out in a later interview with one of the ward doctors, these patients are not out-patients, but rather day-patients. The distinction is that an out-patient is not admitted, and therefore not under doctor care. Day-patients, on the other hand, are admitted and under doctor care. This is an example of differing terms between groups that was recorded during the interviewing process.

^{xc^{vii}} Similar repurposing patterns were later found in other narratives as well. These patterns will be elaborated on in Chapter 7.

Chapter 7: Data Analysis and Findings: Organizational Routine Disruption

This chapter includes the findings derived from the case of a technology initiated routine disruption and renewal event that occurred in a nurse blood collection routine at The Ottawa Hospital. In previous chapters, we have presented details surrounding the organizational context (Chapter 5) and the data collection process (Chapter 6). This chapter details the results of our qualitative study. The results found in this chapter are derived from nurse narrative accounts of their experience with a recent CPOE system introduction. This analysis contributes new insights by detailing how an organizational routine responds to technology initiated disruption and identifies unexpected emergent changes in a routine as a result of technology introduction and change.

The findings in this chapter are organized into three sections. First, we identify and contrast the original routine with the espoused routine that represents the change target for the enactment of the blood collection routine. Secondly, using the Narrative Network approach (Pentland & Feldman, 2007), we identify the actual blood collection structure that nurses engage in when performing their routine in practice. Lastly, we catalog five distinct subroutines and further identify key variations in the performance of these subroutines and any unexpected, or emergent, behaviours associated with these events.

7.1 Section 1 – The Espoused and Original routine

Organizations often invoke the return of extraordinary value to justify technology investments (Brynjolfsson & Saunders, 2010; Mahmood & Mann, 1993). This justification is partially constructed by management expectations about how individuals within the organization will accomplish work tasks using the various aspects of the proposed technology (Markus, 2004). Managers define these expectations by articulating a new organizational routine. Following (Rerup & Feldman, 2011), we define the espoused routine as the anticipated target pattern of work that is expected as a result of the technology introduction.

In this section, we identify the espoused routine and then contrast this with the original work routine which it was to replace. This analysis establishes the structure of the routine before the technology initiated disruption, and the target change expected from the deployment of the technology.

The espoused routine is an important analysis structure, as it represents the change target (Feldman, Pentland, D'Adderio, & Lazaric, 2016). Though the espoused routine is typically articulated in many forms during the design and implementation process, in this study, it was most relevant to identify the espoused routine from a user perspective. Our focus, therefore, is to understand the espoused and original routine from the perspective of the nurses.

7.1.1 Identification of the Espoused Routine

The espoused nurse blood collection routine was identified through system design documentation (Appendix A), training artifacts (Appendix B), and nurse narrative analysis. One of the key sources of this data was the presentation material used by the Chief Medical Information Officer (CMIO) at TOH, as he promoted the project throughout TOH. This data served as a primary source for the espoused routine; this data was also augmented using nurses' observations and reflections on the original positioning of the new system. From this data, we identified actions and relations between these actions, and represented these findings in Figure 38, Espoused Blood Collection Routine.

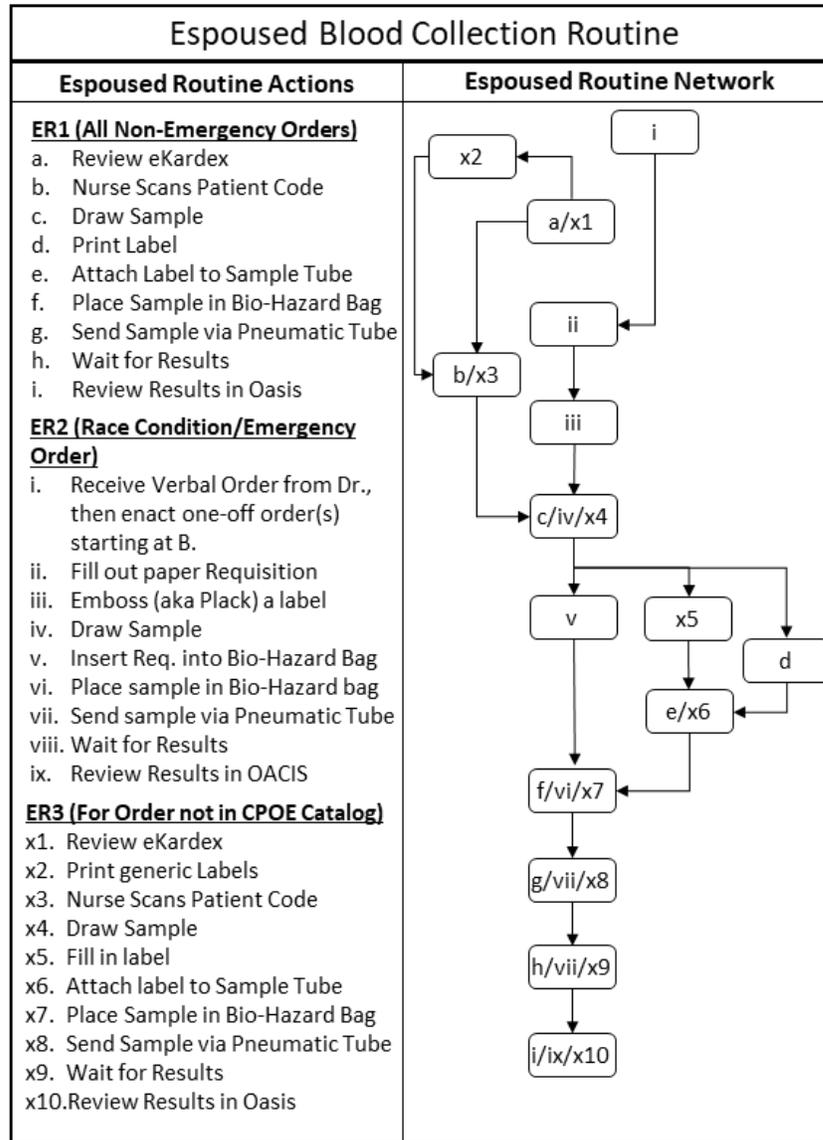


Figure 38. Espoused Blood Collection Routine.

An analysis of the espoused routine (Figure 1) indicates three general performance contexts:

7.1.1.1 ER1: Non-emergency orders

The first performance pattern found within the espoused routine (ER1 in Figure 38) describes how to handle non-emergency blood collection orders. These are orders placed by the doctor in one of three general forms: single instance orders, repeated orders, or standing orders. Single instance orders occur once, while repeated orders are orders that are scheduled at some regular intervals over for the period of patient care. Standing orders (nurses used differing terms to describe this order, the second most commonly used term is “conditional order”) are orders that nurses may never instantiate but operate as standing doctor approvals that allow nurses to initiate new tests at their discretion depending on the condition of the patient. The most common type of this order is blood cultures in response to vitals that indicate a patient is febrile.^{xcviii}

7.1.1.2 ER2: Emergency orders/Race condition

The second performance pattern found within the espoused routine (ER2 in Figure 38) describes the blood test ordering context of declining patient health (in extreme cases referred to as a race call). When a patient shows a significant health decline, a race call is declared, and a response team of healthcare providers enters the room to coordinate and deliver emergency care. During this time, the CPOE system is bypassed completely, and a nurse is assigned as a “runner” to manage and fill in paper requisitions and send samples. Race conditions are a more extreme version of a stat order. Stat orders are often one-off orders that require quick processing of test results. Stat orders are handled as single instance orders using ER1.^{xcix}

7.1.1.3 ER3: Orders not found in CPOE catalog

The third performance pattern found within the espoused routine (ER3 in Figure 38) describes the order context for situations when an order is not in the TOH lab catalog. During the implementation of the system, considerable variation across units in both the type of orders and the references used to indicate those orders were found. According to a lab supervisor involved in the design and deployment of the system (steering committee level), matching differing order catalogs was a key and ongoing challenge for the CPOE project team. Since not all of these discrepancies could be resolved in time, the new CPOE system included the use of generic labels to accommodate orders not yet supported by the CPOE process. These generic labels were printed by the CPOE devices and contained information associated with a patient, but not with a specific test. When nurses encountered a non-CPOE order^c, nurses were instructed to print generic labels and write in the required test information with a pen, which, in turn, would be manually interpreted at the lab by specimen receiving personnel.

7.1.1.4 Additional findings of note

The espoused routine used by management was a simplified version of the more detailed design documents. Though we identified a number of design documents that contained more detail, these documents were clearly developed more to support the development process. This assertion is supported by our analysis of nurse narratives which indicated that more detailed representations of the proposed routine were not presented to the nurses, nor (based on discussions with the development team) would it seem that these documents

were developed with the intention of doing so. Following Pentland & Feldman (2007), we chose “a view” that was from the nurses perspective. Therefore, these design documents were excluded from determining the espoused routine as they were not presented to the health practitioners that enacted the routine in practice.

7.1.2 Identification of the Original Routine

Similar to the method used for identifying the espoused routine, the structure of the old routine was identified from the materials presented by the Chief Medical Information Officer at The Ottawa Hospital as he promoted the project throughout TOH and to the nurses involved in blood collection routines in 5-West. Further, we slightly augmented this method to accommodate the general representations of the old routine found in the collected nurse narratives. The findings from this analysis are presented in Figure 39, Original blood collection routine.

Our findings indicate that the original routine consisted of both paper processes and a rather new digital electronic health record system – Open Architecture Clinical Information System (OACIS). As part of this original process, patient care plans were generally stored in both paper and electronic form, but the long-term goal of this process was to move to a fully digitized system.

Within this original blood collection routine, order requisition processing was accomplished in one of two general ways: 1) via pre-printed labels supplied by the lab, or

2) by paper order sheets manually filled in by nurses as part of the blood collection processes.

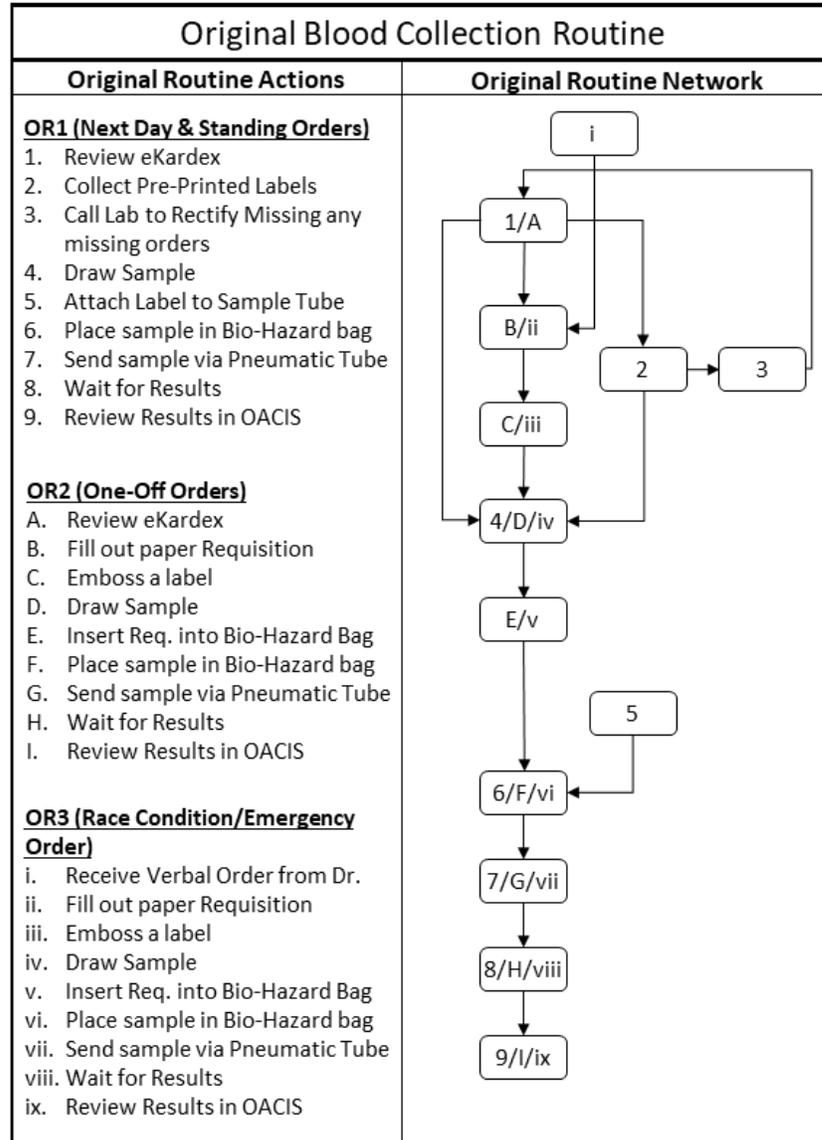


Figure 39. Original blood collection routine.

A decomposition of the original blood collection routine (Figure 38) indicates three general performance contexts:

7.1.2.1 OR1: Next day & standing orders

The first performance pattern found within the original routine (See OR1 in Figure 39) describes the handling of anticipated, or routine orders that doctors schedule in advance. Doctors define patient care plans which often include order patterns associated with common treatment regimes. For example, many patients of 5-West undergo bone marrow transplantation. To help reduce the risks associated with a diminished immune system, bone marrow transplant patients require the administration of an immunosuppressant drug (Tacrolimus) along with antibiotics (e.g. Vancomycin). The levels of each of these drugs must be monitored very closely through daily blood test administration that measures current levels of each drug. Physicians document this test regime, and other test schedules/patterns in a patient care plan. Clerks review these plans and transcribe the next day orders onto an attestation sheet. At the end of each day, the clerks send this daily attestation sheet to the lab. Each night, the lab processes the sheets by entering the data in the lab information system (Cerner), printing test labels for all the tests scheduled for the upcoming daily collection round. Each morning, the unit clerk receives these labels from the lab via a pneumatic tube material delivery system. Clerks then collate and organize the received labels for each patient currently being treated. Nurses further verify the correctness of the day's scheduled orders for their

patients^{ci}, and finally, collect and send the required test samples back to the lab via the pneumatic tube system.

7.1.2.2 OR2: One-off orders

The second performance pattern found within the original routine (See OR2 Figure 39) describes the handling of unanticipated orders that are the result of changing care plans and changing patient conditions. Nurses handle these orders by a process which they refer to as “Placking a Req”. This process involves using a pen to write order information on an order sheet and then imprinting patient information on this sheet using a device called an addressograph. The placking is a reference to the process of taking an imprint of the patient information, but nurses of 5-West have adopted this as a term to represent the entire “old” paper requisition process.

7.1.2.3 OR3: Emergency orders/Race conditions

The third performance pattern found within the original routine (See OR3 Figure 39) describes the handling of patient emergency orders and varies only slightly from OR2. During patient emergencies, such as the aforementioned race call, doctors will call out orders while a nurse designated as a “runner” would process

these one-off orders using paper based requisitions. OR3 is a slight variation in OR2, in that – in OR3 – the order recording in a patient care plan is bypassed.

7.1.2.4 Additional findings of note

Under the old routine process, routine blood collection was primarily organized by the lab and the floor clerk, with oversight by the nurses. A large part of a nurse's identity seems to be derived from overseeing the order process for their patients. The lab would send blood collection labels for the required sample for the day; the clerk would organize these labels to develop a manifest for the routine blood collection anticipated for the day. Nurses were, and continue to be, responsible for ensuring that the proper test is administered – and nurses commonly double-check the daily manifest against the patient care plan. Anomalies, such as missing orders, were addressed using a new paper requisition. Non-routine orders consisted of one-off orders in response to changing treatment regimens or changing patient conditions.

7.1.3 Analysis of original and espoused routine

Both the new espoused routine and the old routine were compared and contrasted to identify key changes that were anticipated by management, and what changes were required for the new blood collection routine performance by nurses.

As indicated in our prior documentation of the CPOE project, managers of the CPOE project billed the project as a large and innovative new health information technology deployment. We found that, despite the characterization of CPOE as an innovative and

complex deployment project, the actual changes anticipated to the blood collection routine were minimal. When contrasting the espoused and the original routine, these changes were identified as the removal of two actions and the addition of four new actions. These findings are illustrated in Figure 40, “Original and espoused routine contrasted”.

Original Blood Collection Routine	Espoused Blood Collection Routine
<p>Original Routine Actions</p> <p>OR1 (Next Day & Standing Orders)</p> <ol style="list-style-type: none"> 1. Review eKardex 2. Collect Pre-Printed Labels 3. Call Lab to Rectify Missing any missing orders 4. Draw Sample 5. Attach Label to Sample Tube 6. Place sample in Bio-Hazard bag 7. Send sample via Pneumatic Tube 8. Wait for Results 9. Review Results in OACIS <p>OR2 (One-Off Orders)</p> <ol style="list-style-type: none"> A. Review eKardex B. Fill out paper Requisition C. Emboss a label D. Draw Sample E. Insert Req. into Bio-Hazard Bag F. Place sample in Bio-Hazard bag G. Send sample via Pneumatic Tube H. Wait for Results I. Review Results in OACIS <p>OR3 (Race Condition/Emergency Order)</p> <ol style="list-style-type: none"> i. Receive Verbal Order from Dr. ii. Fill out paper Requisition iii. Emboss a label iv. Draw Sample v. Insert Req. into Bio-Hazard Bag vi. Place sample in Bio-Hazard bag vii. Send sample via Pneumatic Tube viii. Wait for Results ix. Review Results in OACIS 	<p>Original Routine Network</p> <p>Actions Removed from New Routine</p> <ul style="list-style-type: none"> 1. Review eKardex 2. Collect Pre-Printed Labels 3. Call Lab to Rectify Missing any missing orders 4. Draw Sample 5. Attach Label to Sample Tube 6. Place sample in Bio-Hazard bag 7. Send sample via Pneumatic Tube 8. Wait for Results 9. Review Results in OACIS
<p>Original Routine Network</p> <p>Actions Removed from New Routine</p> <ul style="list-style-type: none"> 1. Review eKardex 2. Collect Pre-Printed Labels 3. Call Lab to Rectify Missing any missing orders 4. Draw Sample 5. Attach Label to Sample Tube 6. Place sample in Bio-Hazard bag 7. Send sample via Pneumatic Tube 8. Wait for Results 9. Review Results in OACIS 	<p>Original Routine Network</p> <p>Actions Removed from New Routine</p> <ul style="list-style-type: none"> 1. Review eKardex 2. Collect Pre-Printed Labels 3. Call Lab to Rectify Missing any missing orders 4. Draw Sample 5. Attach Label to Sample Tube 6. Place sample in Bio-Hazard bag 7. Send sample via Pneumatic Tube 8. Wait for Results 9. Review Results in OACIS
<p>Original Routine Actions</p> <p>OR1 (Next Day & Standing Orders)</p> <ol style="list-style-type: none"> 1. Review eKardex 2. Collect Pre-Printed Labels 3. Call Lab to Rectify Missing any missing orders 4. Draw Sample 5. Attach Label to Sample Tube 6. Place sample in Bio-Hazard bag 7. Send sample via Pneumatic Tube 8. Wait for Results 9. Review Results in OACIS <p>OR2 (One-Off Orders)</p> <ol style="list-style-type: none"> A. Review eKardex B. Fill out paper Requisition C. Emboss a label D. Draw Sample E. Insert Req. into Bio-Hazard Bag F. Place sample in Bio-Hazard bag G. Send sample via Pneumatic Tube H. Wait for Results I. Review Results in OACIS <p>OR3 (Race Condition/Emergency Order)</p> <ol style="list-style-type: none"> i. Receive Verbal Order from Dr. ii. Fill out paper Requisition iii. Emboss a label iv. Draw Sample v. Insert Req. into Bio-Hazard Bag vi. Place sample in Bio-Hazard bag vii. Send sample via Pneumatic Tube viii. Wait for Results ix. Review Results in OACIS 	<p>Original Routine Network</p> <p>Actions Removed from New Routine</p> <ul style="list-style-type: none"> 1. Review eKardex 2. Collect Pre-Printed Labels 3. Call Lab to Rectify Missing any missing orders 4. Draw Sample 5. Attach Label to Sample Tube 6. Place sample in Bio-Hazard bag 7. Send sample via Pneumatic Tube 8. Wait for Results 9. Review Results in OACIS
<p>Original Routine Actions</p> <p>ER1 (All Non-Emergency Orders)</p> <ol style="list-style-type: none"> a. Review eKardex b. Nurse Scans Patient Code c. Draw Sample d. Print Label e. Attach Label to Sample Tube f. Place Sample in Bio-Hazard Bag g. Send Sample via Pneumatic Tube h. Wait for Results i. Review Results in Oasis <p>ER2 (Race Condition/Emergency Order)</p> <ol style="list-style-type: none"> i. Receive Verbal Order from Dr., then enact one-off order(s) starting at B. ii. Fill out paper Requisition iii. Emboss (aka Plack) a label iv. Draw Sample v. Insert Req. into Bio-Hazard Bag vi. Place sample in Bio-Hazard bag vii. Send sample via Pneumatic Tube viii. Wait for Results ix. Review Results in OACIS <p>ER3 (For Order not in CPOE Catalog)</p> <ol style="list-style-type: none"> x1. Review eKardex x2. Print generic Labels x3. Nurse Scans Patient Code x4. Draw Sample x5. Fill in label x6. Attach label to Sample Tube x7. Place Sample in Bio-Hazard Bag x8. Send Sample via Pneumatic Tube x9. Wait for Results x10. Review Results in Oasis 	<p>Original Routine Network</p> <p>Actions Added to Old Routine</p> <ul style="list-style-type: none"> x1. Review eKardex x2. Print generic Labels x3. Nurse Scans Patient Code x4. Draw Sample x5. Fill in label x6. Attach label to Sample Tube x7. Place Sample in Bio-Hazard Bag x8. Send Sample via Pneumatic Tube x9. Wait for Results x10. Review Results in Oasis

7.1.4 Figure 40. Original and espoused routine contrasted. Summary of findings

The attestation sheet process (see OR1, Figure 39) was known to be error prone and was considered labor intensive by the clerks and by lab personnel. Also, since nurses are responsible for the integrity of the ordering process, considerable nurse time was consumed monitoring the process by calling on the lab and the clerk to obtain more information or to correct errors.

Within the new espoused routine, this attestation sheet processing routine was replaced by a new process which tasked nurses with printing the necessary labels as part of their patient scanning and blood collection process. Under this new process, nurses would be given a handheld device (referred by nurses in various terms, the most common of which are “handheld,” “scanner,” and “bridge”) which would allow them to print their own labels as part of the specimen collection process. This change was expected to reduce work required from the daily routine of the lab^{cii} and clerks^{ciii}, and empower and enable the nurses to more accurately manage the ordering process. Due to the nurse’s responsibility in ensuring the integrity of the orders, this was initially seen by the nurses as a good thing.

Over time, however, as the nurses gained experience using the system, perceptions developed that characterized the system as lacking sufficient flexibility, stability, and

integrity. Increasingly, for some nurses, the system seemed to frustrate more than empower:

...it almost seemed like old technology by the time it was rolled out, like the handhelds they are slow they load like - it seems like, why couldn't they put it on an iTouch?... I found that it wasn't the most user-friendly app. Sometimes you'll try to launch it like click on the button to actually open up the lab work and it will just load, and it doesn't open. (Nurse10)

There was process-flow documentation that provided detail surrounding the steps required to process a blood collection order, but these system process flows were not communicated to nurses. Nurses could not recall the use of any process flows or design documents during their training. The nurse training material focused more promoting the system:

So the training I found was very -- [pause, then sighs] it wasn't very comprehensive. And a lot of the questions couldn't be answered during it as well. So when we ask how is this going to work, [their response was] "just give it a go and see what happens." (Nurse03)

As was apparent during many of the interviews, the full realization of the complexity of the new system was not revealed until the nurses began using the system in practice. Compounding this problem was the time nurses needed to take from their busy work schedule in order to receive training from a designated support person. Nurses were often distracted by other tasks, and some felt that this training approach was not effective, nor appropriate:

We were encouraged to [take the training]. We were told we had to learn how to do it because we do so much of it, right... [but] I don't know how well planned it was. They would just pull people off the floor, go with them in the conference room, sometimes taking us away from our work at the worst times. (Nurse09)

This lack of detail found in the espoused routine resulted in nurses engaging in a great deal of exploration and improvisation as they explored appropriate use of the system for their needs.

In response to her questions about CPOE, Nurse03 was told to “give it a go” and see what happens. Similarly, during the initial introduction of the system Nurse15 said she found that “it was a bit of trial and error on my part.” Other comments from nurses included that depended heavily on receiving help from their peers (i.e. Nurse15: “I've learned what to do ... by asking peers mostly”), and another nurse characterized her early experience with the system as “randomly hitting buttons until I figured it out.”

Another area of contrast between the original routine and the new espoused routine is that the old routine included a method of clearly identifying a “stat” or one-off order. Within the original routine, these orders were filled in on special “pink sheets” that clearly indicated that the order was a special one-off order that required quick processing. Within

the new espoused routine, the new CPOE system did not print labels to identify on the specimen label that an order was STAT:

...we could put STAT [on the paper requisitions], but there is no indication on [the new labels] indicated STAT for the lab to see if it's a stat order. Like, if it's on a pink req [old paper requisitions], they see that as a STAT, and they take those first. With the new system, we don't know how to indicate that it's a STAT order. (Nurse09)

Interviews with lab managers indicated that this distinction may no longer be necessary as received specimens were now processed automatically and the data loaded into their lab information system via automatic testing equipment. Therefore, data from this Lab Information System would then be automatically transferred to OACIS for nurse review. From the nurse's perspective, after years of experience in having to indicate a stat order clearly using the pink sheet, there was a sense of uneasiness and mistrust for this new process. The source of this uneasiness was a dialectic tension between the ostensive aspect of the nurse blood collection routine and their current performance of that routine, and tension motivated new behaviours such as unnecessary calls to the lab to indicate that an emergency order is being sent.^{civ}

One key aspect of the CPOE system, from a nurse's perspective, is that doctors would more closely monitor and manage their orders. In the old routine, a large portion of nurse work was directed at ensuring the integrity of the paper based processes and the eKardex and patient care plan documentation approved by the doctors. A common theme within nurse

narratives was that many orders were not being entered into the system correctly, or even at all:

I'm comfortable with logging in, scanning. I can enter orders like entering blood work and stuff. I don't like it that I'm sometimes the one who has to do it because the doctors are not always keen on doing it like they need a lot of encouragement or reminders to put in their own blood work, because it beats the purpose of the system. They call it physician order entry, not nurse order entry. When they are ordering stuff throughout the day, they write CBC, whatever in their [care plan], but it's not in CPOE. The clerk, it's not their job to do it, and it's not our job to do it, but we end up doing it. (Nurse09)

With the occurrence of missing orders, previous nurse work involved checking and verifying the integrity of orders was not eliminated but transferred to mitigating new, often more complex, issues with the CPOE system order integrity. Moreover, some nurses expressed concern that the new system allowed the generation orders without the attending doctor's approval:

[in response to missing order] I can order blood work, but the physician doesn't have to co-sign it which seems very wrong because I'm technically not supposed to have that authority as a nurse. But we do it anyways, {whispered} "sometimes" {with a laugh}. (Nurse01)

When asked how they now identify missing orders, one nurse's responded:

...mainly on experience, I would say I use my judgment, that this person should have this [order], but it's not in there, why is it not in there? So I'm constantly going back to take a look and see. (Nurse31)

7.2 Section 2: The Enacted Routine in Practice

To more fully explore the micro foundational processes through which routines responded to technology initiated disruption and renewal, we must first establish how the routine is performed in actual practice. In this section, we utilize a narrative analysis technique to document the structure of the nurse blood collection routine in practice.

Organizational routines are enacted by specific actors who utilize various tools to accomplish tasks (Gaskin, 2012). Identification of how the routine is enacted in practice cannot be determined from design documentation alone, as such artifacts do not adequately account for the varied ways in which work is performed in practice (Yeow & Faraj, 2011). By applying the narrative network technique to identify the details about how the routine is performed or enacted in local practice we can further understand the results of the technology disruption and renewal process, and identify both the performative structure and the variations that occur in the execution of the routine.

In response to this concern of identification of enacted routines, many researchers have called for greater use of the Narrative Network approach as a means of better identifying and analyzing actual routine enactment in practice (see for example: Yeow & Faraj, 2011; Chao, 2016; Hayes, Lee, & Dourish, 2011; Constantinides & Barrett, 2012; Danner-Schröder & Geiger, 2016; Berente, Lyytinen, Yoo, & King, 2016; Berente et al., 2016; Sele & Grand, 2016; Sammon, Nagle, & McAvoy, 2014; and Gao, Deng, & Bai, 2014).

Narrative networks allow researchers to identify and represent specific actions and the relationship between actions, and thus provide an ideal mechanism for routine performance analysis:

The narrative network is a method for representing and visualizing patterns of technology in use. Consistent with theory, it puts action in the foreground and expresses patterns of action in a way that retains possibilities and alternatives. (Pentland & Feldman, 2007, p. 787)

Using this approach to understand how a routine is enacted, the focus this section is on the analysis of the enacted routine from the perspective of the agents, by identifying the specific actions they perform, and the sequences of actions that they consider a valid performance of the routine. In this analysis, we have found that such perspective is often not made explicit or direct, but must be assembled from the various agents involved in the performance of the routine and their various and differing accounts.

7.2.1 Coding approach

To analyze the collected narratives, we used a combination of structural coding and descriptive coding as outlined by Saldaña, (2016). Such coding involves attributing meaning to portions of individual narrative nurse accounts for the purposes of pattern detection:

In qualitative data analysis, a code is a researcher-generated construct that symbolizes or “translates” data... Just as a title represents and

captures a book, film, or poem’s primary content and essence, so does a code represent and capture a datum’s primary content and essence.

(Saldaña, 2016, p. 4)

Our specific focus was applying these techniques to the identification of patterns of action and variations in performance patterns.

The analysis was guided by the coding levels found in Figure 41.

Data	Analysis	Information		
		1st Order Coding	2nd Order Coding	3rd Order Coding
Captured Narrative	Analysis of Performance	Actions	Routine Performance	Performance Patterns

Figure 41. Coding approach – Enacted routine.

The details of this approach are outlined in the following three subsections.

7.2.1.1 First order coding: Actions

Actions represent the key elements of an organizational routine (Feldman & Rafaeli, 2002). Individual narrative accounts of nurse experience with the deployment and use of the new CPOE system are a rich source of data that indicates actions involved in the actual routine performance. Our first level coding involved identifying narrative fragments that detail the performance of the routine in practice.

7.2.1.2 Second order coding: Routine performance

In our second order coding, narrative fragments identified in our first level coding were analyzed to identify the discrete actions and sequential structure of the enacted routine.

As we have seen in much of the literature on organizational routine, the execution of routines involves variations in both action selections and the structural patterns of those actions performed (Feldman & Pentland, 2003; Gaskin, 2012; Pentland et al., 2012), and that narrative networks serve as an effective means of capturing this variation (Pentland & Feldman, 2007).

Using the information from our second level coding, a representational structure of the enacted routine as a narrative network of actions was developed.

7.2.1.3 Third order coding: Subroutine bracketing

Using information from the second level coding, we identified the structure of any actual or enacted subroutines. This structure was identified by analyzing the underlying patterns found in nurse narratives that indicated a single, or special, performance of the routine in practice. By bracketing these performance patterns based on common clusters of actions found within the nurse narratives, the larger narrative was decomposed into key subroutines. These subroutines were then further analyzed to identify key variations in subroutine performance. Using this method, we determined the key events and contexts that led to routine performance variation. This information is later used in the dialectic content analysis of Section 3.

7.2.2 Specific implementation

Consistent with our analytic schema (See Figure 41), the following steps were used, as documented in Table 7.

Step	Goal	Method
1	Identify narrative fragments indicating performance/actions	Using NVIVO software, we review all transcribed nurse interviews and identify narrative fragments where the performance of a routine was mentioned
2	Identify specific actions	Using NVIVO software, and the in vivo technique, the narrative fragments identified in step 1 are forward coded to identify specific actions taken in the performance of the routine
3	Synthesize categories of actions	Using NVIVO software, the specific actions identified in step 2 are aggregated to produce general categories (to accommodate the varying reference terms and language used)
4	Identify the narrative network	Using NVIVO software, identified actions are collected into a narrative network model that documents both actions and the sequential relationships involved in the performance of the new routine
5	Decompose narrative network into key subroutines	To support further analysis of change and variation in the enacted routine over time, we decompose the identified narrative network into sub-routines that represent typical clusters of actions discussed by the nurses when recounting their performance of the blood collection routine
6	Identify Variation Events	For each subroutine identified, we identify the perceived normal performance and any variation events that alter this performance

Table 7: Narrative Network Method.

7.2.2.1 Step 1: Identify narrative fragments

To identify the enacted routine structure, first, we coded nurse transcripts to identify instances where the performance of a routine was discussed by the nurse.

7.2.2.2 Step 4: Identify narrative network

Having determined the structure of individual nurse blood collection routine performance, we then identified the general structure of the collective routine performances and

synthesized a narrative network structure to represent the enacted blood collection routine in practice.

7.2.2.3 Step 5: Identify subroutines

Using the narrative network results, we identified clusters of actions most often associated together and segmented the narrative network into a number of key subroutines.

7.2.2.4 Step 6: Identify variation events

For each of the identified subroutines, we found a number of common performance patterns and variations in these performances. This served to identify key cases of unexpected emergent blood collection routine behaviour within each subroutine.

7.2.3 Summary of results

7.2.3.1 The enacted routine in practice

The identified narrative network of the enacted routine is presented in Figure 42, “Narrative network of collective nurse blood collection routine”. This diagram illustrated the actions and action sequences that represent the collective possibility of actions that a nurse may engage in during the performance of a blood collection routine. Therefore, this narrative network structure represents the known sets of possible actions. Each performance instance is the result of a nurse’s selection of a specific path through this identified network of possible actions represented in the routine.

In terms of routine theory, this narrative network structure represents the ostensive aspect of the routine. Organizational routines are defined as “repetitive, recognizable patterns of interdependent actions, carried out by multiple actors” (Feldman & Pentland, 2003, p. 94). The performance of a routine is specific to a time and set of environmental conditions. The ostensive aspect enables these agents to “guide, account for, and refer to specific performances of a routine” (Feldman & Pentland, 2003, p. 94). The performance of the routine is an enacted instantiation of the ostensive structure of the routine. The applied narrative analysis method was used to determine the group level ostensive aspect of the blood collection routine.

The identified enacted routine includes seventy-five distinct general actions and four sub-actions.

7.2.3.1 Enacted routine versus espoused

Contrasting the espoused routine with the enacted routine can reveal significant differences between those actions assumed in design and those actions performed in practice (Bertels, Howard-Grenville, & Pek, 2016; Rerup & Feldman, 2011).

The comparison between the enacted and the espoused routine findings reveal that nurse accounts of their routine performance were significantly more complex and varied than anticipated within the espoused routine (see Figure 43). Our analysis found alignment between the espoused and enacted routine along twelve of the seventy-five identified actions. Within the identified enacted blood collection routine, all twelve espoused routine

actions were represented in the new routine structure along with additional sixty-three new actions.

This finding is not unexpected, as the actual performance of a routine is often much more complex than representations of the target routine found in project plans and design (Dosi et al., 2000), but the degree to which enacted routine diverged from the espoused was surprising.

In the next portion of the analysis (Section 3), we looked at these variations and summarize the context that generated, or instigated such events. In this analysis, “normal” performances are identified. Here, “normal” is what is considered by the nurses as the expected set of actions performed in the blood collection routine (even if they choose to enact the routine with another set of actions).

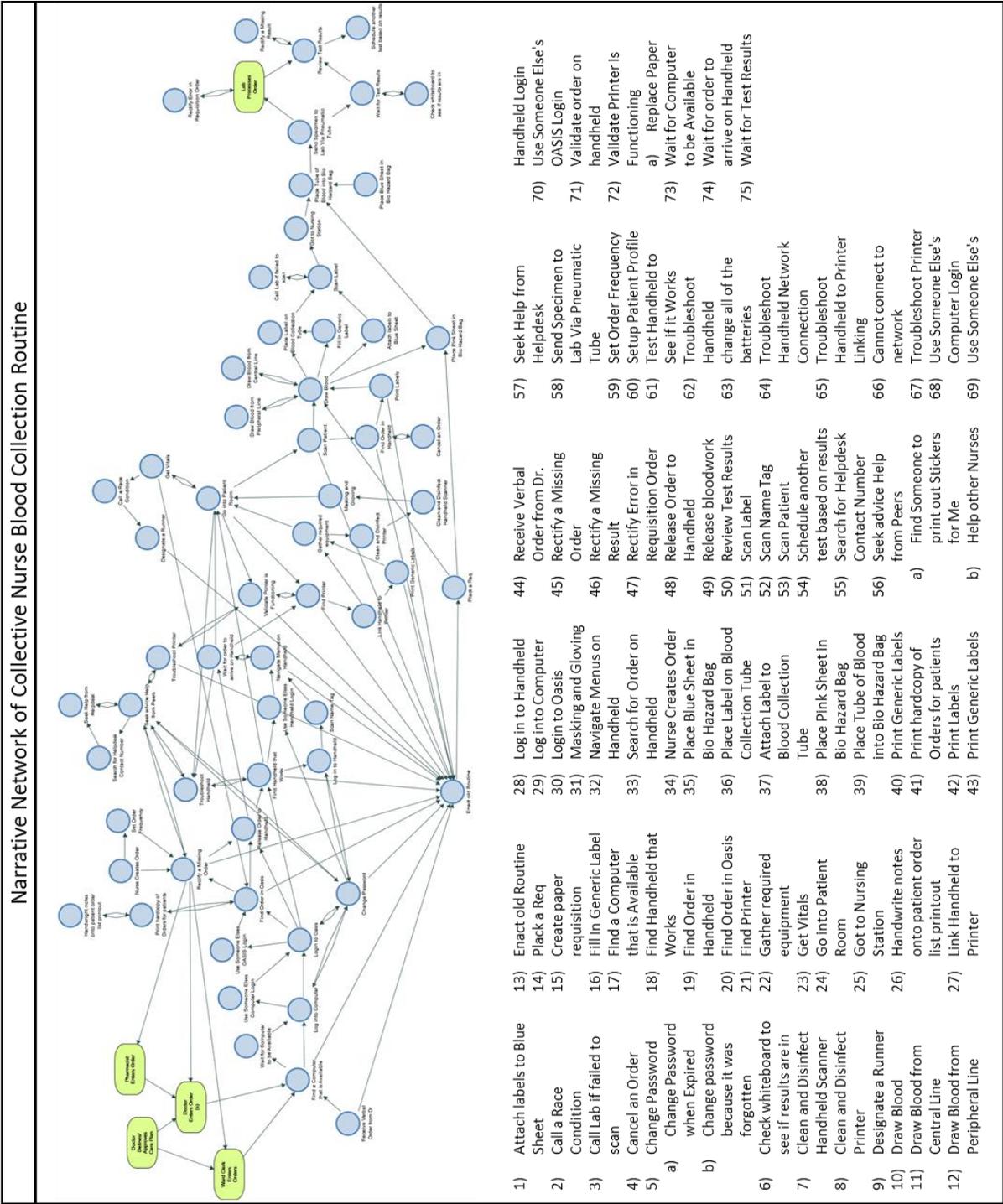
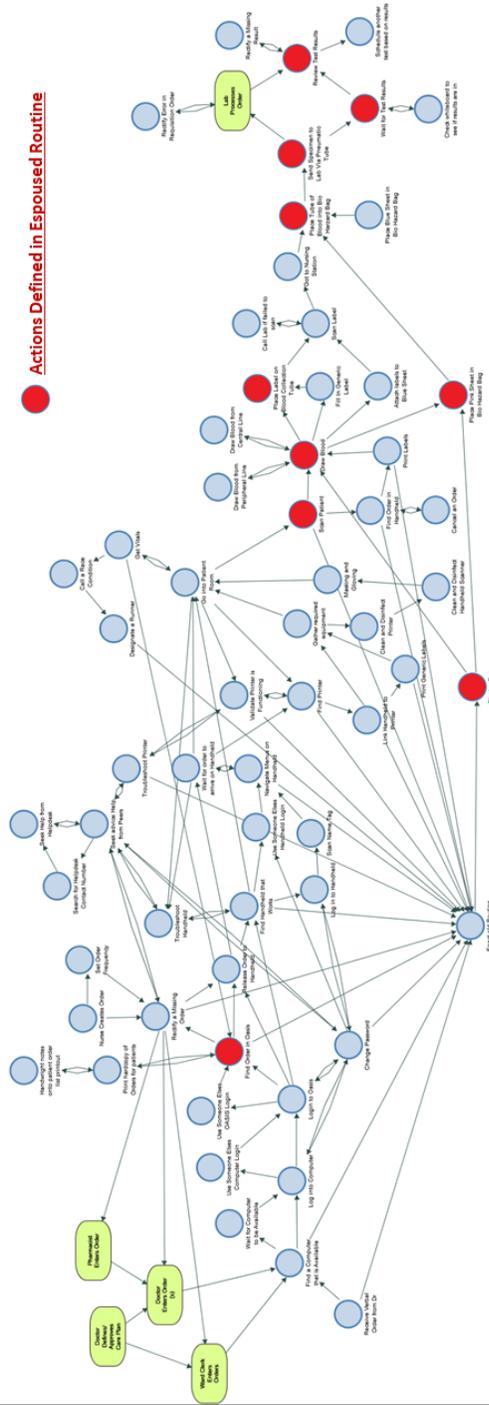


Figure 42. Narrative network of collective nurse blood collection routine.

Identification of Espoused actions within the Enacted Routine



● Actions Defined in Espoused Routine

- 1) Attach labels to Blue Sheet
- 2) Call a Race Condition
- 3) Call Lab if failed to scan
- 4) Cancel an Order
- 5) Change Password
 - a) Change Password when Expired
 - b) Change password because it was forgotten
- 6) Check whiteboard to see if results are in
- 7) Clean and Disinfect Handheld Scanner
- 8) Clean and Disinfect Printer
- 9) Designate a Runner
- 10) Draw Blood
- 11) Draw Blood from Central Line
- 12) Draw Blood from Peripheral Line
- 13) Enact old Routine
- 14) **Place a Red requisition**
- 15) Create paper requisition
- 16) Fill in Generic Label that is Available
- 17) Find a Computer that is Available
- 18) Find Handheld that Works
- 19) Find Order in Handheld
- 20) **Find Order in Oasis**
- 21) Find Printer
- 22) Gather required equipment
- 23) Get Vitals
- 24) Go into Patient Room
- 25) Got to Nursing Station
- 26) Handwrite notes onto patient order list/printout
- 27) Link Handheld to Printer
- 28) Log in to Handheld Computer
- 29) Log into Oasis
- 30) Login to Oasis
- 31) Masking and Gloving
- 32) Navigate Menus on Handheld
- 33) Search for Order on Handheld
- 34) Nurse Creates Order
- 35) Place Blue Sheet in Bio Hazard Bag
- 36) **Place Label on Blood Collection Tube**
- 37) Attach Label to Blood Collection Tube
- 38) **Place Pink Sheet in Bio Hazard Bag**
- 39) **Place Tube of Blood into Bio Hazard Bag**
- 40) Print Generic Labels
- 41) Print hardcopy of Orders for patients
- 42) **Print Labels**
- 43) **Print Generic Labels**
- 44) Receive Verbal Order
- 45) Rectify a Missing Order
- 46) Rectify a Missing Result
- 47) Rectify Error in Requisition Order
- 48) Release Order to Handheld
- 49) Release bloodwork
- 50) **Review Test Results**
- 51) Scan Label
- 52) Scan Name Tag
- 53) **Scan Patient**
- 54) Schedule another test based on results
- 55) Search for Helpdesk Contact Number
- 56) Seek advice Help from Peers
 - a) Find Someone to print out Stickers for Me
 - b) Help other Nurses
- 57) Seek Help from Helpdesk
- 58) **Send Specimen to Lab Via Pneumatic Tube**
- 59) Set Order Frequency
- 60) Setup Patient Profile
- 61) Test Handheld to See if Works
- 62) Troubleshoot Handheld
- 63) change all of the batteries
- 64) Troubleshoot Handheld Network Connection
- 65) Troubleshoot Handheld to Printer Linking
- 66) Cannot connect to network
- 67) Troubleshoot Printer
- 68) Use Someone Else's Computer Login
- 69) Use Someone Else's
- 70) Handheld Login
- 71) Use Someone Else's handheld
- 72) Validate Printer is Functioning
 - a) Replace Paper to be Available
- 73) Wait for Computer to arrive on Handheld
- 74) Wait for order to arrive on Handheld
- 75) **Wait for Test Results**

7.3 Figure 43. Espoused versus enacted routine structure. Section 3: Subroutine Performance Patterns and Variation

In our third set of analyses, we segmented the overall narrative network into five identified subroutines. The purpose of this was to identify the patterns in the performance of these subroutines, and what unexpected, or exceptional performance patterns emerge. Our findings identified key aspects of the disruption and renewal change process, which we further analyze for dialectic content in Section 4.

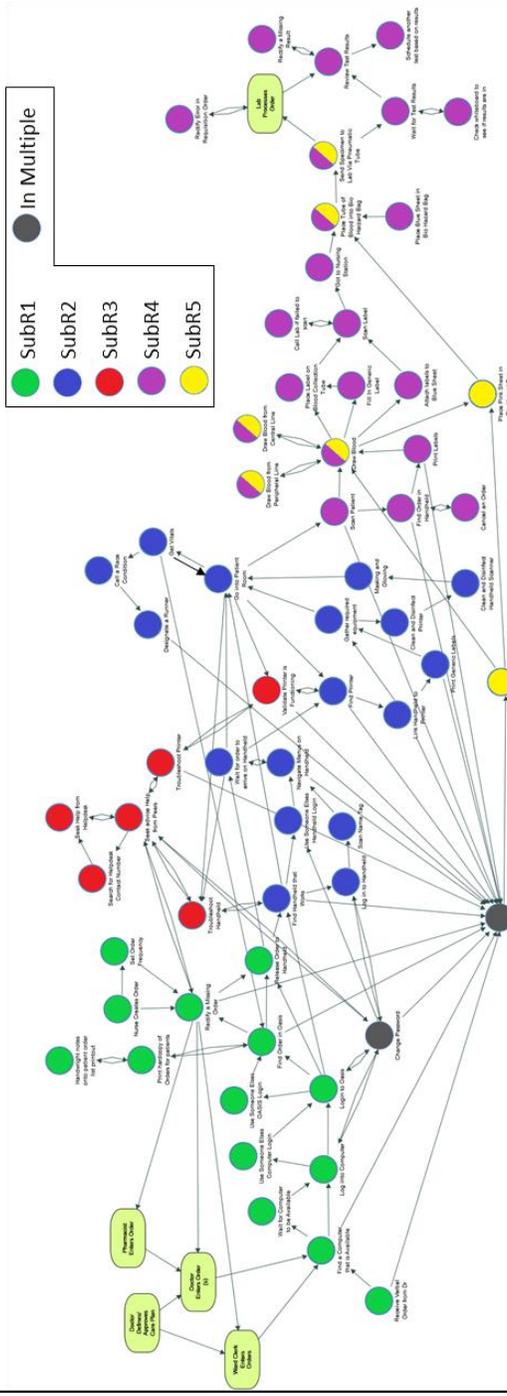
Nurse experience narratives indicate that nurses perceive their blood collection routines as an enactment of five key subroutines:

- SR1: Planning and management of orders
- SR2: Preparation for specimen collection
- SR3: Address system troubles
- SR4: Specimen collection and processing
- SR5: Enacting old routine

An illustration of these five subroutines in relation to the overall routine is found in Figure 44, “The 5 identified subroutines of the enacted routine “.

In the following subsections, we discuss each of these five subroutines identified.

Narrative Network of Collective Nurse Blood Collection Routine



● SubR1
● SubR2
● SubR3
● SubR4
● SubR5
● In Multiple

SR1-Plan and Manage Orders

- 1) Receive Verbal Order from Dr.
- 2) Find a computer that is available
- 3) Wait for Computer to Be Available
- 4) Login Into Computer
- 5) Use Someone Else's Computer Login
- 6) Login to OACIS
- 7) Use Someone Else's OACIS Login
- 8) Find Order in OACIS
- 9) Release Order to Handheld
- 10) Rectify a Missing Order
- 11) Nurse Creates Order
- 12) Set Order Frequency for Patients
- 13) Print Hardcopy of Orders
- 14) Handwrite Notes
- 15) Enact Old Routine

SR2-Preparation for Specimen

- Collection**
1. Find Handheld that Works
 2. Log into Handheld
 3. Use Someone Else's Handheld Login
 4. Scan Nametag
 5. Navigate Menus on Handheld
 6. Wait for Order to Arrive on Handheld
 7. Find a Printer
 8. Link Handheld to Printer
 9. Gather Required Equipment
 10. Clean and Disinfect Print Handheld
 11. Clean and Disinfect Handheld
 12. Masking and Gloving
 13. Go into Patient Room
 14. Get Vitals
 15. Call Race Condition
 16. Designate a Running Enact Old Routine

SR3-Addressing CPOE/Bridge

- System Troubles**
1. Troubleshoot Handheld
 2. Seek Advice/Help from Peers
 3. Search for Helpdesk Number
 4. Seek help from Helpdesk
 5. Validate Printers is functioning
 6. Troubleshoot Printer
 7. Enact Old Routine

SR4-Specimen Collection and Processing

- Processing**
1. Scan Patient
 2. Find Order in Handheld
 3. Cancel and Order
 4. Print Labels
 5. Draw Blood
 6. Draw from Central Line
 7. Draw from Peripheral Line
 8. Place Label on Tube
 9. Fill in Generic Label
 10. Attach Labels to Blue Sheet
 11. Scan Label
 12. Call lab if failed to Scan
 13. Go to Nursing Station
 14. Place Tube into Bio-Hazard Bag
 15. Sent Specimen to Lab via Pneumatic Tube
 16. Wait for Test Results
 17. Check Whiteboard to see if Results in
 18. Review Test Results
 19. Rectify a missing Result
 20. Rectify Error in Requisition Order
 21. Schedule Another test
 22. Enact Old Routine

SR5-Enact Old Routine

1. Place a Req
2. Draw Blood
3. Draw Peripheral Line
4. Draw Central Line
5. Place Tube of Blood into Bio-Hazard Bag
6. Place Pink Sheet in Biohazard Bag
7. Send Specimen to Lab via Pneumatic Tube

7.3.1 Figure 44. The 5 identified subroutines of the enacted routine.SR1-Plan and manage orders

A key aspect of the nurse blood collection routine affected by the technology introduction was the managing and planning of orders (see Figure 45). A significant portion of nurse work includes the management and monitoring of their patient orders.

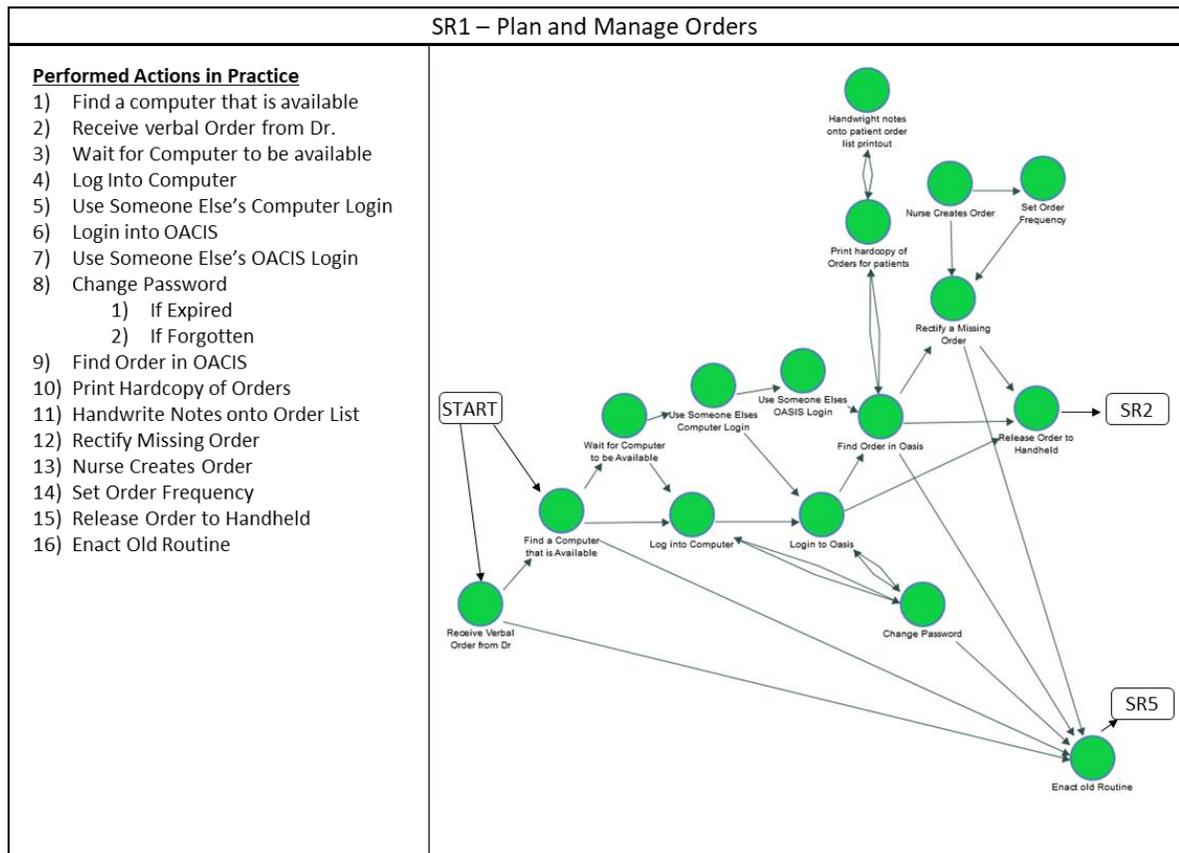


Figure 45. SR1 - Plan and manage orders.

In our analysis of SR1, we identified a “normal” path and four variations in the collective performance of this subroutine. The following section elaborates on the normal path.

7.3.1.1.1 SR1-Norm: Performance Pattern Normal/Expected

Under normal conditions, a nurse enacts the four-action sequence identified in Figure 46, “SR1-Norm/Expected performance“. This sequence represents the expected performance that nurses perceive as a normal execution of the routine.

This performance pattern includes actions such as a nurse finding and logging into an available computer, logging into the OACIS software, reviewing and releasing orders to the handheld, and moving onto the next subroutine SR2: Preparation for specimen collection.

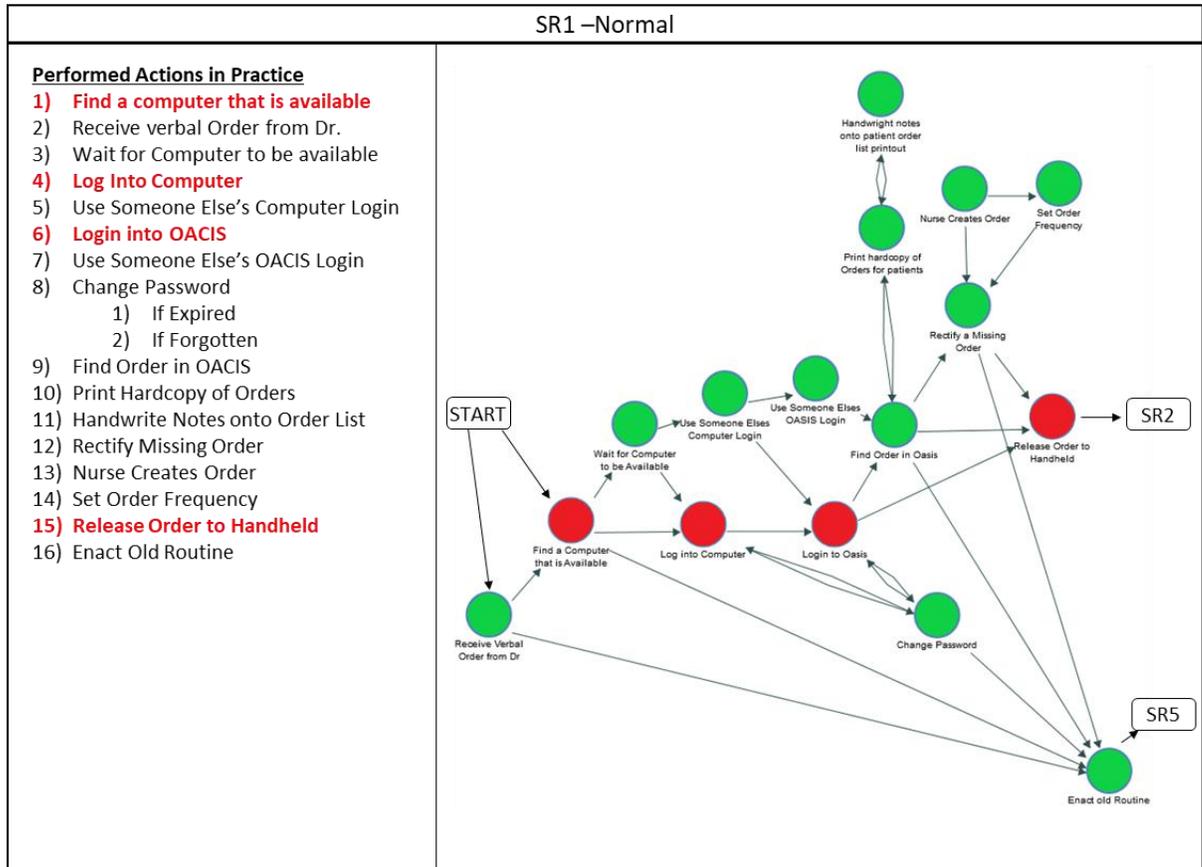


Figure 46. SR1-Norm/Expected performance

Five performances that diverge from this expected, or normal, performance were identified and detailed in the following sections.

7.3.1.1.2 SR1-D1: Disrupted Pattern #1-Device Access Troubles

The first disruption to enacting the normal subroutine is trouble accessing a device (See Figure 47). To plan an order, a nurse must first find a computer to log into, and then load and log into the OACIS software. There are approximately ten computers conveniently located outside patient rooms and three computers at the nursing station. Due to perceived

slowness of these computers, none of the nurses interviewed use the computers outside the patient room, making the effective number of available computers three.^{CV}

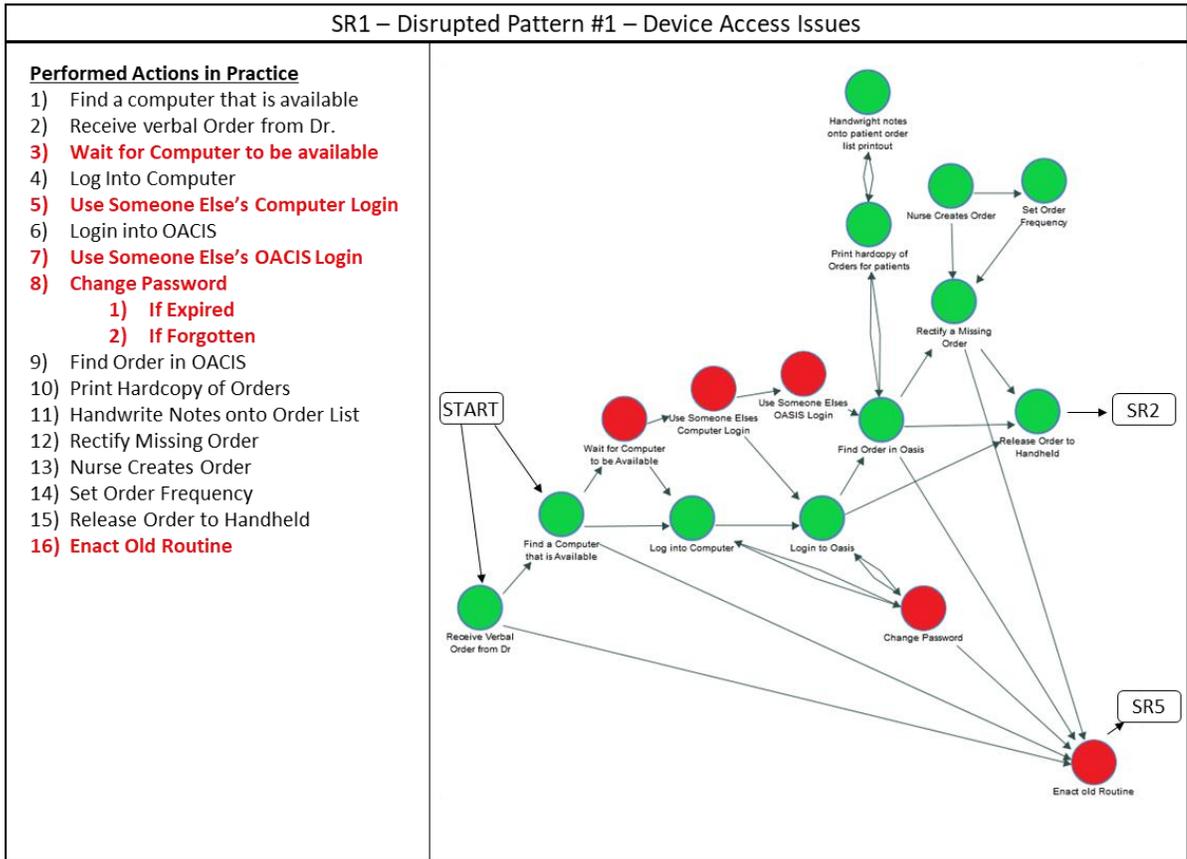


Figure 47. SR1-D1 – Device access troubles.

In the ward are also two whiteboards originally installed to assist nurses in identifying any pending results, or flagged orders that need collection. One of these whiteboards was found not to be functioning (and has not functioned for some time), and that none of the nurses interviewed use this whiteboard to assist in their planning.

The three computers used by the nurses to review and plan their orders are shared among a staff of up to six nurses, along with multiple doctors, residents, and fellows. This environment creates considerable contention during the day and often results in having to wait to access a computer. If nurses experience a long wait or expect a long wait, some will resort to enacting the old paper routine. This issue is more prevalent during the day when there are more staff and more activity on the floor and is much less of an issue in the evenings.

The systems used by the nurses also requires a username and password to log in. These passwords expire at different rates, and nurses are often surprised by the need to create a new password before they can log in. Also, some nurses, if they've been away on maternity leave, for example, will forget their passwords and need to call the helpdesk for a password reset.

Though most nurses will manage these passwords effectively, some have resorted to using other nurse's login credentials. Also, if the nurse feels that changing the password or getting a reset will take too long, they enact the old paper requisition routine.

SR1-D1: Unexpected Outcomes & Emergent Behaviours

- 1) Using other nurse's passwords
- 2) Negative effects on productivity due to device contention
- 3) Enacting paper routine for ordering that should be processed through CPOE
- 4) Usage of note taking, which creates privacy issues as notes are known to be left outside of the ward, or lost

5) Whiteboard not being used

7.3.1.1.3 SR1-D2: Disrupted Pattern #2-Rectifying a Missing Order

The second variation in performance identified is missing orders (See Figure 48). One of the key espoused advantages of the new CPOE system was that doctors would enter their orders directly into the system using handheld iPad devices. This was to help reduce the occurrence of errors and improve safety. Many nurses claimed that doctors make errors in entering these orders, and often, do not enter these orders into the system. This seems most prevalent with residents and visiting doctors and fellows. Another common cause of a missing order is when repeating orders timeout while the patient is still under care.

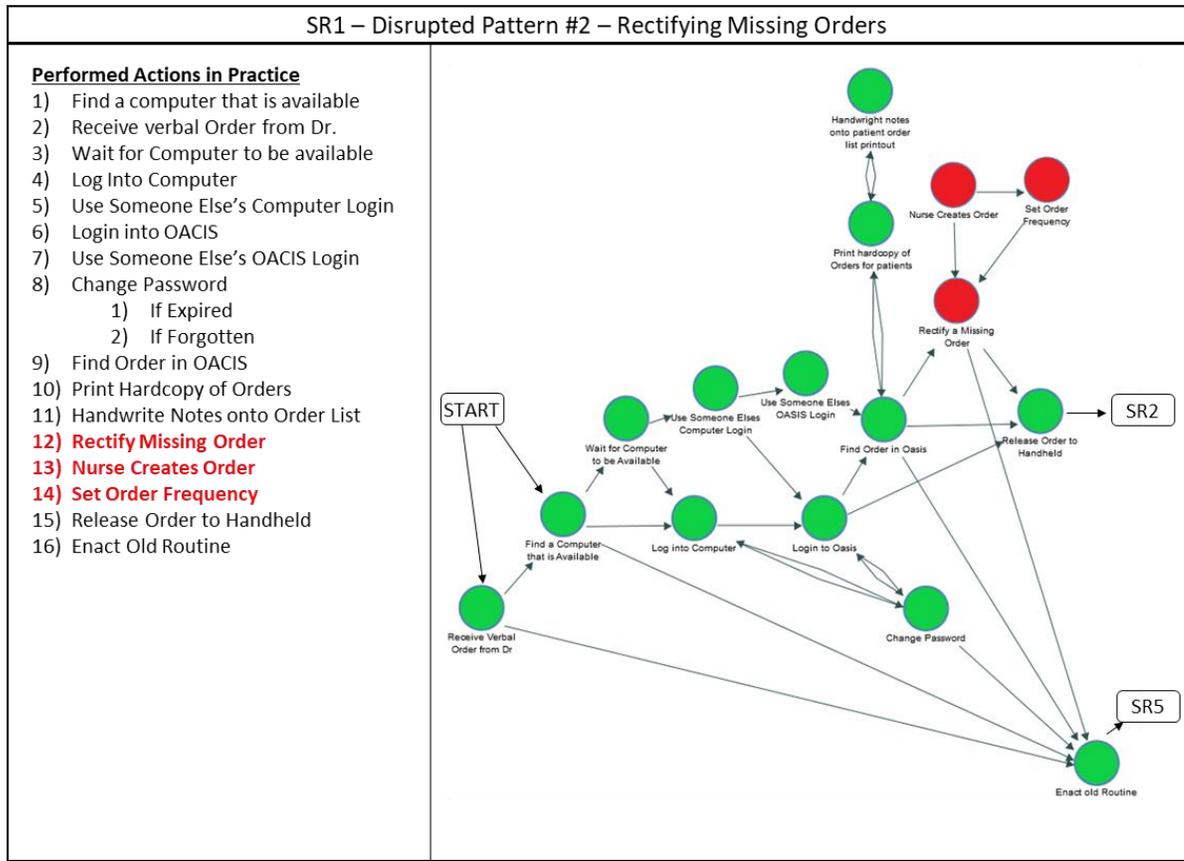


Figure 48. SR1-D2-Rectifying a missing order.

When a nurse encounters a missing order, some nurses will enter the order in the CPOE system, while other nurses would simply enact the old paper requisition based routine. This latter behaviour was initially discouraged by the lab and other personnel, but over time became common practice as some nurses and related staff (lab techs, nurse managers, etc.) continued to enact the old routine while receiving fewer reprimands and complaints.

SR1-D2: Unexpected Outcomes & Emergent Behaviours

- 1) Doctors not entering orders
- 2) Repeating orders timing out too soon

3) Frustrated nurses enacting the old routine has become accepted practice for some

7.3.1.1.4 SR1-D3: Disruption Pattern #3-Enactment of Old Routine

In the espoused routine, under emergency situations, nurses were expected to enact the old paper requisition-based routine when faced with a patient emergency.

In such emergency, or “race” conditions, doctors will verbally call out orders:

So, a race call is when somebody is not doing well at all, and we need some extra help, so ICU comes in to help us. So, the intensive care unit come down, and they assist us with the patient to see if they -- if we need to get them to the ICU. So it’s very fast paced when that happens, so there are several people in the room, they are calling for orders.
(Nurse03)

In these situations, the new routine was intended to allow for the enactment of the old paper ordering process (See Figure 49), which nurses commonly refer to as “Placking a Req”:

Yes, and we’ve always been told that in training, like if we are having a code situation or having a race call, it’s just easier to have someone just go plack a bunch of reqs and labels and just have them at the bedside and label them. (Nurse09)

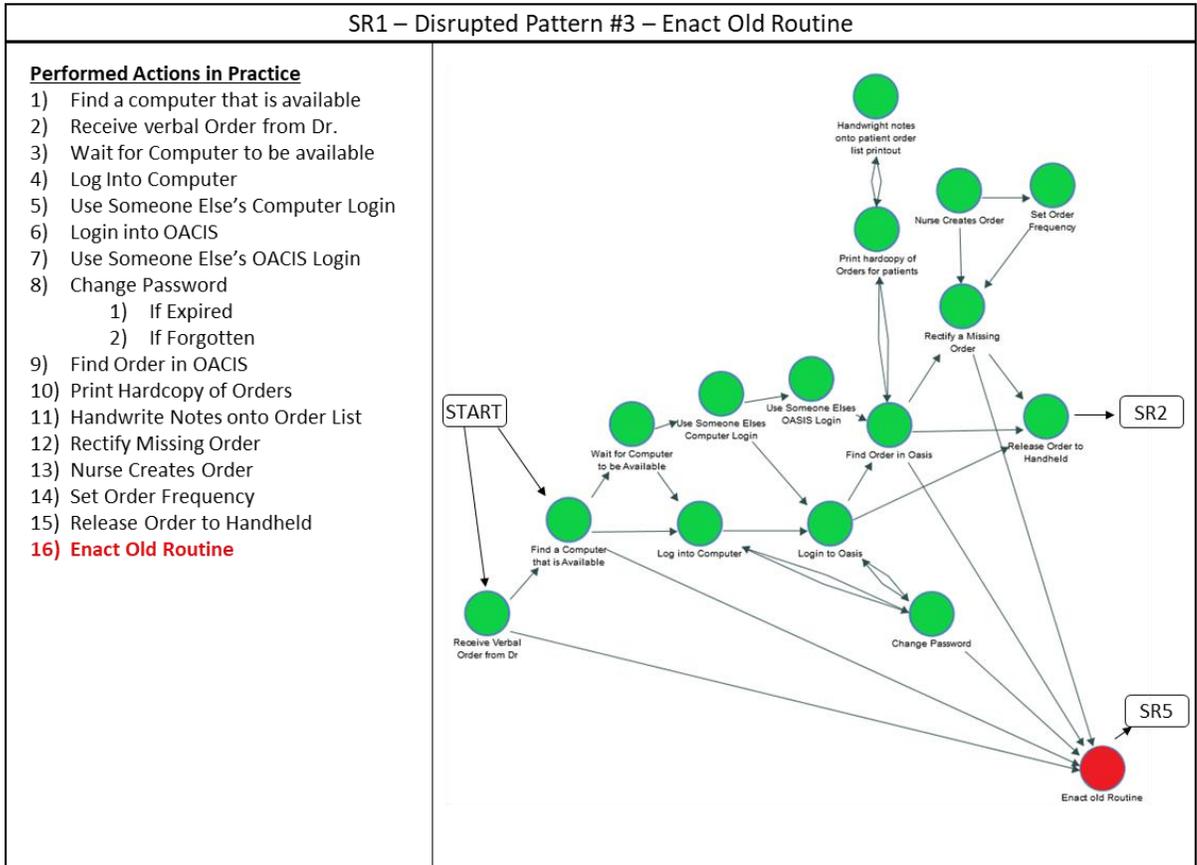


Figure 49. SR1-D3-Enact old routine.

Using the old paper requisition system is considered a normal response only for situations when there is an emergency response required. In such cases, a “runner” (nurse tasked with handling orders) would receive calls for orders from the treating doctor and process the orders using the old paper requisition process within the old routine.

An unexpected result of maintaining support for the old routine is that if a nurse becomes sufficiently frustrated by any aspect of the new ordering system, he/she may determine (or argue) that this puts patients at undue risk and will use this to justify the discontinued use of CPOE to complete the order. We found this to be a very common practice by many of

the nurses, in that, if they experience any device access issues – or missing of misplaced orders – they will enact the old routine of “Placking a Req”. Such performances may leave unfulfilled orders in the system that require deleting by other nurses, clerks, or lab technicians.

SR1-D3: Unexpected Outcomes & Emergent Behaviours

- 1) Orphaned system orders
- 2) Bypassing CPOE use at inappropriate times
- 3) Creating the requirement for a new process of monitoring and deleting orders that were in the CPOE system, but processed using the old paper requisition routine

7.3.1.1.5 SR1-D4: Disruption Pattern #4-Nurse note-taking

Prior to the deployment of CPOE, nurses would keep a paper record of their patient data and use this to write notes and reminders about patients and orders. With the deployment of the new CPOE system, nurses were expected to view the whiteboard as a central source of this information, and also to log into OACIS to view all patient information, including pending orders and order results history. In practice, many nurses continue to use the paper-based system as a “backup” for reasons of convenience and lack of trust in the availability/integrity of the CPOE system (See Figure 50).

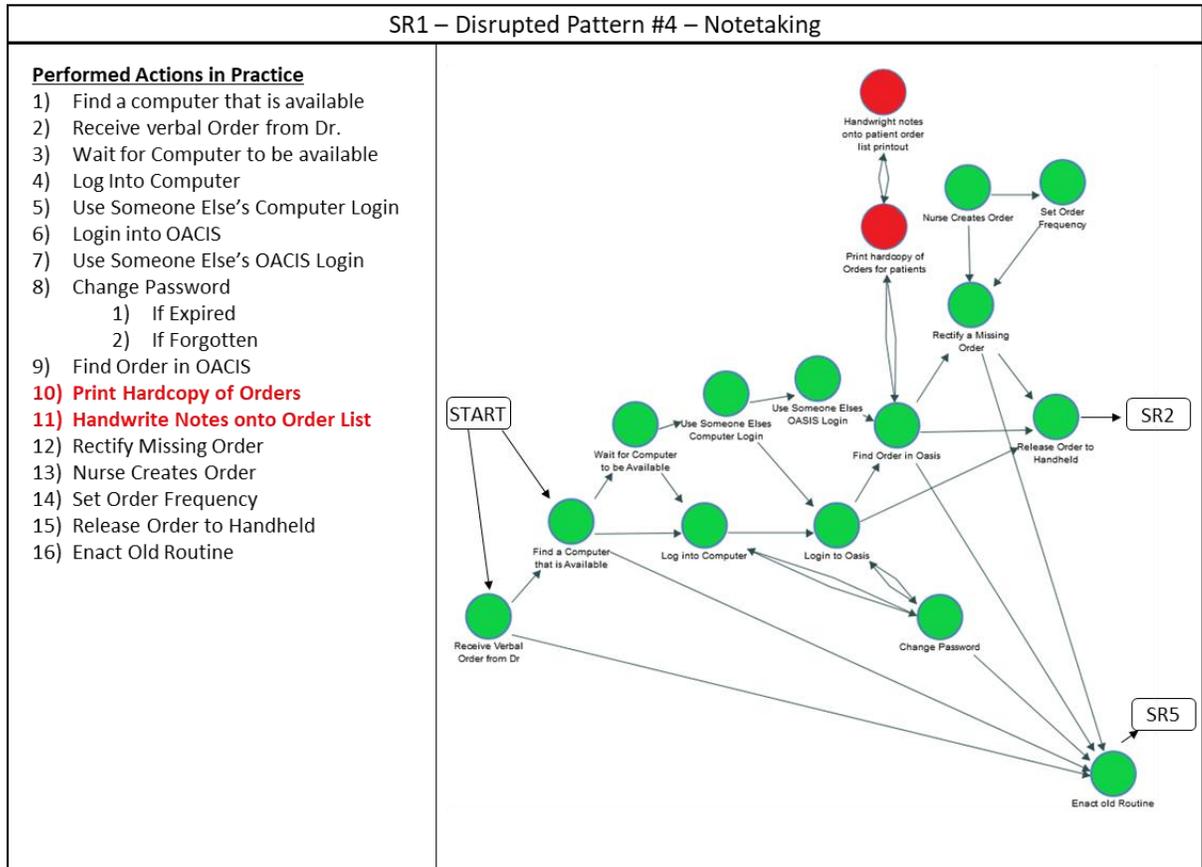


Figure 50. SR1-D4-Note-taking.

These unplanned behaviours create two issues. The first issue is that nurses work from possibly outdated information as the notes they take do not necessarily reflect the current state of patient orders or treatment. By continuing to rely on notes alone, some of the intended advantages of the CPOE system are diminished.

The second issue resulting from the note-taking behaviour is privacy concerns. It was mentioned in two nurse interviews that nurses often lose their notes, either misplacing them within the unit or leaving them behind in places outside the unit such as the cafeteria. Since these notes can contain sensitive patient information, this presents a privacy issue.

- A combination of mistrust in the integrity of the system, and lack of convenient access results in the continuation of the nurse practice of note-taking
- Some information is passed between nurses using these notes, thus bypassing the CPOE role in maintaining an accurate, up-to-date account of patient care and condition
- Privacy violation risks continue as nurses continue to depend on physical note-taking to manage their orders

7.3.1.1.6 SR1-D5: Disruption Pattern #5-Emergency Order

Nurses were told during their initial training that they should enact the old paper routine in cases of emergencies (See Figure 51). The two situations where they were told to use the old paper process included a “race call,” and a “code.” In these situations, a response team rapidly enters the room. Things move fast, and a number of nurses and other healthcare professionals are engaged in the immediate patient treatment. During such emergency events, a nurse is assigned as a runner, where his/her job is to collect blank paper requisition forms, fill in these requisitions, and run the collected sample to the pneumatic tube to send to the lab. The new CPOE system was thus rolled out with the expectation that the old process would continue to be maintained to handle emergency ordering situations.

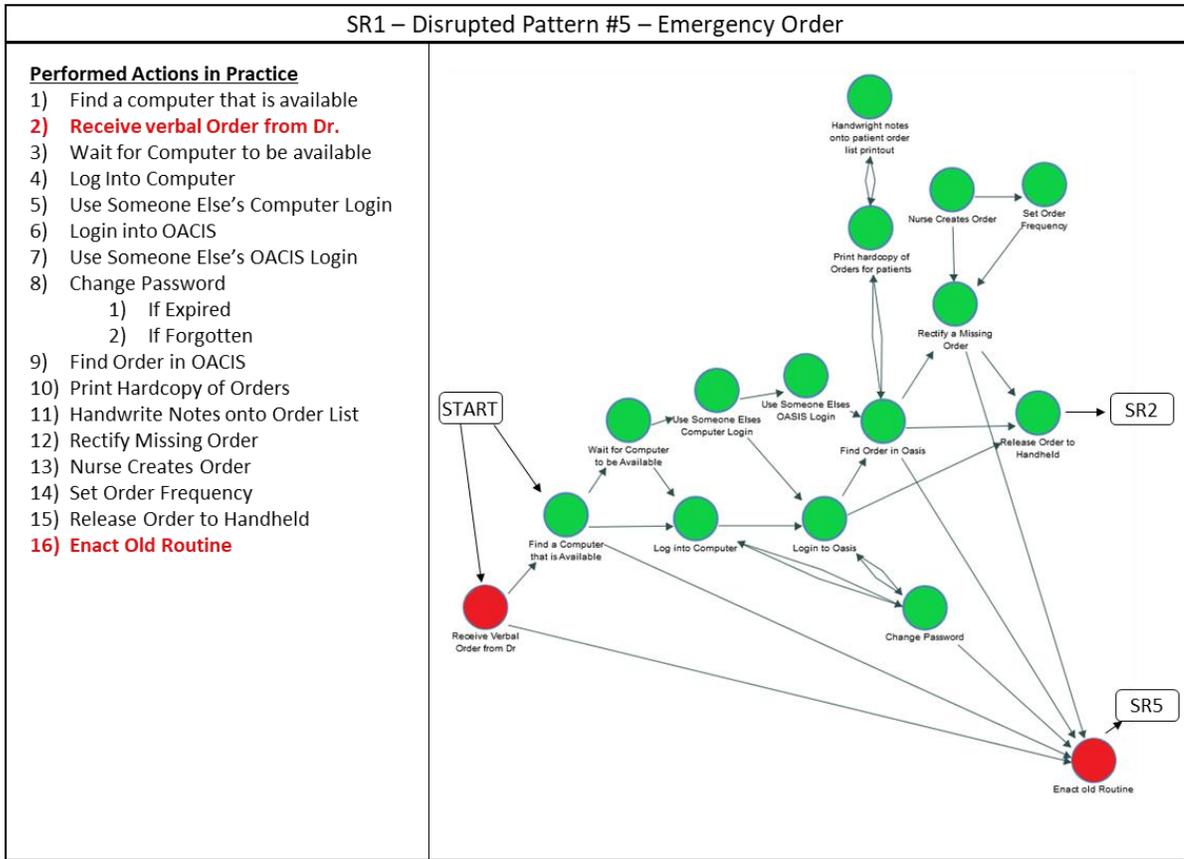


Figure 51. SR1-D5-Emergency order.

One of the unexpected consequences of maintaining the old process is that many nurses will justify using the process because of an “emergency” or critical patient situation. During one nurse interview, the nurse claimed that she has never used the new CPOE system. At first, for those nurses that did not use the system, there were calls from the lab, and “push back” from managers. Over time, as nurses justified their bypassing of the system for each case, these calls diminished. Now, nurses will commonly enact the old process across many non-emergency contexts and do so without any repercussions.

- CPOE bypassed in non-emergency situations. Though initially this was justified in some critical situations, with repeated use of the old system, it became increasingly acceptable to use the old process in situations that it was not originally intended for

7.3.2 SR2-Preparation for specimen collection

The second key subroutine is the nurse preparation for specimen collection. This subroutine involves a nurse using the handheld and printer to scan a patient and collect a sample (See Figure 52).

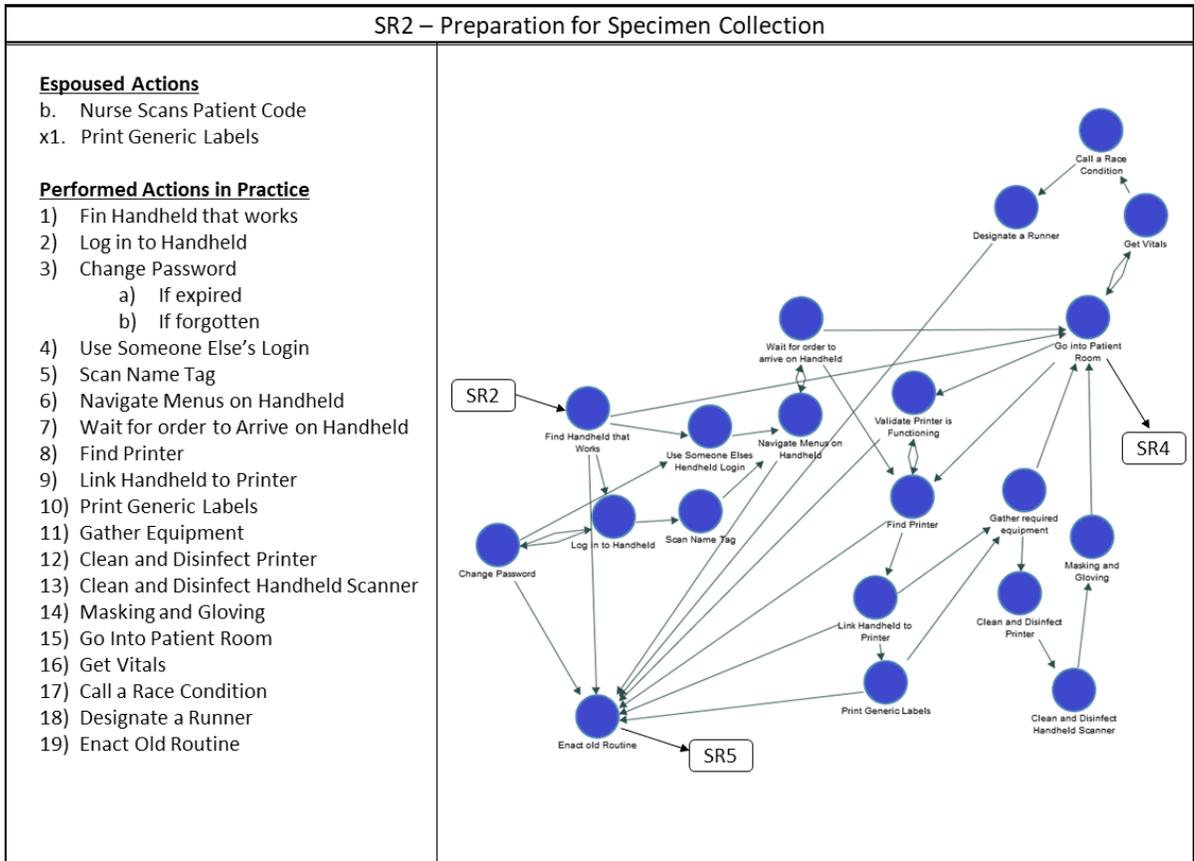


Figure 52. SR2 - Preparation for specimen collection.

Our analysis indicated that this subroutine exhibited a “normal” path and four variations in the collective performance of this subroutine. Each of these performance variations is elaborated on in the following sections.

7.3.2.1.1 SR2-Norm: Normal/Expected Performance Pattern

Under normal conditions, the nurse will search for a handheld that works, log into this handheld, find the order, find and link to a printer, gather equipment required for collection, enter the patient's room, and before collection, record vitals. This subroutine is enacted

after SR1 Plan and Manage Orders, and is followed by SR4 Specimen Collection and Processing (See Figure 53). A number of special situations and exceptions can also result in this subroutine to be followed by SR5 Enact Old Routine.

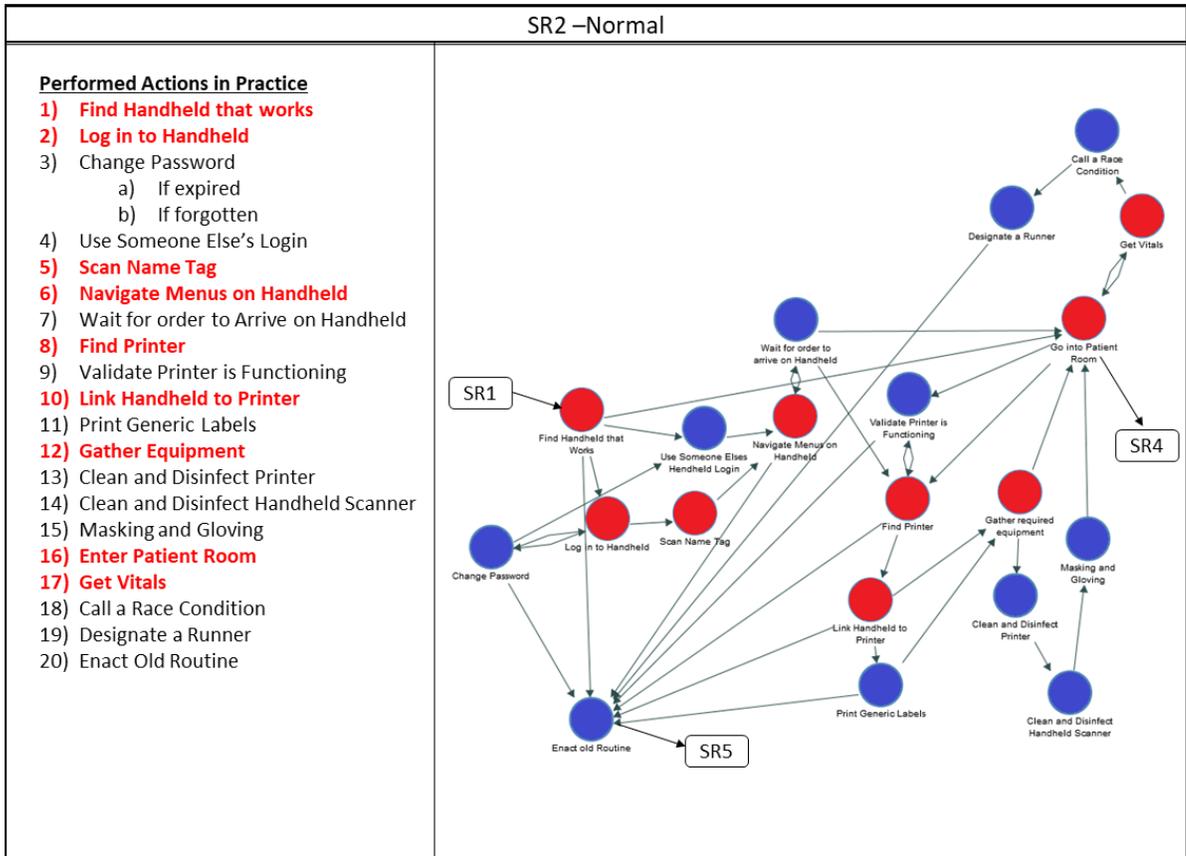


Figure 53. SR2-Norm/Expected performance.

When the CPOE was originally launched, handheld and printer devices were located in each patient room. Over time, given the issues with these devices and the dwindling number of those that remained operable, the nurses have collectively altered their environment by maintaining these devices at a location next to the nursing station. As a

result, nurses will now generally find, login, and validate a device before entering the patient room. It was originally expected that nurses would access and use the devices at the patient bedside.

SR2-Norm: Unexpected Outcomes & Emergent Behaviours

- Frequent device failures and breakdowns have resulted in nurses storing devices at the nursing station rather than in patient rooms. This has resulted in nurses accessing these devices, validating that they work, and identifying orders, before entering the patient room. Such behaviour could increase the frequency with which devices enter and leave a room, and thus present increased risk of spreading infection. This behaviour also leads to inefficiencies, as the situation is that fewer devices are functional than there are nurses on staff thus requiring extra coordination planning, and for some nurses, delays in completing their order rounds

7.3.2.1.2 SR2-D1: Disruption Pattern #1-Device Issues While in Patient Room

The first disrupted pattern of SR2 (see Figure 54) is when nurses have prepped and entered a room and then experience device issues. Many patients on 5-West are prescribed immunosuppressant drugs. Blood collection for these patients requires that the nurses gown, mask, and disinfect before entering rooms. When the CPOE system was initially deployed, CPOE devices were installed (scanner and printer) within each room, but over time, as these devices began to break down, nurses began to adapt their routine to include disinfecting and bringing into the room devices from the nursing station area. Nurses also experience issues with the device while working in the quarantined area – issues such as lost network connectivity, or missing orders. Handling such situations is especially time-consuming for order collection from patients under quarantine, as it requires the nurses to repeat the process of gowning, masking, and disinfecting equipment before re-renting the room. This frustration has led to some nurses to develop the performance pattern of “Placking a Req”, while others have resorted to using “Generic Labels” (see Figure 56).

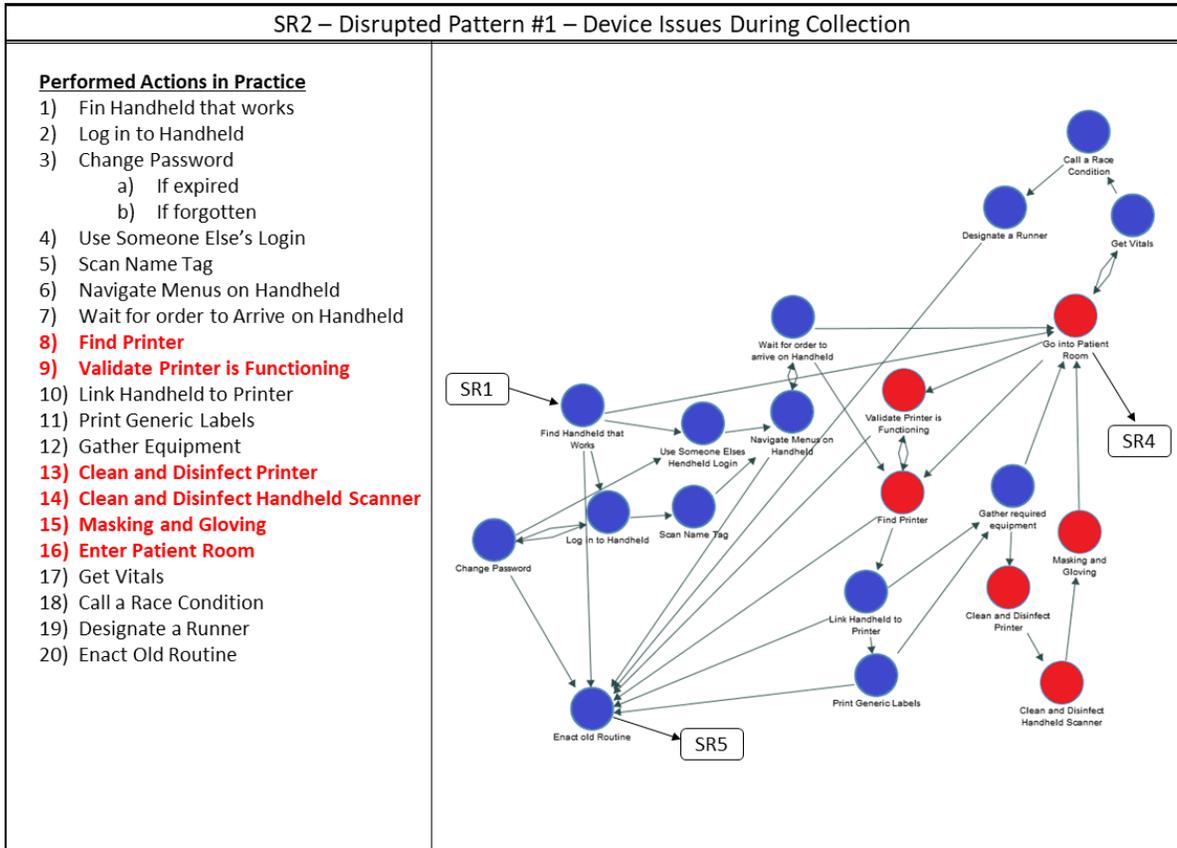


Figure 54. SR2-D1-Device issues during collection.

SR2-D1: Unexpected Outcomes & Emergent Behaviours

- 1) Frequent device issues resulted in motivating nurses to enact the old routine for situations where the CPOE system is to be used
- 2) Frequent device issues have led to using generic labels for orders that were expected to be handled using printed CPOE order labels
- 3) Device failures can put patients at increased risk of infection

SR2-D2: Unexpected Outcomes & Emergent Behaviours

- Loss of logging integrity/audit trail due to sharing of login information
- Enacting the old paper routine for orders that should be processed through CPOE

7.3.2.1.4 SR2-D3: Disruption Pattern #3-Usage of generic labels

The third identified disruption pattern of SR2 (See Figure 56) is the use of generic labeling by nurses in ordering situations where they should be using order specific labeling. To address the processing of orders not in the standard order catalog, the CPOE system was deployed with a special “generic label” function.

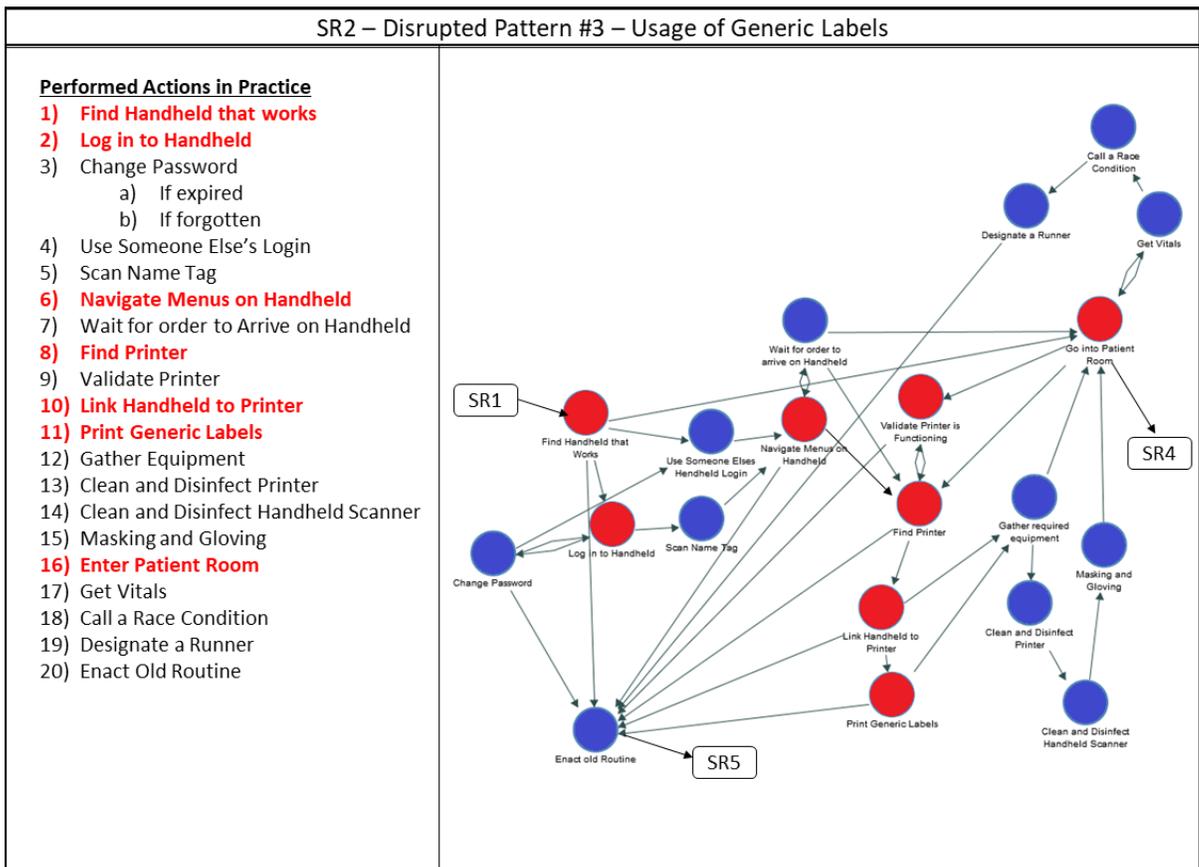


Figure 56. SR2-D3-Usage of generic labels.

Each medical specialization can have unique order types for their treatment practice. Prior to CPOE deployment, TOH had many differing localized order catalogs. These local

catalogs would often contain different terms for the same test or contain completely different tests.

Part of the CPOE deployment project included resolving catalog discrepancies. The approach was to standardize these catalogs using the lab information system as the core catalog. Though the CPOE project made great strides in creating a standardized order catalog, two issues remained: 1) some order integrations were deferred to a later date, and 2) some orders were handled by another hospital and were not part of the lab processing system.

To handle these non-standard orders, the CPOE system included a “generic label” function. Nurses could, without any specific order in the system, use the handheld printer to print generic labels. These labels contained patient information, but no specific information on the test. Nurses would then fill in these generic labels with the appropriate test information and send for processing.^{cvi}

The interim solution has resulted in an unexpected behaviour emergence. To save time, some nurses will print out a number of generic labels for each of their patients, and then use them like they would for the old paper requisition process. This has resulted in creating a “hybrid” of both the old routine performance and the use of CPOE. In this case, the nurses receive the benefit of better and easier patient identification without the burden of having to manage orders in the CPOE system (many nurses consider this a burden as the time it takes to process an order in the CPOE system, the difficulty in finding an order, and the

problems with missing orders that result in having to re-input doctor orders are a negative disruption to their productivity).

SR2-D3: Unexpected Outcomes & Emergent Behaviours

- Overuse of generic labeling has resulted in the creation of a “hybrid” between the old and new routines – inheriting the convenient flexibility of the old routine but taking advantage of better patient tracking offered by the new system.

7.3.2.1.5 SR2-D4: Disruption Pattern #5-Worsening Patient Condition

The fourth SR2 disruption pattern is in response to worsening patient condition (See Figure 57). To assist in order management, nurses developed the practice of checking vitals before beginning a blood collection draw. This is done to optimize for situations where vital indicators are worsening and may require new blood tests to be added to the currently planned blood draw. To reduce the frequency of needles the patient must endure (or draws from central/peripheral lines), nurses check vitals, leave the room to add any necessary new orders to the draw, and then return to the room to collect all samples. Figure 57, “SR2-D4-Worsening patient condition.” illustrates this behaviour for a “race call” situation, but this pattern can also occur in the processing a standard order as well.

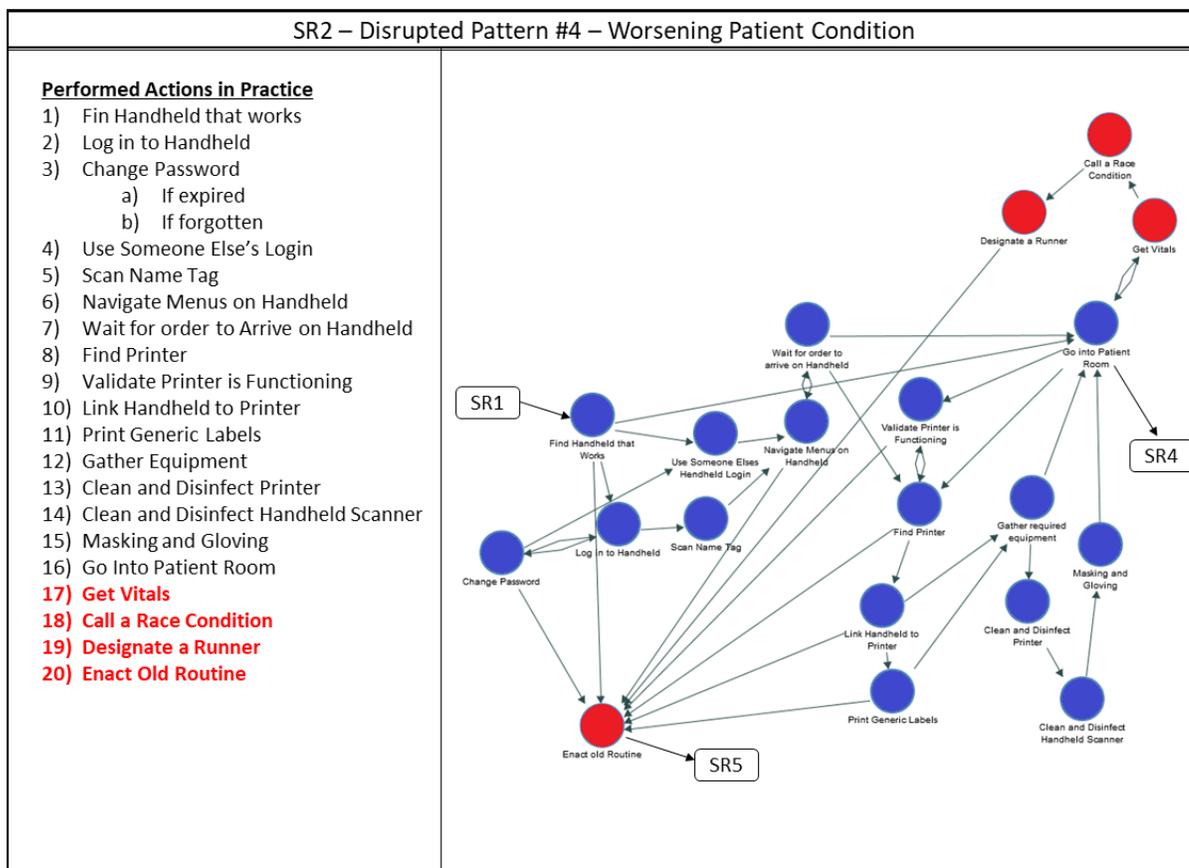


Figure 57. SR2-D4-Worsening patient condition.

SR2-D4: Unexpected Outcomes & Emergent Behaviours

- One nurse insinuated that, due to the difficulties in entering an order – such as a blood culture in response to a patient exhibiting a fever – that a nurse, if at the end of his/her shift, may not add the order; instead, s/he may ignore the patient condition and let the nurse on the following shift deal with the new order and test. This nurse only raised this as a hypothetical, but it does indicate that due to the excessive time and complexity that some nurses feel is involved in the process of adding a new order to the system, these nurses may avoid adding the order thus potentially delaying treatment

- The indication of a worsening patient condition, though not an emergency, may be treated as an emergency order in order to avoid the process of entering a new order. Emergency orders are handled using a paper requisition system that many nurses continue to see as a less restrictive and quicker process

7.3.3 SR3-Addressing CPOE/Bridge system troubles

Nurse narratives indicate that issues with the handheld scanners and printers frequently occur. When this happens, a nurse's blood collection routine is significantly disrupted (see Figure 58). Through experimentation, many nurses have developed patterns of troubleshooting to identify and resolve the most common problems encountered with the device (i.e. dead batteries/charging batteries, moving to avoid a network dead-spots, replacing printer paper).

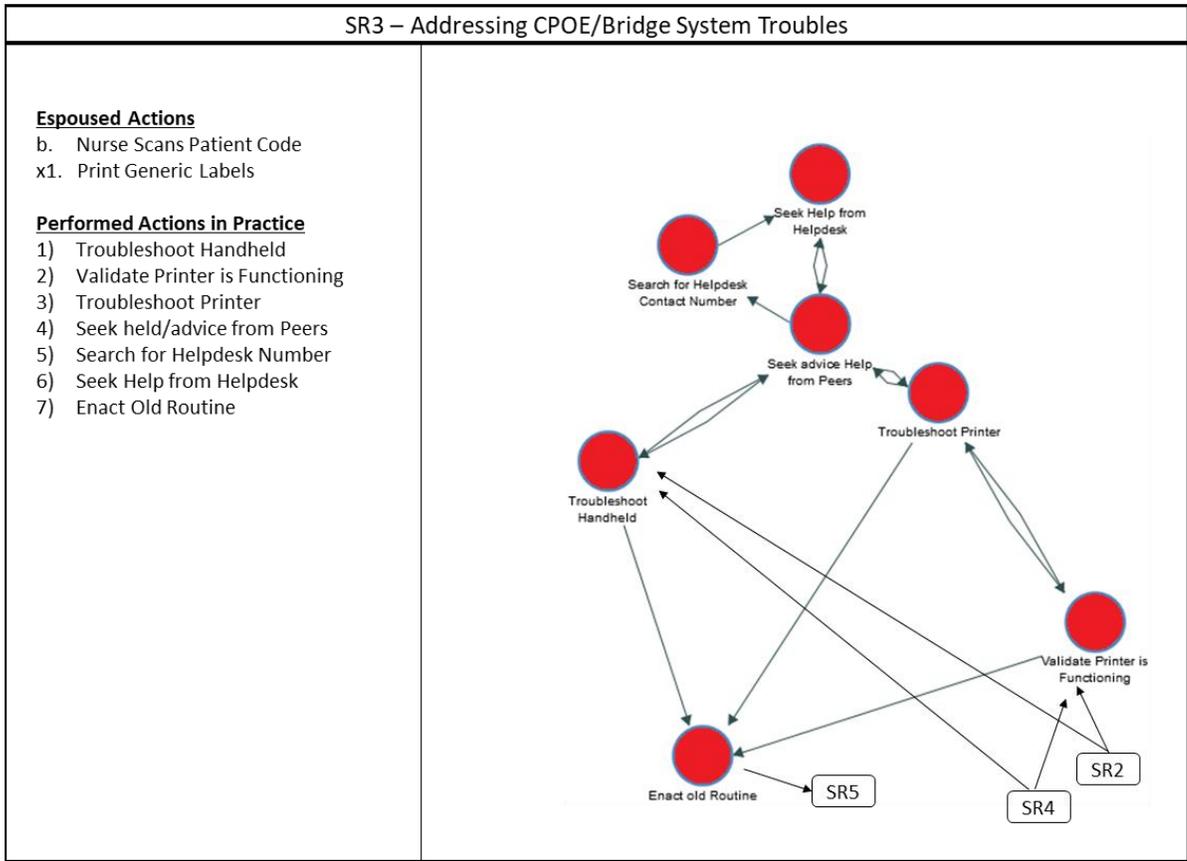


Figure 58. SR3.Address CPOE/Bridge system troubles.

When encountering a device problem, nurses will spend the time to troubleshoot, reach out to peers, or contact the helpdesk. If a nurse is busy or frustrated with the system, it is common that once a device error is encountered, the nurse will resort to enacting the old routine by ignoring the order in the system and “placking” a paper requisition.

Another issue related to the CPOE devices is that many of these devices have stopped working or have “disappeared” since their introduction to the unit (Nurse06). In response, nurses have altered their working environment to help reduce the negative impacts on their work. Many nurses on 5-West now try to store printers and handhelds at the nurse’s station,

and periodically check them to make sure batteries are being charged. Despite this, having to search for a handheld or a printer somewhere on the floor is a common occurrence.

SR2 - Unexpected Outcomes & Emergent Behaviours

- Development of hoarding practices to collect devices that work, but devices still found lying elsewhere in the unit
- Inappropriate enactment of old routine
- Disruption of peer work flow to seek help

7.3.4 SR4-Specimen collection and processing

Actions within the specimen collection subroutine represent the most frequently referenced portion of the blood collection routine by nurses. The 5West unit consists of 20 patient rooms, most which are constantly taken/filled. Nurses work at the central nursing station area for most of the routine, reviewing orders, planning their rounds, checking patient records, etc. The specimen collection subroutine is the only part of the routine that requires the nurses to enter the room. The general flow for this subroutine (see Figure 59) is that nurses scan the patient, print labels, draw a blood sample, scan the labels to confirm collection and leave the room to send the specimen to the lab for processing. Most patients in the 5-West unit have a central line installed; phlebotomists, who typically do most of the blood work in other units, are not qualified to draw blood from a central line. Nurses in 5-

West, therefore, draw the majority of the blood specimens, including those specimens from a direct needle/central line that are typically handled by phlebotomists in other units.

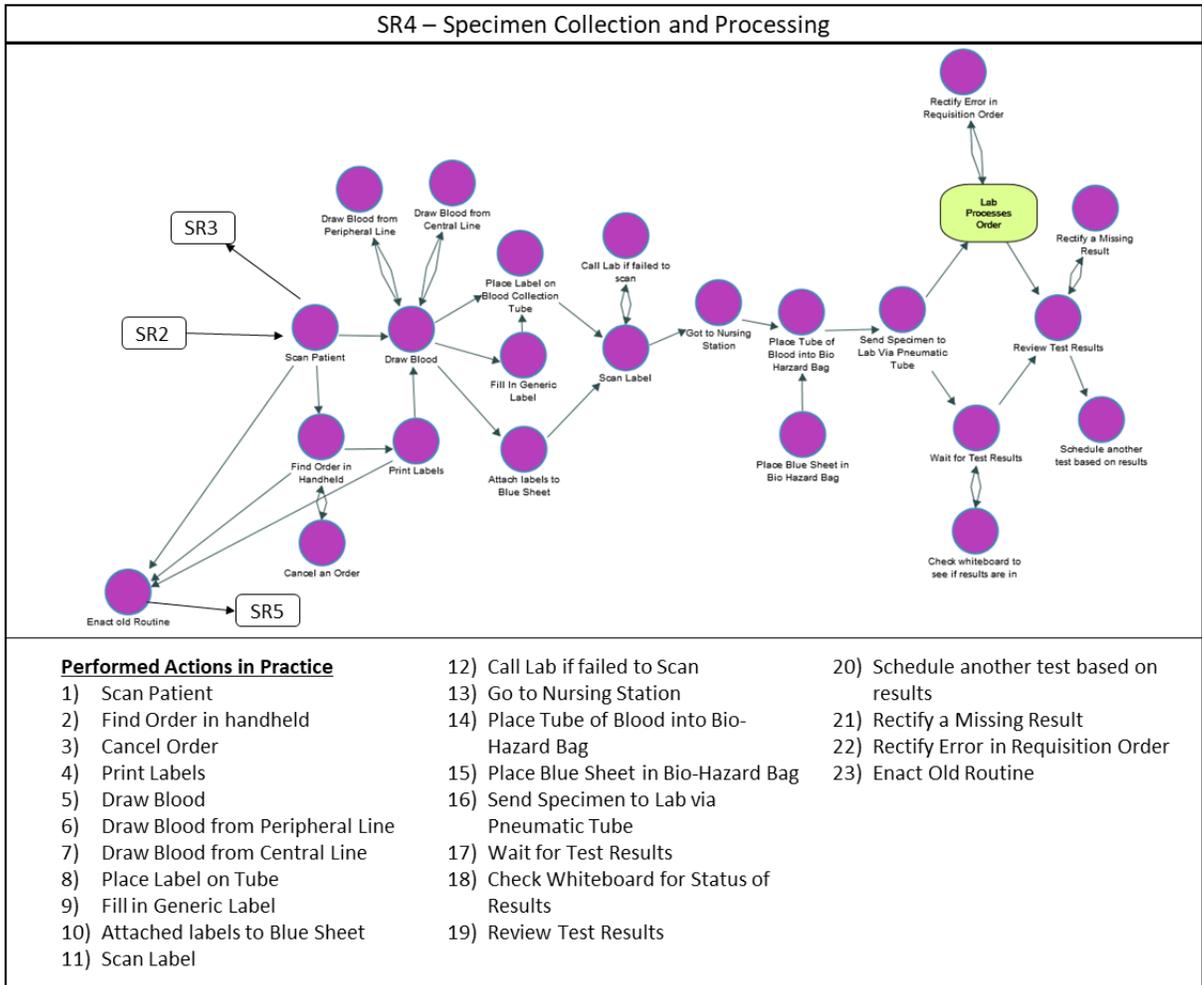


Figure 59. SR4 - Specimen collection and processing.

Our analysis of the narratives surrounding this subroutine routine indicates six performance variations or patterns. In this section, we review and analyze these for variation events and unexpected change outcomes.

7.3.4.1.1 SR4-Norm: Normal/Expected Performance Pattern

Under normal conditions, a nurse will enact the thirteen-action sequence identified in Figure 60, SR4-Norm. This is the expected performance nurses see as part of the normal routine execution. One slight variation in this expected performance pattern is regarding the whiteboard. Most nurses claim to not refer to the whiteboard at all, but three of the nurses indicated that they do sometimes refer to the whiteboard to see if orders/tests are ready.

This performance pattern consists of a nurse scanning a patient, finding patient orders in the handheld, printing labels for each of these orders, drawing blood, placing the printed labels on the collected samples, conducting a verifying scan, and the leaving the patient by going to the nursing station to send the specimen to the lab via pneumatic tube. Once tests are processed by the lab, the results are automatically loaded and made available for review on OACIS.

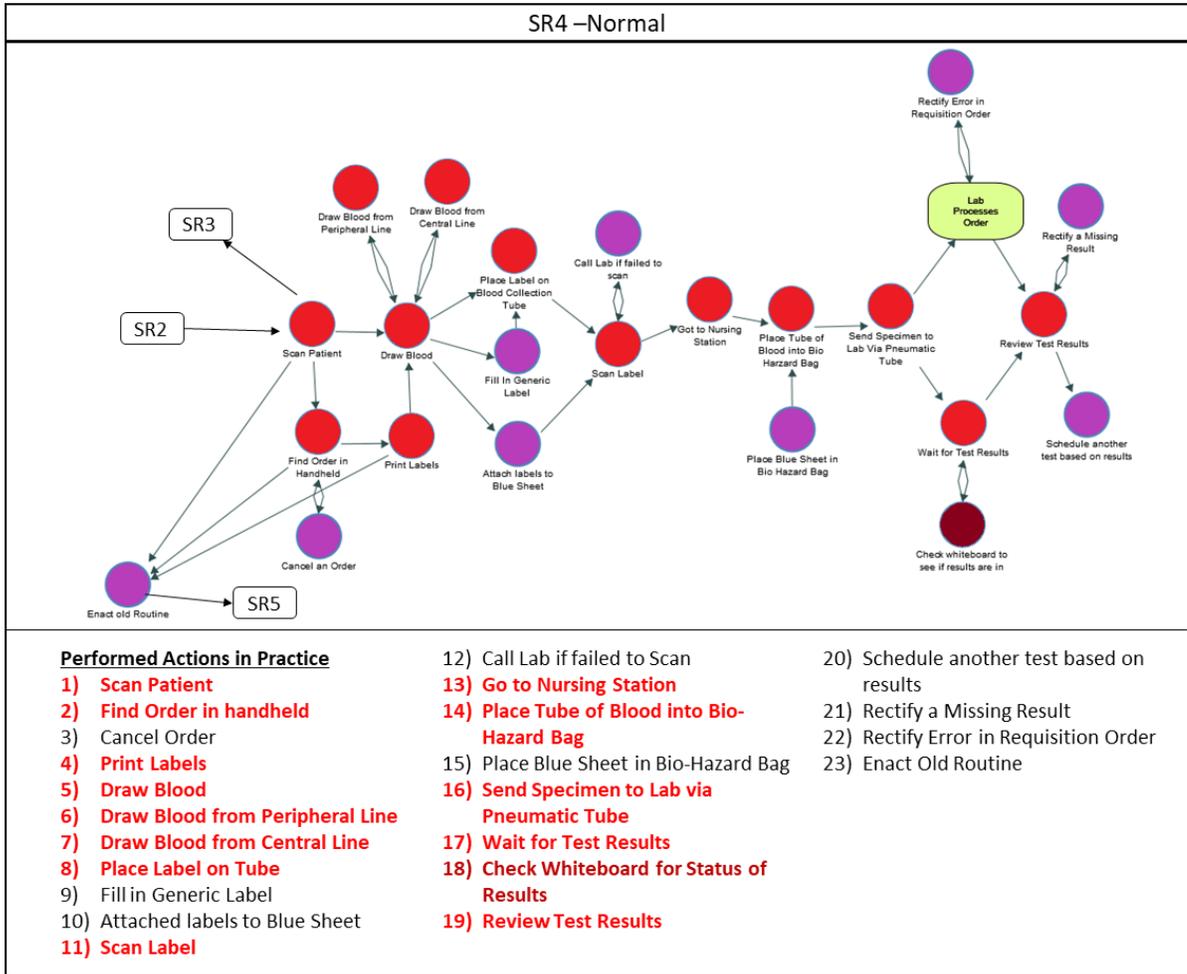


Figure 60. SR4- Normal/Expected performance.

Five exceptional performance patterns are enacted in response to a disrupted performance.

These are detailed below in the following subsections.

7.3.4.1.2 SR4-D1: Disruption Pattern #1-Multiple Test for a Single Collection

The first disruption pattern found in SR4 is when nurses receive multiple orders that can be fulfilled with one specimen collection (See Figure 61). One issue that designers needed

to address with the CPOE system is that not all specimens are associated with only one order requisition. For blood collection, each specimen is a tube of blood. The issue arises when multiple blood collection requisitions arrive for a single patient, and a portion, or all, do not require a single separate tube. In such instances, one specimen collection can serve multiple requisition orders. Considering the small size of the tube, applying multiple labels is not a feasible option.

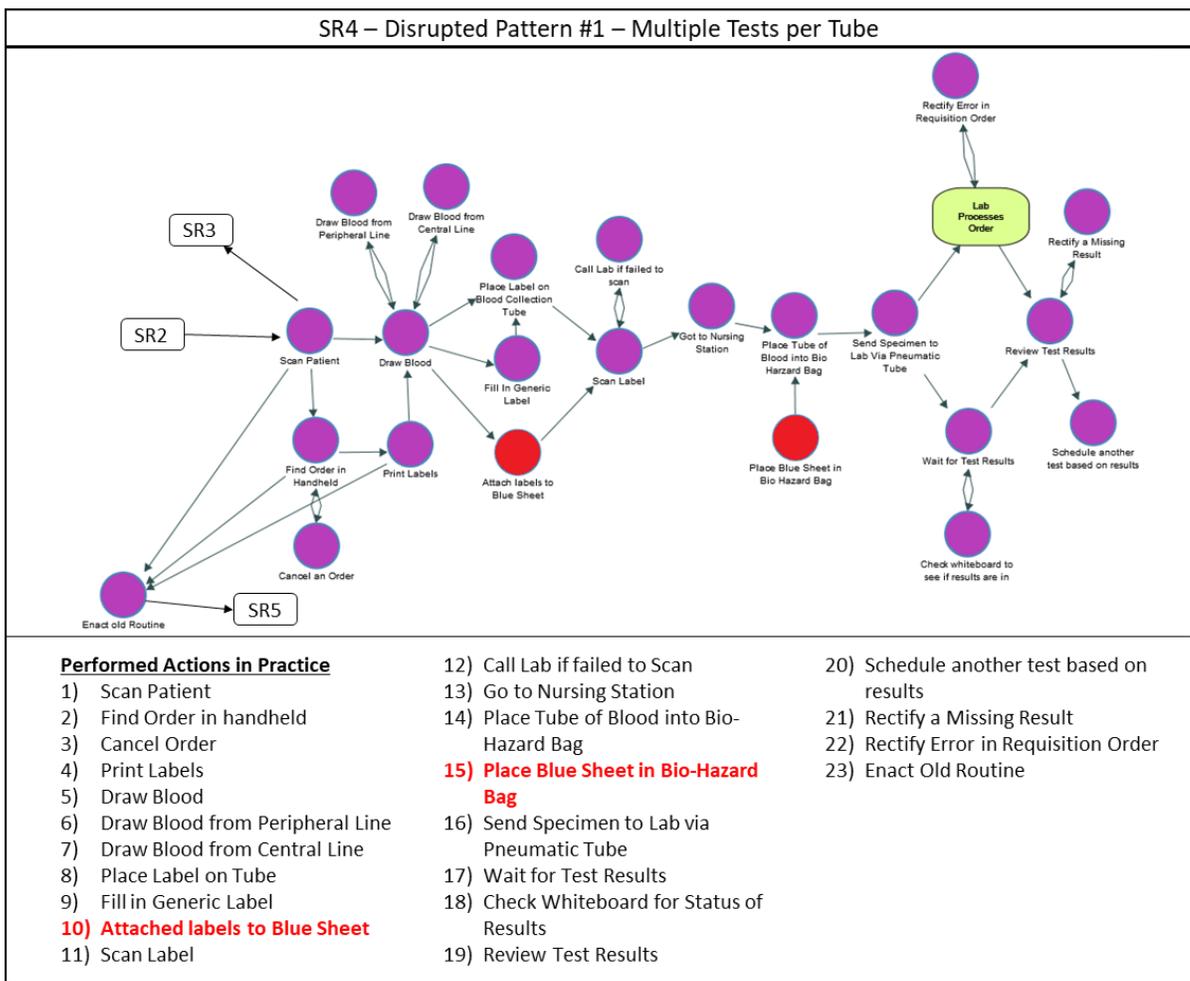


Figure 61. SR4-D1-Multiple tests per tube.

To resolve the issue and yet maintain the structure of the “one order – one label” connection, the design introduced what nurses refer to as “blue sheets”. When a blood collection specimen (tube) is intended to fulfill multiple orders, the nurses print the labels for these orders as usual, but then attach these labels on a piece a paper called the “blue sheet” and this “blue sheet” is then sent along with the tube to the lab.

Nurses indicate that they thought this was an additional change to the system as it was introduced sometime after the system was launched. Despite the timing, it would seem that the “blue sheet” approach is a patchwork attempt, added to address an exceptional situation that would allow for a one-to-many relationship between specimen samples and order thus avoiding a significant change rewrite to the core CPOE system.

SR4-D1: Unexpected Outcomes & Emergent Behaviours

Nurses, in general, seem comfortable with using, and including, a “blue sheet” in their blood collection process. Two issues, however, seem to occur frequently. The first is that nurses will often forget to bring a “blue sheet”, or not know they need one until they are in the patient room. This is especially disruptive if the patient is in isolation. The second issue is that some nurses will avoid this more complex order process and simply revert to “placking a req”.

7.3.4.1.3 SR4-D2: Disruption Pattern #2-Generic Labeling

As was detailed in an earlier subroutine, the generic label process was included in CPOE to address issues with orders not in the CPOE catalog. When this exception occurs, nurses will not print out a label that contains all the test information, but rather, they will print a generic label. They would then write, with a pen, the information necessary to process the order on the label. In such cases, the requisition order is not entered or managed by the system (See Figure 62).

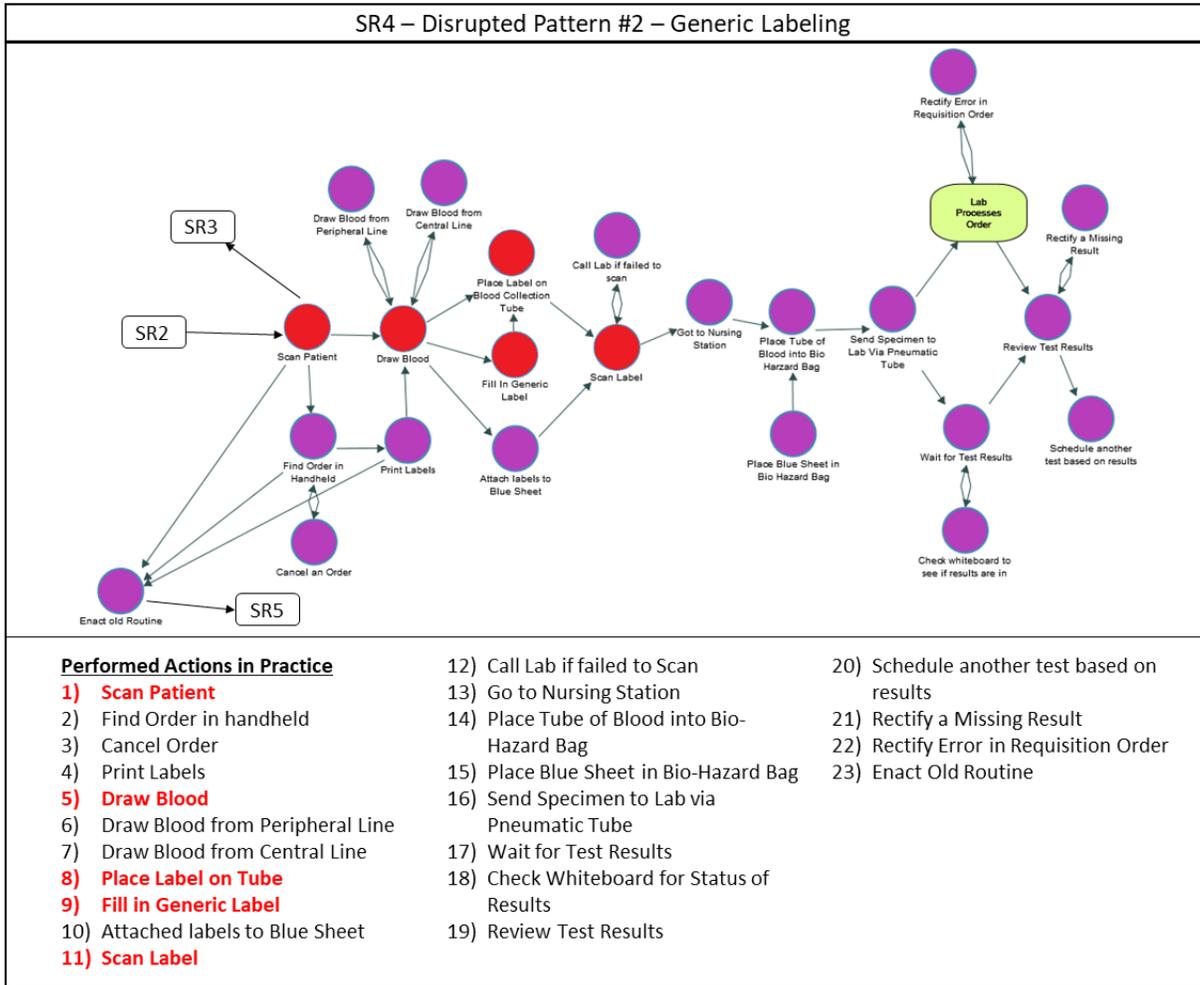


Figure 62. SR4-D2-Generic labeling.

SR4-D2: Unexpected outcomes & Emergent Behaviours

Many nurses found using the generic label to have benefits over the old paper requisitions, as it avoids the most time-consuming aspects of entering and managing the requisition order within the CPOE system. This has resulted in the proliferation of generic labeling use, often used for orders that should be managed by the CPOE system.

Generic labels are also being used in the day patient area. Though it is not fully clear if this is part of the original design, one nurse indicated that this was the adoption of the partial use of the technology – using the scanner and printer for generic label processes for what were to be paper requisitions. The indicated generic label advantage over the old paper requisitions is that they save time from having to “plack a req” and increase safety; the generic labels are printed with the patient details on them thus avoiding the need to find an addressograph to add an imprint of the patient information to a paper requisition.

7.3.4.1.4 SR4-D3: Disruption Pattern #3-Troubleshoot with Lab

Another performance pattern that can disrupt normal specimen collection flow is when issues with the scanning of a label or missing results appear (See Figure 63). There are times when the scanner stops functioning during a blood draw. If this happens, the CPOE system will record that a label has been printed, but not scanned. The lab will want to reconcile this, so the nurse will typically call the lab to let them know what has happened. Otherwise, at some point, the lab will call the unit in an attempt to rectify what will seem like a missing specimen incident. The other situations occur when a nurse cannot find the results from a previous test on his/her computer. In such cases, nurses will need to monitor their outstanding order and identify when one is taking an excessively long time to process.

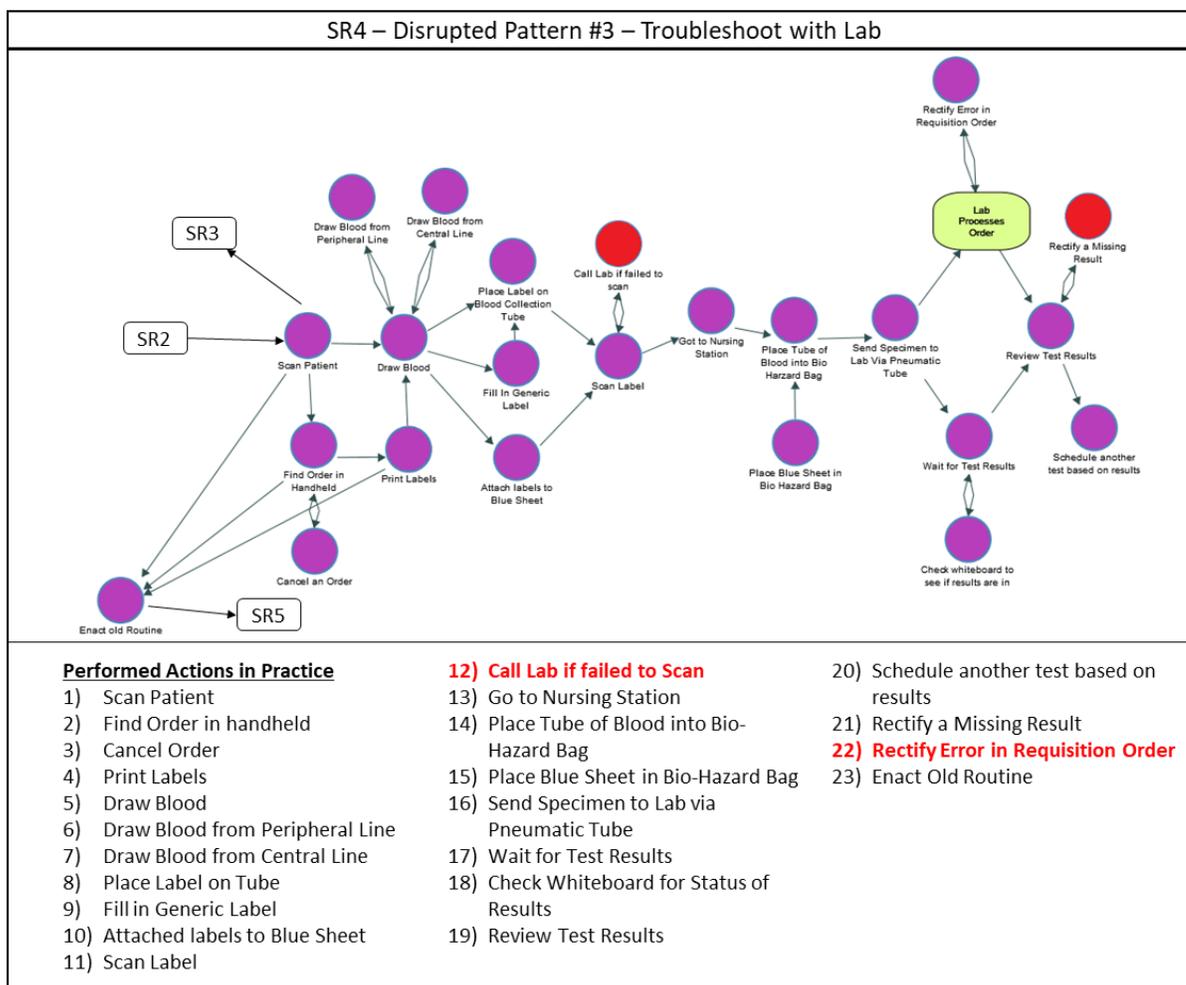


Figure 63. SR4-D3-Troubleshoot with lab.

SR4-D3: Unexpected Outcomes & Emergent Behaviours

Instead of calling the lab to notify them that there is an issue with the scanner, some nurses will, in frustration, simply send the order to the lab. This will result in the need for a lab technician to investigate the unverified order received. Such instances create extra work for the lab technicians, and the floor clerks, as they attempt to rectify the problem. This could also delay the processing of order, or even result in a new draw needing to be taken.

7.3.4.1.5 SR4-D4: Disruption Pattern #4-Rectify Order Requisition Errors

The fourth disruption pattern found in SR4 is when there are problems with processing an order (See Figure 64). This disrupted pattern occurs when there are issues with a requisition order. Instances include mislabeling, or incorrect information entered in the order record. This process was frequently referenced by nurses as occurring most often in the initial period post CPOE deployment.

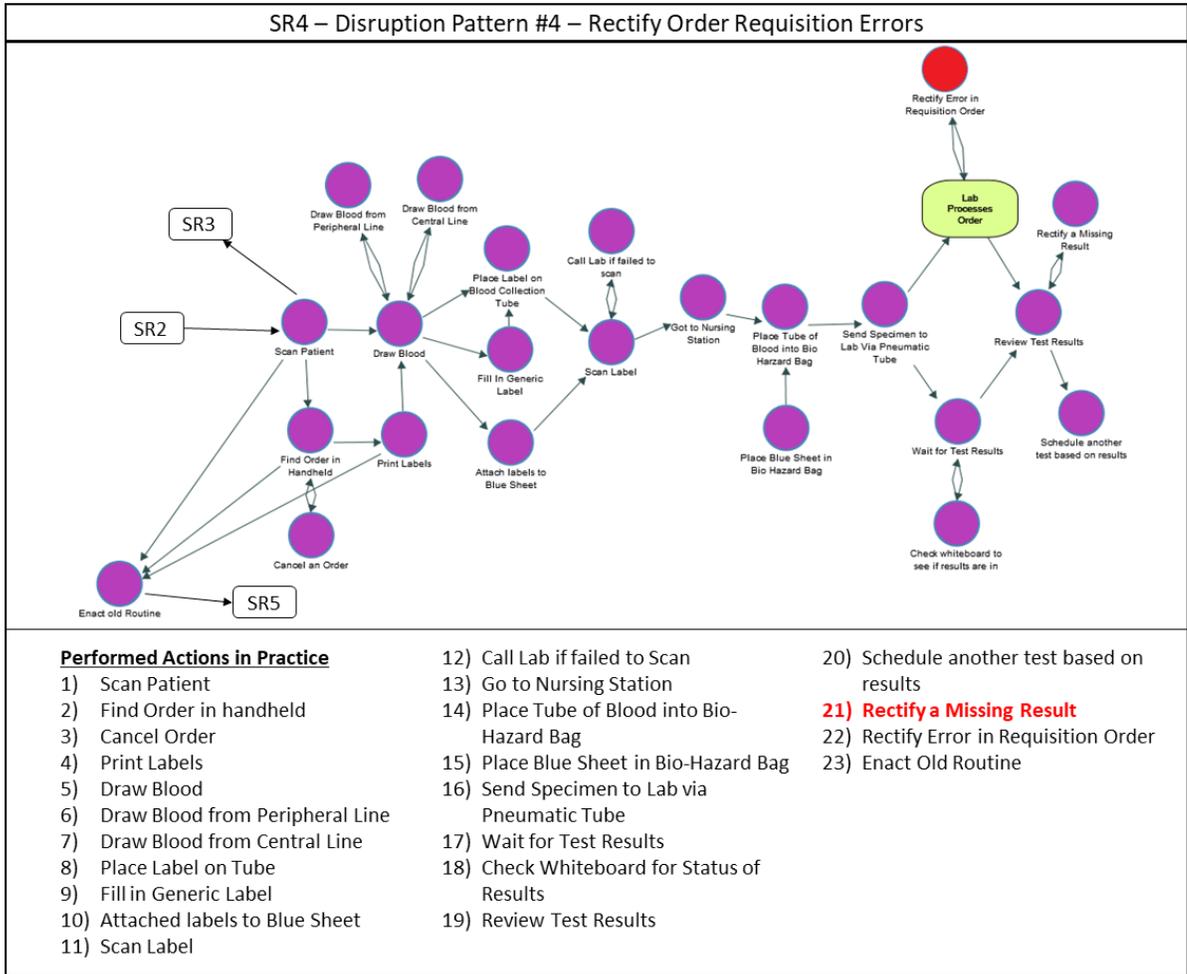


Figure 64. SR4-D4: Rectify order requisition errors.

In reviewing the narratives from lab administrative personnel, it is clear the launch of the CPOE system has greatly simplified the order receipt and ordering process with the lab. The lab department had encouraged more nurses to use the CPOE labeling system over the old paper requisition system. Initially, when a nurse would submit a paper requisition order for an order that should be processed through CPOE, the lab would phone the unit and encourage the nurse to submit the order using the new method. Some claim that there were

threats that submitted tests would be rejected until the nurse entered it using CPOE; no nurses could identify a specific case of this ever happening.

SR4-D4: Unexpected Outcomes & Emergent Behaviours

Support for the old paper requisitions continued for emergency orders, making it possible for some nurses to avoid using the CPOE system and submit their orders via paper, and some of the nurses most resistant to the new CPOE system took advantage of this fact. Initially, there was pushback (or as one lab administrator noted, “encouragement”) from lab technicians and administrators. When a nurse submitted an order, s/he may have received a call from the lab, or an e-mail from an administrator, encouraging him/her to use the new process. Over time, however, this practice stopped. Continued instances system bypassing over time resulted in making this accepted practice. Only one nurse indicated that she doesn’t use the new system at all, while a number of nurses will more quickly revert back to using the paper requisition than others. Such bypassing of the system introduces extra work order processing, and in rectify side effects such as, cancelling orders that may have been entered into the CPOE but were fulfilled via the old paper process.

7.3.4.1.6 SR4-D5: Disruption Pattern #5-Enact Old Routine

The fifth disruption pattern of SR4 can occurs at virtually every point in the performance of SR4 (See Figure 65). If the nurse accumulates sufficient frustration with the system (e.g. missing order, device not working, difficulty releasing or finding an order, etc.), s/he may

resort to enacting the old routine. With relatively little push-back or repercussions for such behavior, some nurses resort to the old process more frequently than others. When a number of nurses were asked why they use the system, many exhibited an intrinsic motivation to do what they felt was the right thing (one nurse said she likes to follow directions, another felt that there were safety benefits for doing so and that this warrants the extra time). Those nurses which exhibited little such intrinsic motivation to use the device relied more heavily on external encouragement which, over time, significantly diminished.

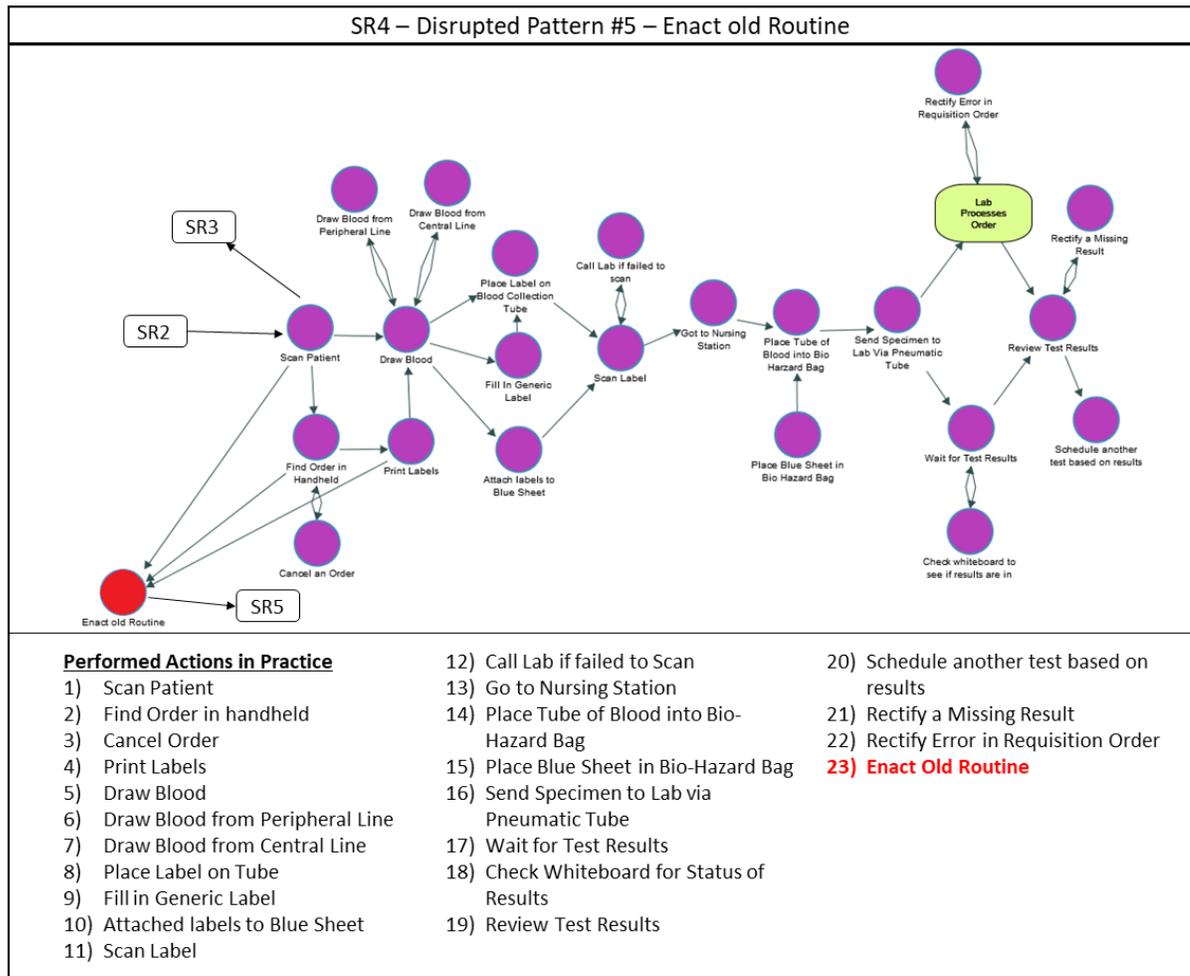


Figure 65: SR4-D5-Enact Old Routine

- Excessive use of the old paper system leads to audit and order handling inefficiencies and increases the risk of error

7.3.5 SR5-Enact old routine

The espoused routine for which the system was developed and deployed defined only a subset of blood collection orders. By design, the new routine was to be enacted to support blood collection routines of a non-emergency nature. Under emergency conditions, whereby time is of the utmost concern, the anticipated performance of the new routine would, on an exceptional basis, include the use of the “old” paper based order requisition process. This, therefore, meant that the enactment of old routine continued to be a part of the new routine (See Figure 66). Though this was only expected for handling emergency orders, the application grew to nonemergency situations as well. As one nurse stated, “I never use the system... the lab then just enters in what I send down” (Nurse02).

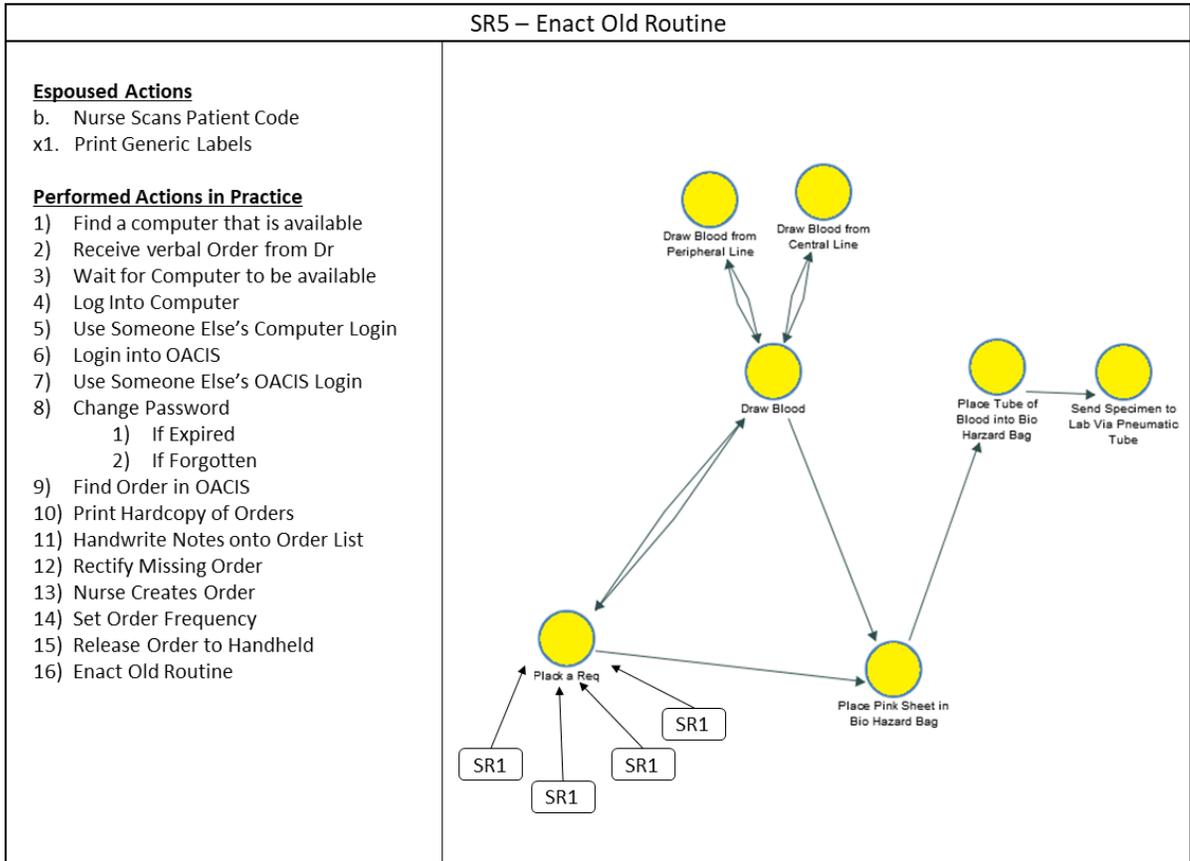


Figure 66. SR5 - Enact old routine.

7.4 An enacted network of subroutines

Our objective for Section 1 and 2 was to identify the espoused routine, the original routine, and the enacted routine. In Section 3, we identify patterns of performances of the routine, and identify disrupted performance patterns. To accomplish this, we first analyzed the narrative network for indications of clusters of actions and performance patterns, which resulted in identifying five key subroutines. We then further analyzed each of these subroutines for the performance patterns and disruptions found in each.

Our findings show that though the project was considered a large change effort, the changes represented in the espoused routine were minimal. In practice, the enacted routine was much more varied and complex than the espoused routine predicted. We also found five identifiable subroutines. Two of these subroutines are disrupted patterns, and not part of the originally espoused routine - that is SR3 is in response to individuals having trouble with the devices, and SR5 is in response to some form of frustration or emergency. The other three subroutines (SR1, SR2, and SR4) constitute what would be the expected portions of the routine that a nurse would consider “normal performance”. Within each of these three core, or normal, subroutines, we identified a number of disruption events and resulting disruption patterns found within the narrative. Figure 67, “Summary of subroutine analysis findings” displays a summary of these results.

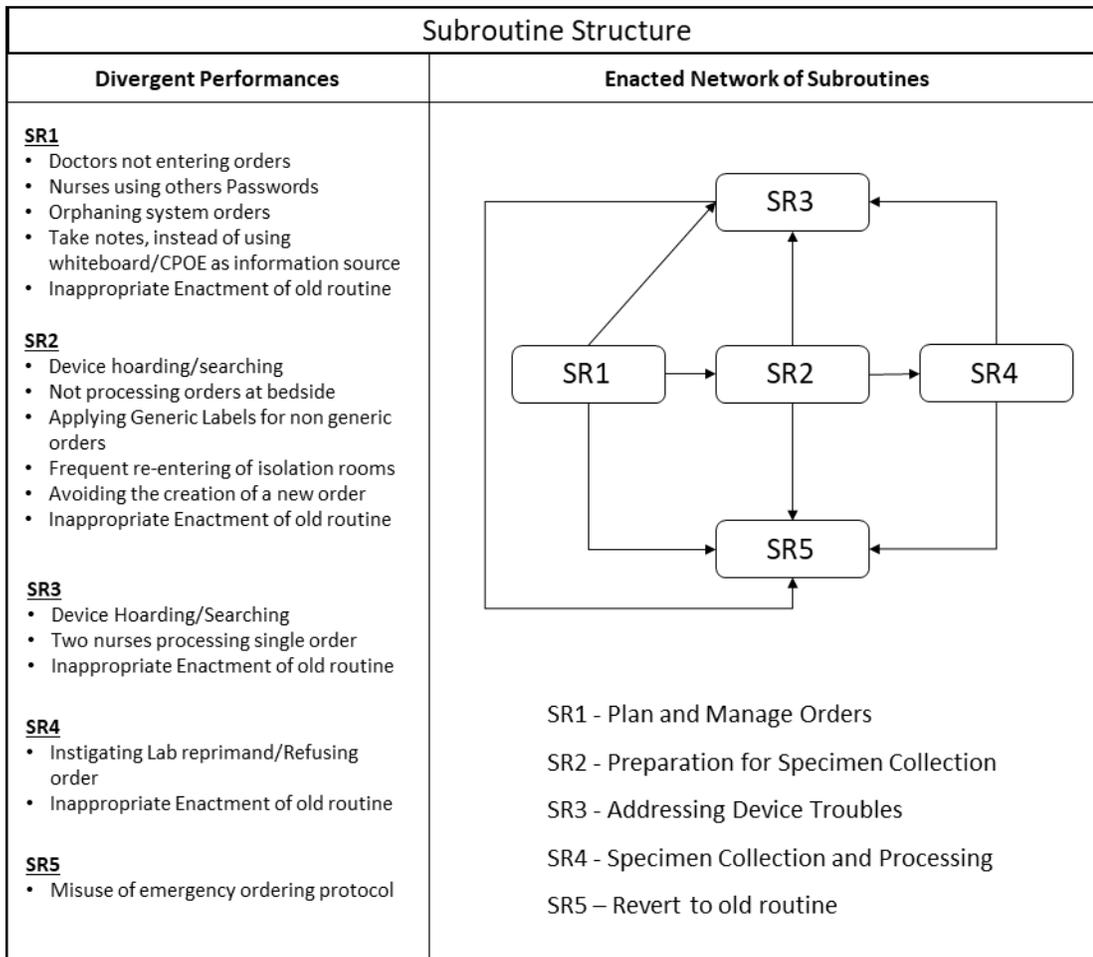


Figure 67. Summary of subroutine analysis findings.

7.5 Summary

This chapter has provided an in-depth analysis of the original routine, the espoused routine, and the routine enacted in practice. As indicated in the narrative network representations of these routines, we find a significant divergence between the enacted and espoused routine – with many more patterns of performance being enacted than was expected prior to the deployment of the system.

In the following Chapter 8, we analyze the dialectic content found within each of the disruption events and resulting patterns. In Chapter 9, we discuss our findings, and in Chapter 10 we conclude with a summary of contribution, limitations and recommendations for future research.

^{xcviii} Indicating a fever from an infection.

^{xcix} STAT orders were originally determined by the inclusion of a pink version of the paper form. This *pink sheet* provided a clear visual indication to the lab that this was a STAT order. A number of nurses expressed concern that the new system did not have a way to indicate a STAT order.

^c That is, an order not available within the CPOE catalog of tests.

^{ci} Nurses of 5-West repeatedly mentioned their responsibility in ensuring that the orders properly match the care plan established by the doctors – one nurse indicated that “At the end of the day, it’s our neck on the line. If there is a mix up, it’s our fault”.

^{cii} As indicated in interviews with lab administrative staff, the lab maintained a receiving desk where receipt and processing of lab test orders would occur. With this new process, the receiving desk was greatly simplified.

^{ciii} In an interview with one of the clerks, the clerk mentioned the new process was much easier and less time consuming for clerks to manage. They would now simply “drag and drop” templated order patterns into CPOE upon patient admittance.

^{civ} As will be discussed later, this uneasiness was a factor that caused some nurses to more easily revert to the old paper based routine in contexts where the new system was to be used.

^{cv} The nurses claim that the computers outside patient rooms are too slow and take too long to work with. None of the nurses interviewed use these computers.

^{cvi} One such test includes tissue typing. 5-West requires a genetic tissue typing test in order to determine appropriate donor candidates for bone marrow transplant patients. These orders are not processed by TOH labs, and are required to be sent to another hospital for testing.

Chapter 8: Data Analysis and Findings: Dialectic

Patterns of Routine Change

In this chapter we thematic narrative content analysis (Riessman, 2008) to analyze our data. Using a dialectic lens, we identify how dialectic tension motivates variation in an organizational routine. To accomplish this, we utilize aspects of the “dialectic modalities” lens defined in Chapter 3. A fundamental assertion underlying our position is that variation in routine performance(s) is directed by agents engaging in a simultaneous dialectic between their performance of the routine and the ostensive aspect of the routine and their performance and the environmental context in which the routine is performed. This position is consistent with, and expands upon, prior seminal work on routines such as that of Martha Feldman (2000), who noted that organizational routines involve actors “reflecting on what they are doing, and doing different things (or doing the same things differently) as a result of the reflection” (p. 625).

8.1 Coding approach

We first identify instances of *dialectic moves* found within the collected nurse narratives. These moves are *dialectic moments* from which agents initiate variation in their performance (we provide further detail in 7.4.3: Dialectic Moments of Change).

Secondly, we identify the general *dialectic paths*, or sequential patterns, that nurses experienced in response to work pattern disruptions brought on by the introduction of a new CPOE system.

Consistent with Riessman (2008), “Thematic Narrative Analysis” method, where “data are interpreted in light of thematics developed by the investigator” (p. 54), we analyze the thematic content of the collected nurse narratives along with our own reflective notes made during initial coding work conducted in support of Section 3 analysis. Using the interpretive “dialectic modalities” lens introduced in Chapter 3, we identify moments and patterns of dialectic tension between environment fit and misfit, and between ostensive consistency and novelty (divergence).

8.2 Elaborating our thematic frame and notation

To further contextualize the dialectic lens introduced in Chapter 3, the “thematics” (Riessman, 2008, p. 54) applied to the interpretation of nurse narrations of experience must be first elaborated.

8.2.1 The dialectic modalities lens

Within this theoretical lens, an agent performing a routine begins their performance in a dialectic modality. While enacting a performance of a routine, an agent may choose to diverge from this modality. Through this experience, an agent either confirms expected results or reflects on unanticipated results:

- A modality is a context, or position, within which an agent develops their performance
- A performance is an instantiation, or enactment, of an organizational routine. Here, performances are a sequence of actions enacted by the agent
- Each performance can be experienced by the agent through its level of dialectic tension
- Each performance can initiate a transition to a new modality, or continue the old one
- Agents prefer lower dialectic tensions over higher dialectic tensions, and if individual thresholds are exceeded, the agent moves to change their future performances with a goal of reducing dialectic tension

Our dialectic modalities lens highlights two fundamental dialectic dimensions: the dialectic between the performance and the ostensive aspects of the routine (the correctness of the routine) and the dialectic between the performance and its fit with the environmental context in which the routine is performed (the difficulty in performing the routine). Each performance, therefore, can be seen as having high or low dialectic tension across each of these two dimensions. We view these dialectic tensions as psychological cost, with increasing dialectic tensions introducing increase costs on the agent.^{cvi}

8.2.2 Dialectic notation

To help organize and communicate the results of our analysis, we introduce the following notation displayed in Table 8, “Dialectic tension notation”.

- **O** - A performance that is consistent with the ostensive aspect of the routine, and therefore has low ostensive dialectic tension
- **O'** - A performance that is not consistent with the ostensive aspect, and is divergent or novel relative to the ostensive, and therefore has high ostensive dialectic tension
- **E** – A performance that, based on the nurse's assessment, fits the environment well, and thus has a low cost of enacting this performance within the current environment. This performance, therefore, has a low dialectic tension with the environment
- **E'** – A performance that, based on the nurse's assessment, does not fit the environment well, and thus has a relatively high-performance cost, producing a high environmental dialectic

Table 8 Dialectic tension notation.

The result from each performance is an achieved position or modality – that is – $E+O$, $E'+O$, $E'+O'$, $E+O'$. When agents enact work, each performance of their routine produces an outcome, which is the agent's subjective evaluation of their performance. Unsatisfying performances result in agents directing future performances in an attempt to transition from one dialectic modality to another. An agent may also achieve this transition unintentionally, but in either case, the resulting position from the performance remains the agent's

subjective interpretation. We illustrate this structure of this lens in Figure 66, “Summary of modalities”.

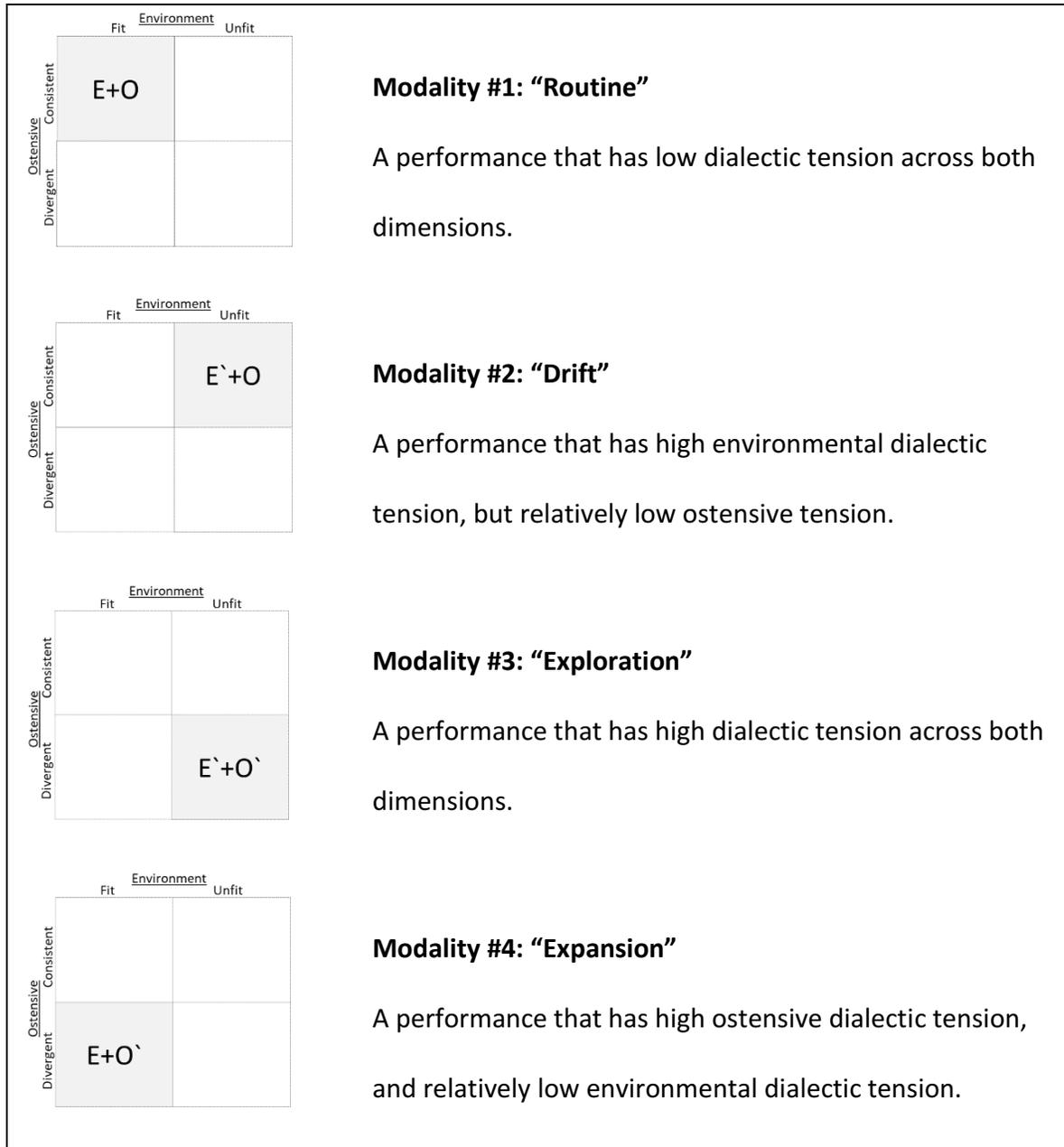


Figure 68. Summary of modalities.

We utilize this dialectic to analyze each nurse’s routine performance narration as a translation, or dialectic moment that moves from modality to modality. These moves are illustrated in Figure 69, “Model of dialectic moves” below.

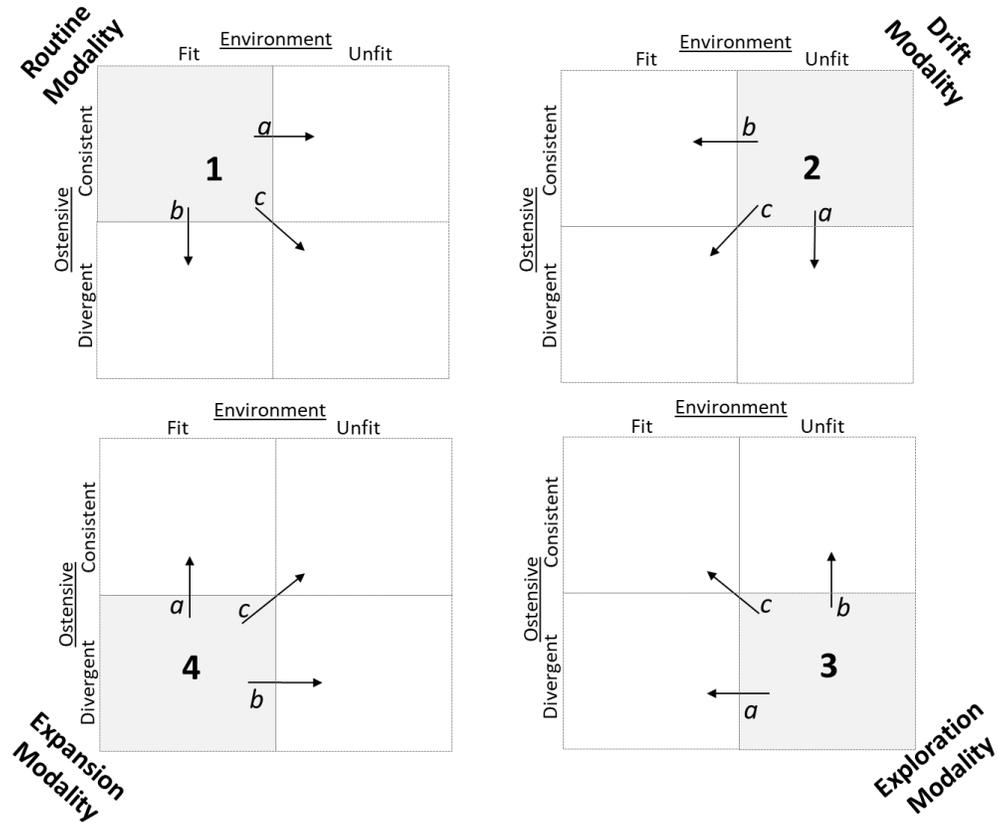


Figure 69. Model of dialectic moves.

8.2.3 Temporal model of dialectic paths

In our review of nurse accounts of lived experiences during the introduction and post-introduction use of the new system, we found that nurses (who we also refer to more generally as agents) indicate a number of dialectic moves. These narrations also indicate

sequential patterns, or paths, through which nurses motivated changes to their patterns of work – from the initial introduction of the system through to their present-day accounts.

As a review, in Chapter 3, we proposed that the dialectic paths would indicate a temporal model of dialectic change, where agents would follow a general sequence of progressing moves, punctuated with brief incidents of regressing moves that ultimately fully traverses each modality to arrive at a repaired and renewed routine.

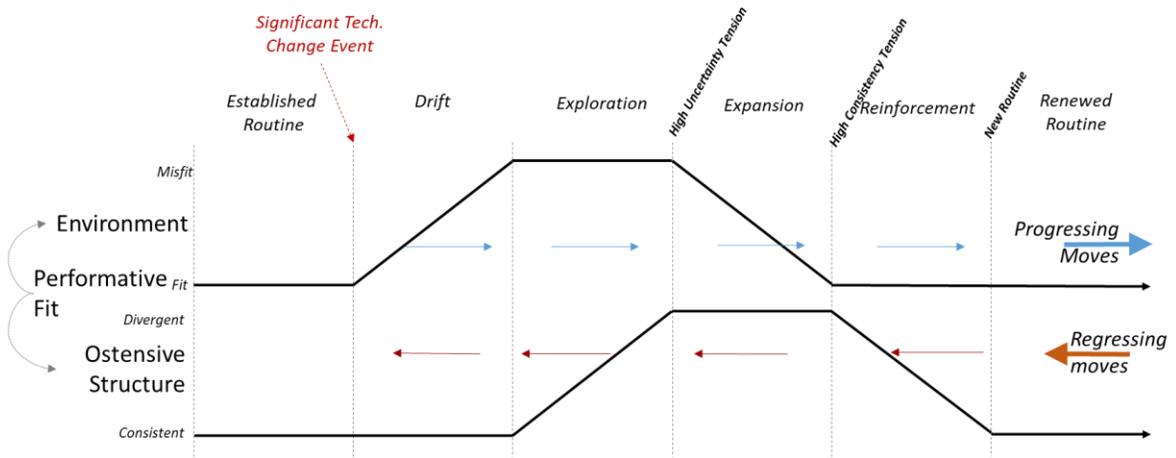


Figure 70. Dialect Path.

In this section, we reveal our findings of both dielectric moves and the patterns of these moves that have led to the nurses’ present cumulative experience with the new system.

8.2.4 Dialectic moments of change

Our findings were that nurses initiated six dialectic moments, or *moves*, as they initiated changes to their performance of a routine. Table 9, “Identified Dialectic Moments”

provides a summary of these moves, along with a characterizing descriptive phrase we've attached to each of these moves.

Dialectic Move	Description	Status	Anticipated in Temporal Model
E+O to E'+O	Establishing drift	Identified	Yes
E'+O to E+O	The "hold your ground" move	Identified	Yes
E'+O to E'+O'	The "give it a go" move	Identified	Yes
E'+O' to E+O'	The "make do for now" move	Identified	Yes
E'+O to E+O'	The "follower" move	Identified	No
E'+o' to E'+O	The "frustrated" move	Identified	Yes
E+O' to E+O	The "establishing routine" move	Indirectly Identified	Yes

Table 9 Identified Dialectic Moments

Using our dialectic notation, in the following sections, we elaborate on each of the moves identified.

8.2.4.1 E+O to E'+O - Establishing Drift (exogenous event occurs)

From the nurses' perspective, the introduction of the new CPOE system is an exogenous event, as the nurses of 5-West did not initiate this change or participate in its development. This event resulted in significant immediate changes to the environment in which nurses performed their blood collection routines.

Once the initial introduction of the system and training occurred, some nurses continued to use the old system to process orders that should be processed through the new CPOE system. Nurses at this stage were not yet feeling any significant ostensive dialectic tension, as their view of the "correct" way to perform a blood collection routine was still relative to

the ostensive aspect of their old routine (O). They were, however, facing increasing environmental dialectic tension (E').

Examples of this increasing environmental dialectic tension included nurses receiving calls from the lab, refusal of an order request, or other reprimands in response to enacting the old routine (paper requisitions) for CPOE orders (digital requisitions). At this stage, through the performance of their work, nurses began experiencing how their old patterns of performance no longer fit this still new and unfamiliar environment:

Nurse25: So, it's because it was new, it was frustrating. We had been using the old paper system for so long, and it worked...

Interviewer: Was there any pushback from anybody not to use the paper requisitions?

Nurse25: There was in the beginning because they were watching us like hawks to make sure we're doing it right. So -- but now there is never an issue they accept whatever --

Interviewer: Who are they?

Nurse25: The lab.

Interviewer: The lab were the ones that would say you should use the system?

Nurse25: Yeah. They would ask questions at first - we were told this is how the system is going to be now, this is what you should expect. Some nurses I think had their orders [rejected]... it was a stressful time - we didn't know if we were doing it right.

In this modality, nurses performed old familiar routine patterns (O) with the expectation of an E+O result but experienced E`+O – a point of higher dialectic tension. As we will later see in our analysis of dialectic paths (see Section 8.2.5 Dialectic path sequences and outcomes), this E`+O position proved to be unstable, and nurses applied various tactics to transition away from E`+O such as reaching out to peers for help (transitioning from E`+O to E+O`) or by their own initiative via exploration and testing (transitioning through E`+O` to reach E+O`). It was also indicated that encouragement to use the new system lasted only for a brief period during (and post) initial introduction of the system. As we will see in the next section, some nurses also exhibited a “hold your ground” move (transitioning back to E+O) (see Section 8.2.4.2 – “Hold your ground move”), which ultimately contributed to wearing down those that were tasked with helping to discourage instances of old routine performances.

8.2.4.2 O+E` to O+E - The “hold your ground” move

As outlined in the previous section, the drift modality (O+E`) was established once high environmental dialectic tension was introduced by the deployment of the new system. Despite significant encouragement to use the CPOE system, a subset of nurses rejected the system outright and continued to use the old paper requisition system for all order

processing. After much persistence, this encouragement eventually subsided, and the environment changed so that these types of performances were now a fit with the environment (move from E`+O to E+O).^{cviii}

As indicated in the E+O to E`+O observation (see section 8.2.4.1 – Establishing drift), these, and other, nurses experienced organizational resistance, or *push back*, for bypassing the use of the CPOE system. This resulted in an increased dialectic tension between the performance of old routine patterns with the new environmental context:

[after describing how the lab has benefited from the introduction of the system...] We spent a lot of time encouraging the nurses to use the new system. We'd help whenever possible – but we needed the nurses to transition from the old paper requisitions. (Admin01)

Despite this increasing environmental dialectic tension, some nurses “held their ground” and continued to enact the patterns that fit the old paper based blood collection routine and avoided using the newly deployed CPOE system. From our data, however, it is not clear if this set of nurses had higher threshold/acceptance of environmental dialectic tension, or if they received less pushback due to their seniority (near the end of career). In any case, when a nurse in this category was confronted by the organization, agents justified bypassing CPOE usage by claiming a patient emergency or that the system wasn't working:

I had one of the people who, not the administrator but people teaching, came up to me to tell me “you have a red flag” and I am like well I am

too busy to do it. **I have a sick patient here.** I am not going to leave them to go and check the board which is at the desk. (Nurse04)

Over time, the organizational pushback for new system lack of use became less frequent, resulting in a reduced environmental dialectic tension^{cix}. The side effect of this push back decline was that the use of the old system was now considered more acceptable:

Interviewer: So you fill out a paper form, is that what you're doing?

Nurse02: Yeah. That's what I've always done and continue to do...

...

Interviewer: So has there been any pressure for you to conform and use the system? Have people said, "you need to do this"?

Nurse02: **At first there was**, but I've got no calls from the lab in years, and I put my name on everything, so if they want to call me and discuss this then they can call me, but **I've had no calls from the lab.**
Maybe other people got complaints about me, but I haven't heard.

Nurses who “held their ground” did not indicate ostensive dialectic tension for doing so. For instance, Nurse02, one of the more aggressive resisters of the system, seemed to continue to hold the old ostensive routine structure as a referent to her current actions, therefore, enacting the old routine as an ostensive fit, or consistency:

Interviewer: So your kind of back to where you were. Your performance is the same as before, mainly because you're avoiding using the system as much as possible.

Nurse02: Yeah, for me, there's been no changes. I continue to place a req as I've always done.

8.2.4.3 E`+O to E`+O` - The "give it a go" move

As the environmental dialectic tension increased post system deployment (O+E`), all nurses indicated that they at least tried to change their performance of the blood collection routine by "giving it a go" (Nurse03).

Initial training for these nurses occurred well before the system launch, and many nurses complained that this training provided little help for them once the system launched, "...the training happened months before it actually got rolled out, which was super annoying" (Nurse01).

Nurse trainers were temporarily assigned to the 5-West unit and would attempt to book one-on-one time with each of the nurses to walk them through using the system to place orders. These trainers would also often make themselves available for a portion of a shift to answer any general nurse questions.

Many nurses indicated that this initial training was not thorough and left many unanswered questions. The duration of this training and support was also brief, with some nurses

indicating that they had not yet established a comfort with using the system before this support ended.

This left nurses with a high degree of environmental dialectic tension, as their performances did not match the current context, and they knew little about how to use the system in practice. As a result, many of these nurses began to experiment with the system, making errors but also identifying key system features that could be applied to their work. Since experimentation did not immediately produce productive results, as they attempted to explore system use in the context of their work, these nurses endured a temporary position of highest dialectic tension (exploration modality). Nurses in this modality moved to perform sets of actions in tension with their views of a correct performance of a routine, and an efficient, well fitting, performance within this new, and still not fully understood, environmental context (O`+E`). These nurses moved to the high dialectic tension modality with the expectation of a payoff, that is, that a better performance (one with lower dialectic tension) would be found:

Nurse04: Training was kind of interesting in that, yes, it is great to see buttons, and yes you can do it when someone is over your shoulder, but when it comes time to do it yourself - it is a pain in the rump roast I have to tell you. I wasted a lot time trying to figure it out on my own – but I [figured it out].

Nurse12: We did have one [training session] - like at the beginning - and we forget right away because it's so complicated to start step by

step and then I have like three months or two months later we started using this. And you're kind of using it on the job you know just to know how to do it make it work, after a while, you get better of it.

Even Nurs02's strong "hold your ground" (discussed in section 7.4.3.2) strategy was preceded by a phase where she tried to explore using the system (but was frustrated with it and reverted back to E'+O):

Finding a machine that works, and seeing the thing that bothered me is okay, I got a machine it works and then there are no specimens [specimen orders] in there, and I have a specimen here that needs to be drawn. It's right there with no specimens. That [expletive removed], so I just told 'em [I'm going to keep doing it the way I always have].
(Nurse02)

8.2.4.4 E'+O' to E+O' - The "make do for now" move

There was indication across various narratives that nurses were comfortable using the system (E) but felt that using the system was forcing them to enact routines that were not consistent with the ostensive aspect of the current routine (O').

One example of this is provided within Nurse31's narratives:

I think that given that we have both online and paper work to do, it's kind of like I said it's kind of annoying in a sense. I don't see how things are better. (Nurse31)

This nurse also indicated that she has at some point explored the features of the system (E'+O'), and found ways to use it and is now able to confidently use that system to perform the blood collection routine, but experiences a high ostensive dialectic tension when doing so (the new way just isn't "right", or "correct") (E'+O' move to E+O').

When there is high ostensive dialectic tension, the nurse is prone to exhibiting a "frustration" move:

...**When I'm in a rush to do something**, honestly, I don't really use it.

I just plack a req - I do try to use the system when I can, it's not what I prefer, but they want us to use it. The old paper req is just faster when you know how to do them. (Nurse31)

With regard to the ostensive tension, there is also no indication that this continued "make do" performance has changed her ostensive structure, as she seems to hold a lingering perception that such performances are not "correct":

I would say that I think if everything, like everything, were online then perhaps it would be better to have the bridge system. But like I said, because everything else is paper it's like you're going in between two methods of working essentially. I'd rather be everything paper or everything online, so just that's my main points I think. (Nurse31)

The dialectic move indicated by such performances shows that the nurse targets (E), a position of less tension, but may see the ostensive aspect of the routine as incorrect, or not

“right” in some way (O’). For example, we see that Nurse31 continues to compare performance correctness with the old routine which she found simpler:

...you’re going in between two methods of working essentially. I’d rather be everything paper or everything online... (Nurse31)

Over time, this high ostensive dialectic tension may be reduced. Routines theory indicates that frequent execution of a pattern of work strengthens the ostensive aspect of the routine. This would indicate that a constantly repeated sequence of these performances that includes the CPOE system, over time, may become the “correct” way, but Nurse31 clearly indicates that this point has not been reached.

Over three years post introduction of the system, we find an indication that the establishment of a new routine, even when performance patterns are being enacted that fit the new environment, may take considerable time, and ostensive dialectic tension may linger.

8.2.4.5 $E'+O'$ || $E+O'$ to $E'+O$ – The “frustrated” move

We found a number of nurse narratives that indicate what we characterize as a “frustrated” move. This move results in a nurse performing the old routine for situations where the CPOE system should be used. We identified this move as starting from $E'+O'$ (exploration modality) or $E+O'$ (expansion modality) and moving to $E'+O$ (drift modality).^{cx}

Two “frustrated” moves were identified from the data. The first is when the nurse has clearly identified patterns of work that use the CPOE system – either having explored uses

herself, or with the assistance of someone else – but then encounters a system failure and must spend time identifying a workaround. We identify this as the “frustrated user” move (from E+O` to E`+O`).

The second “frustrated” move identified occurs when the nurse is still unfamiliar with the system but is exploring ways to work with it (E`+O` (exploration modality) to E`+O (drift modality)). These nurses were frustrated by events where they could not successfully identify patterns of work that included the CPOE system to accomplish they needed to do:

[after being frustrated with trying to figure out how to find an order in the system] We couldn't tell our patients like just wait for technology, so we just sent paper recs down. (Nurse13)

In either of these two “frustrated” moves, nurses revert to using the old system despite any environmental tensions introduced for doing so.

For example, nurses will often perform much of their blood work near the end of a shift. This pattern is most prevalent with night shifts. During this time, due to the time constraints of soon ending their shift, nurses are especially sensitive to system troubles:

... the morning blood work routine is really frustrating. Some mornings like when I'm exhausted and really tired I'm really upset with the blood work system, I just use paper. (Nurse23)

The source of this frustration is often the length of time and number of steps required to use the system to perform a blood collection routine:

Frustration because of the length of time it now takes – say I have to draw a blood culture - I have to go to the computer try and log on to an ancient computer, get into CPOE, enter the blood work, find the patient, if the doctor didn't enter it into the system now I have to enter it into the system. Then wait for few minutes to it takes to go from the computer to the bridge if it goes to the bridge. So that's where I find my frustration lies the most. There are times when I don't have time for all that [and I plack a req]. (Nurse26)

Other examples of frustration occur when there are system failures due to avoidable issues, like ensuring the device has a charge or passwords are changed:

Interviewer: Has there been other times -- like for each of you, where the systems failed --

Nurse08: Just shut off, yeah.

Interviewer: How do you handle these situations?

Nurse08: It's [pause] okay because if it just shuts you off then you can just -- if it doesn't send then you just kind of -- it's kind of like restart so you just have to like log in on a different one and then just restart, so your blood work will still be there, and then you can just go from there. So it's annoying. But, it's not like the end of the world.

...

Nurse08: For certain things, I still plack a req,, yeah often it's too frustrating to use bridge.

8.2.4.6 $E'+O$ to $E+O'$ - The “follow the innovator” move

We identified some nurses that deem to have “leaped” from the initial drift modality ($E'+O$) to one of expansion modality ($E+O'$). Though we expected paths to expansion to be preceded by a period of time in the exploration ($E'+O'$) modality, some nurses – after being frustrated by exploring the use of the system – reverted back to the old routine and sought help from peers. After that, without having to experiment on their own, these nurses “leaped” to the ($E+O'$, expansion) modality:

[...preceded by a discussion of issues with the deployment of the system, and the difficulties she had initially] Interviewer: How did you get past all those issues?

Nurse23: Usually I would ask a co-worker. If no one knew I didn't go too much further than that, if it wouldn't work I would just forget about it and do a paper rec which I don't know I guess that's decreased a little bit over the time as everyone to use the system more and more but yeah I don't know how it could have been improved though the training process.

Interviewer: How significant was colleague input? If you don't have the time for the experiment and you've made some progress then someone that it must have been...

Nurse23: Yeah, very helpful, very helpful if someone had the time to figure it for me or with me or something yeah... someone tends to know some little trick or whatever.

Another example, provided by Nurse20, shows her trying to find a solution, and then reverting back to the old routine before she “leaps” to the expanded stage (E+O`):

...**questions that come up** in the middle of the night that nobody knows [based on the larger context, indicating there was an exploration of a solution, and then a reversion back to the old routine], and then you know the next time you're back during the day you have forgotten totally about them ... [eventually] **I usually find an answer from a fellow worker** that has already figured it out. (Nurse20)

8.2.4.7 E+O` to E`+O` - The “respond to anomaly” move

Nurses identified a number of ongoing issues with the system not working as expected. These nurses start in the expansion modality (E+O`), where they know how to enact performances that align well with the environment but still haven't fully established these performances as consistent with “the” or “correct” way to perform the routine (high ostensive dialectic tension). Within this modality, any unexpected event that disrupts a

nurse performance triggers nurses to move to the exploration modality (E`+O`) and explore new ways of addressing the problem:

Nurse11: ...for example a few nights ago we were working with the nurse who doesn't usually work with us. She works on another oncology floor, she also has [CPOE] access, but she was telling me that her password had expired and though she had changed it, since this she could not access the system and she said she had called support several times to have it change but she was either put on a hold or she had to leave a message and nobody ever called back. I ended up having to access the system for her, and we used my login. Those are things that should not happen.

Nurse03: ...you come up with the solution and try to figure that out. Like there are times where it has happened to me several times where I've got it all in a bridge ready, everything is ordered fine, it's all good and then it crashes on me.

In another example, the nurse clearly implies that a search for a solution has been triggered in the past and that a solution was explored and found:

[after having the scanner die a number of times] I didn't know for the longest time that there was a battery on the back. Like when they wouldn't work, I thought I was docking it, and that was being charged.
(Nurse09)

In these identified “respond to anomaly” moves, we find nurses exhibited a general goal of finding a solution (spend time in E`+O`), and then moving back to performing the new routine (E+O`). This is in contrast with the previously mentioned “frustrated” move that results in the nurse regressing back to enacting the old routine.

8.2.4.8 E+O` to E+O – The “establishing the routine” move

An unexpected finding from this research was that three years after the introduction of the CPOE system, a strong re-established blood collection routine could not be identified. Our findings indicate that nurse performances of the blood collection routine are commonly filled with exceptions and divergences. Also, many nurses show continued strong ostensive dialectic tension, as they see new current patterns of work in terms of the old routine, and in many ways, judged the new ways as incorrect.

We also found that a number of different performance patterns emerged rather than just one. One set of nurses use the system fully, but continues to see these performances as incorrect, what we characterize as “reluctant embracers.” Another set of nurses either refuses to use the system or leverages the slightest of issues as justification to enact the old routine and avoid using the system in what we characterize as “resisters.” Finally, some nurses developed a hybrid of the two systems by using generic labels in what characterizes as “pragmatic innovators.” These latter set of nurses tend to use the CPOE system only to scan patients and write on the labels the order they are requesting using what they see as the “best parts” of the system (ease of patient identification through scanning), while

ignoring what they consider the worst (the inputting and managing of order details within the system).

Considering these various sub-groups identified by categories of performance, we found that a stable organizational routine has not been fully established. Instead, what we find is that the organizational routine change process has resulted in a bifurcated routine where at least three different classes of blood collection routine performances have emerged.

8.2.4.9 Summary of identified dialectic moments

Our summary of findings for the identified dialectic moments, or moves, can be found in Figure 71, “Summary of identified dialectic moves”.

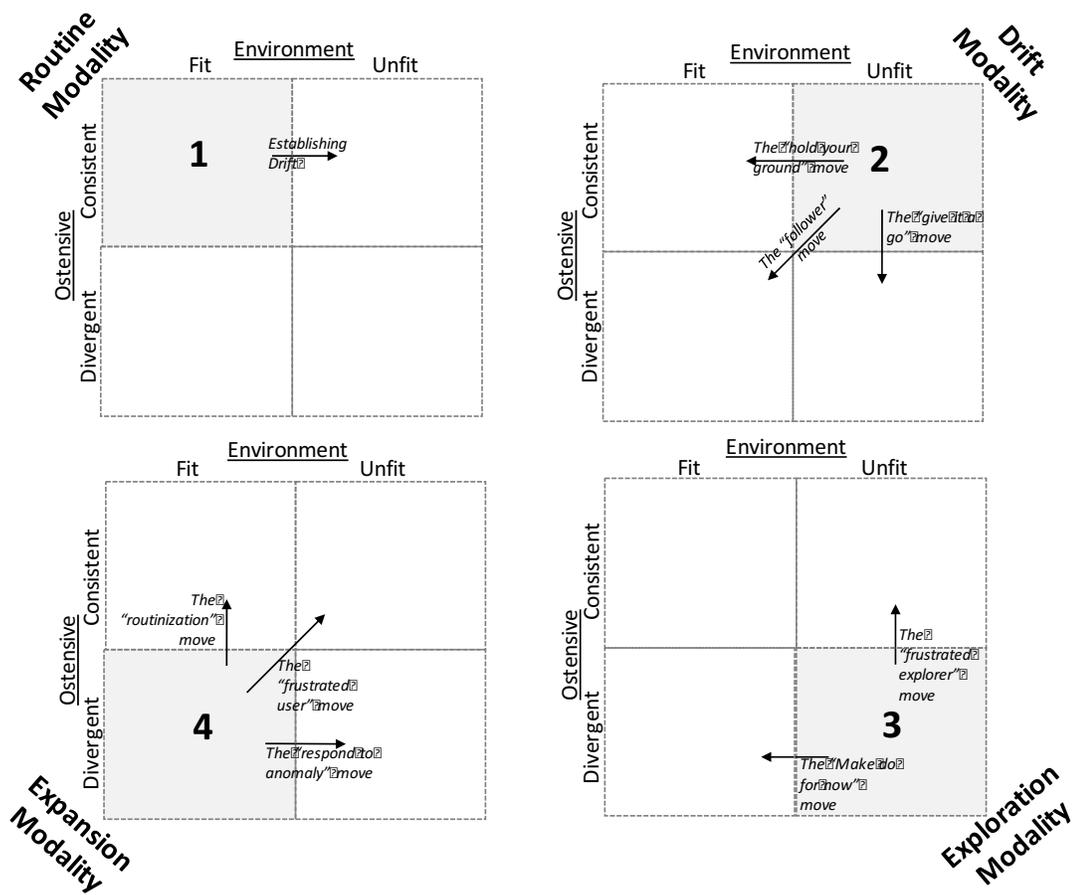


Figure 71. Summary of identified dialectic moves.

8.2.4.9.1 Routine Modality

Performances that exist in the ***routine*** modality represent the lowest dialectic tension. Strongly established routines can be destabilized via an exogenous disrupting event – what we characterize as “drifting.”

- Establishing Drift: Pre-CPOE introduction, nurses indicated that the introduction of the system was an exogenous event that introduced significant changes to their environmental context in which they enact their work

8.2.4.9.2 Drift Modality

During a period following the introduction of CPOE, nurses experienced significant tension with this unfamiliar environment disrupted by the system introduction. Nurses in this modality were not sure, or confident, that they could accomplish their work using the new, and not yet fully explored, system. This was an unstable position that resulted in nurses initiating change. From this modality, we identified three dialectic change moves:

- Hold ground: Nurses, through their refusal to use the system, made system bypassing an accepted practice
- Give it a go: Nurses exhibited an exploratory tendency and were willing to initiate performances that were in contention with the (now old) ostensive aspects of the blood collection routine
- Follow: Nurses could seek help and avoid the exploratory phase (when looking at dialectic paths, no nurses made this move without showing indication that they at least tried exploring its use)

8.2.4.9.3 Exploration Modality

All nurses seem to have spent some time in the exploratory modality. This is an uncomfortable position, as exploring means making errors, and by definition, requires an effort and willingness to do something different than what may be considered correct or right. This was an unstable position that motivated nurses to initiate change. From this modality, we identified two dialectic change moves:

- Frustrated: Though all nurse indicated having been in an exploration modality at some point, many regressed back to the old routine. We characterize this as a “frustrated move.” Each nurse seems to possess some capacity for holding such a position until solutions are found; if not found, after some time, nurses will necessarily revert back to the old routine in order to accomplish their work
- Make do for Now: Many nurses, after exploring different actions, identified performances that fit the environment but do not yet seem correct for them. In this case, these nurses exhibit a tendency for comparison with the “old routine” as the standard, and any new “routine” as an anomaly or incorrect

8.2.4.9.4 Expansion Modality

In the expansion modality, nurses previously explored and found ways to work within this new environment, but may have lingering judgments of “incorrectness” of these

performances as they continue to harbour comparisons with the old routine as the standard.

From this modality, we identified three dialectic moves:

- Frustrated: Much like the move identified in the Exploration Modality, here, nurses experience issues with performing their routine, in this case, due to some yet unidentified environmental problem or anomaly, and revert back to enacting the old routine
- Respond to Anomaly: This is a move to explore. Though the triggers may be like the “Frustrated” move, the nurses, in this case, have the time, or predisposition, to try to explore and find a solution – a new way of performing the routine that addresses any environmental anomaly experienced
- Routinization: This is a complicated move to identify. Many nurses indicated that they now find the blood collection routine using the system “routine,” but none indicated that they didn’t have lingering ostensive contention. Moreover, from a group level, even those that would claim they have established a new routine, across the group, we find variation in the performances that individual nurses claim to now be the routine

8.2.5 Dialectic path sequences and outcomes

We established four dialectic modes and have identified a number of moments of change (as identified as a move from one modality to another). In this subsection, we turn our focus to combinations of dialectic moments, or moves seen in the data. As discussed in the review

of our findings on dialectic moments, each identified move was typically preceded or followed by a combination of other moves. We define these combinations as dialectic paths.

8.2.5.1 The Expected Path

Our original expectations were that the temporal model introduced in Chapter 3 (represented in Figure 72, “Expected Path”) would be identified. Though we found aspects of this model within our narratives, we did not find a coordinated “march” toward the establishment of a new routine, rather, a number of different patterns and outcomes were found instead.

Expected Path (Chapter 3)

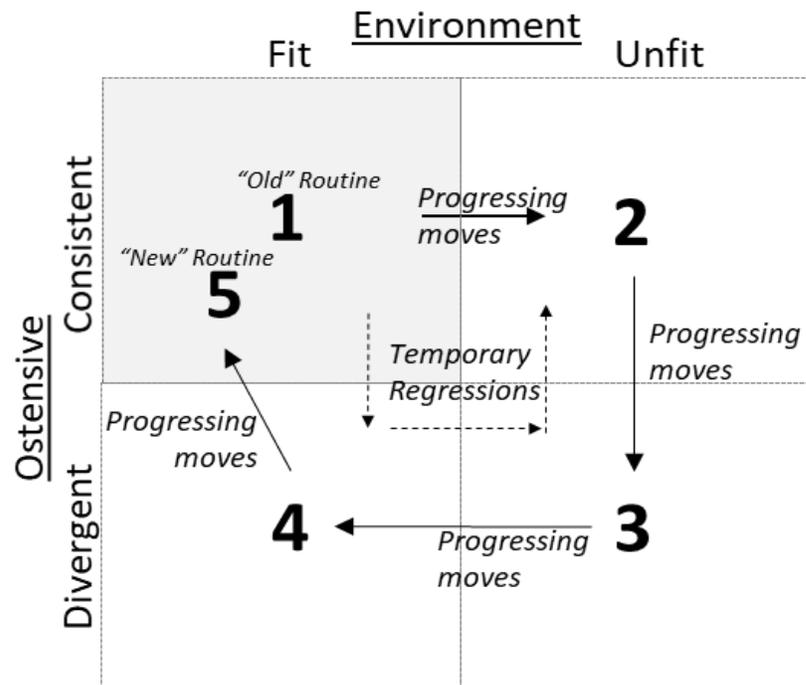


Figure 72. Expected Path (from Chapter 3).

The introduction of the CPOE system was an exogenous force that moved all nurses to a drift modality (from E+O to E`+O). Due to its higher dialectic tension, this is an unstable state.

We set out to demonstrate how agents moved through dialectic modalities to collectively repair and reestablish a routine disrupted by a technology introduction. Instead, of identifying one pattern, we found evidence of four dialectic transition patterns, or paths: the “Hold Ground”^{cx1} pattern, the “Pioneer” pattern, the “Follower” pattern, and the “Anomaly”^{cxii} pattern. We summarize each of four patterns in the following subsections.

8.2.5.2 The "Hold Ground" pattern

The "Hold Ground" Dialectic Path

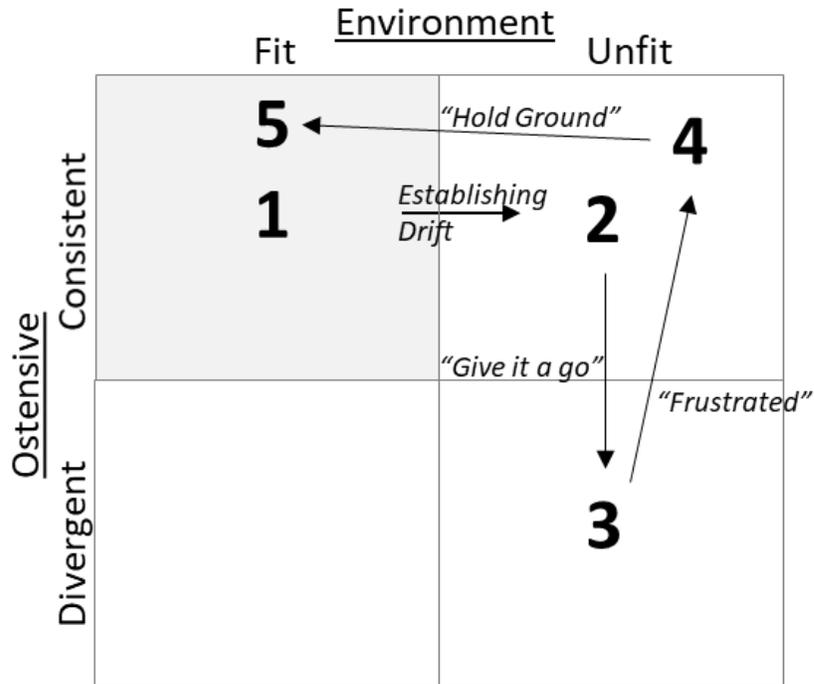


Figure 73. The "Hold Ground" dialectic path

After drift was established (E'+O), some nurses then moved to the exploration modality (E'+O') in an attempt to find new patterns that would fit this new environmental context. Some nurses failed to explore and identify new performances and reverted to the old routine (drift modality, E'+O). Once back in the drift modality, they continued to enact the old routine while they initiated a strategy of waiting out the changes and continuing to enact the old routine as overt resistance. Though they received pushback for not enacting the new espoused routine (high E'), these nurses held fast, enacting the old routine until the organizational push back diminished.

For instance, Nurse02 and Nurse04 explored using the new system but failed to use it properly and as a result, become frustrated. They reverted to the old routine despite the discouragement they received from those outside the unit (i.e. Lab Technicians and Managers).

For a period, these nurses held in a drift modality, but over time, as these nurses resisted using the system changed, the environment changed such that “not using” the system became more accepted. This resulted in an E+O stable position, but this new pattern of work was not defined in the espoused routine. We view this as the bifurcation of the routine, where one subset of nurses sees this old way as a new ostensive structure and the “correct” way to perform the routine. Since there were no repercussions or pushback, the environment changed so that dialectic tension for not performing the espoused routine was significantly diminished.

8.2.5.3 The "Pioneer" pattern

The "Pioneer" Dialectic Path

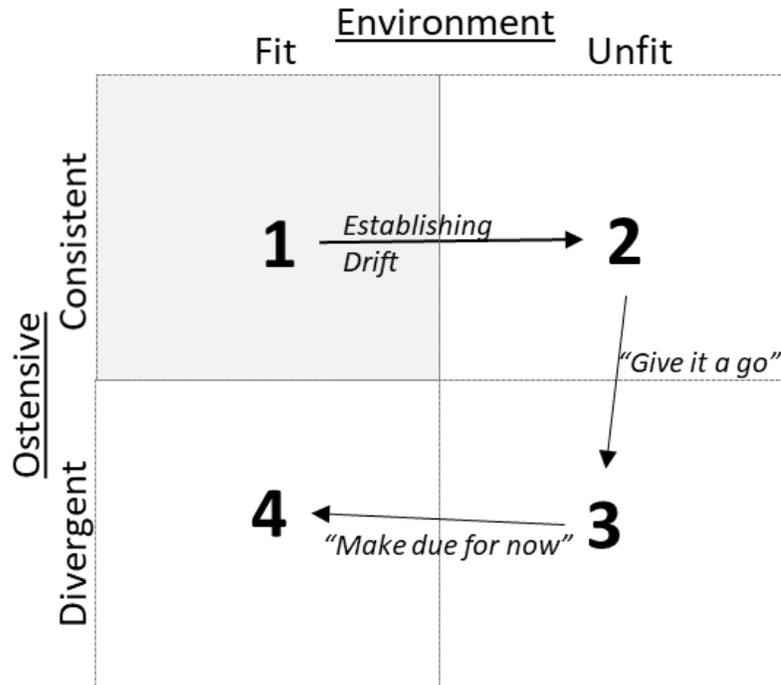


Figure 74. The "Pioneer" dialectic path.

Unlike those that “held their ground”, some nurses took an approach of “giving it a go” and trying to figure out how the system could be used in their practice. In response to the establishment of drift, this set of nurses exhibited a greater willingness to explore and as a result, moved to an exploration modality (E`+O`). In this exploration mode, they “gave it a go”, “randomly hit buttons”, and more generally demonstrated a willingness to embrace the system and try to find ways of working with it. During this phase, mistakes were made, which often meant that these nurses would have to delete or create a new order, and generally take much more time performing the routine than if they enacted the old paper

based system. This is a most unstable state and difficult to sustain, as nurses were pioneering new ways of working that were very different than previously established “old” routine. Nurses that didn’t find satisfactory new performances that fit the environment reverted back to the drift modality and performed the old paper based routine. Those nurses that did find satisfactory ways of working with the system moved to a “expansion” modality, where the performance fit the new environment, but was not yet established as “routine” and was often considered “incorrect”, but would “do for now”.

8.2.5.4 The “Follower/Wait and see” narrative

The “Follower” Dialectic Path

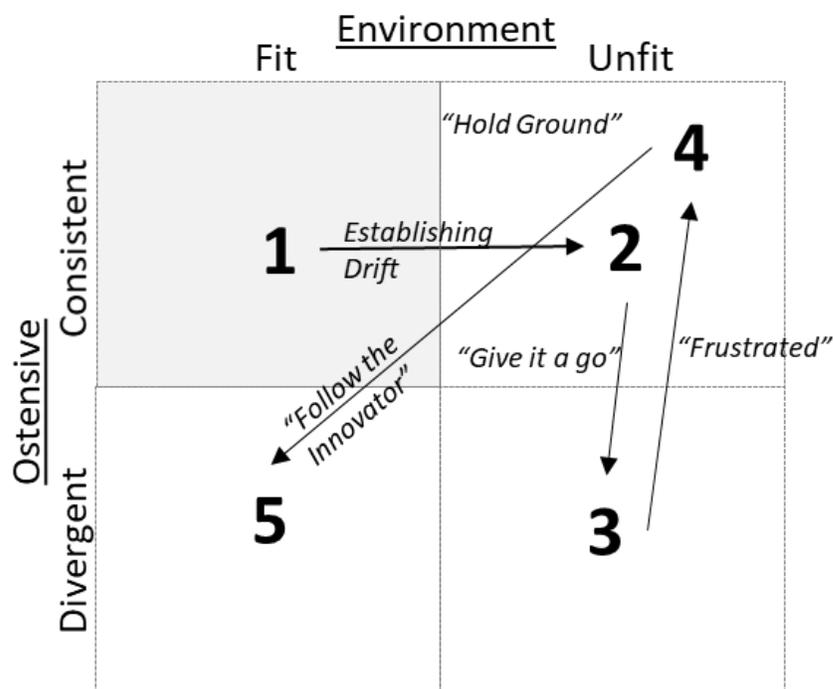


Figure 75. The "Wait and See" dialectic path.

Once drift was established, some nurses moved to the exploration modality (E`+O`), but became frustrated and moved back to the drift modality (E`+O). Over time, as other nurses learned ways of working with the system, these took advantage of this, and with peer support, jumped from drift modality (E`+O) to expansion modality (E`+O).

Like the “pioneers”, these nurses enacted performance they found as rather unstable and not yet fully established. They continued to see their performances as “incorrect”, and demonstrated a tendency to frame the correctness of these performances relative to the old routine.

8.2.5.5 *The response to anomaly dialectic narrative*

The “Anomaly” Dialectic Path

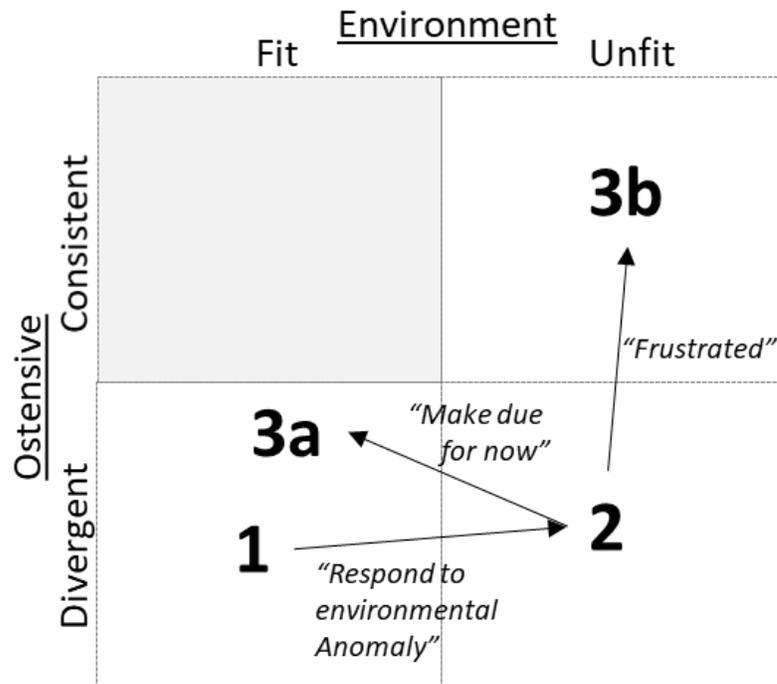


Figure 76. The "Anomaly" dialectic path.

A dialectic path characterized as the “anomaly dialectic path” was found, where the environment offers a surprise, or an unexpected, disruptive event, which results in an unanticipated misfit with the environment (High E'). This dialectic pattern was also found to combine with either the “Follower” or “Pioneer” pattern.

Within this path, a nurse starts from the expanded modality (E+O') and experiences an unexpected change within the environment. This is an exogenous change that reverts their performance to the exploratory (E'+O') modality, which either results in the nurse enacting the “frustrated” move (E'+O to E'+O') or instead taking a more positive effort to explore and find a solution, which then moves them back into the expansion modality (E+O').

One common example of this pattern occurs when a nurse is initially faced with the problem of a missing order. When a nurse encounters such an event, it disrupts the normal routine performance pattern development as the nurse, through exogenous disruption, is moved to the exploratory modality (E'+O').

Two narrative fragment examples indicate this event:

[in response to missing order] I can order blood work, but the physician doesn't have to co-sign it which **seems very wrong because I'm technically not supposed to have that authority as a nurse**. But we do it anyways, {whispered} "sometimes" {with a laugh}. (Nurse01)

I'm comfortable with logging in, scanning. I can enter orders like entering blood work and stuff. I don't like it that **I'm sometimes the one who has to do it because the doctors are not always keen on doing it, like they need a lot of encouragement or reminders to put in their own blood work**, because it beats the purpose of the system, they call it physician order entry, not nurse order entry. When they are ordering stuff throughout the day, the right CBC, whatever on their order forms, but it's not in CPOE. The clerk, it's not their job to do it, and it's not our job to do it, but we end up doing it. (Nurse09)

Within these narratives, we find two general theses:

- Ostensive Thesis – Doctors enter orders, nurses do not
- Environmental Thesis – Any significant delay in process the order will result in patient risk

As nurses begin their collection round, they anticipate enacting a performance that fits current environmental conditions but the environment introduces an unexpected result. This performance disruption results in the nurses exploring solution (exploration modality, O`+E`) – that is – a doctor has not entered an order and should have, and a necessary order is missing. This is an unstable position, with high dialectic tension. A nurse will look to either revert to the old routine (E`+O), or explore a new performance/approach and move to E+O`.

For example, we find Nurse13 reverting to the old routine:

I do trust [Indiscernible] most part there's [Indiscernible] like if no blood work shows up and it's like okay like I know like every Monday it's the full blood work, every Thursday its all blood work, other than that it's just basically blood work ...

Sometimes it will only last like when you order its only for 100 days or a certain amount of weeks so then you have to kind of remind them like did she go continue the order what you want for blood work [Indiscernible] [00:13:58] it's expired in there.

When this happens, if I'm busy I'll just plack a req and fix anything later. (Nurse13)

But, in another case, we find a nurse addressing the problem by contacting the doctor and either having them enter the order, or entering the order for them:

And then I can go to the physician because it's not a resident I'm dealing with, it's actually a doc who's, you know and I say "Hey, this is missing. Do you want to put that in? (Nurse28)

8.3 Summary

This chapter identified the dialectic content within collected nurse narratives and discovered various dialectic moves and dialectic paths being enacted by nurses during their attempt to appropriate and use the system in practice. At over three years since the

introduction of the system, no single “new” strong routine has emerged. Instead, we find pockets of performance patterns that indicate a bifurcation of the original routine.

In the following chapter (Chapter 9), we discuss our findings, and in Chapter 10 we conclude with a summary of contribution, limitations and recommendations for future research.

^{cvi} This is rarely a monetary cost, but rather manifests as negative impacts on job satisfaction, time, and other aspects of an agent’s work.

^{cviii} Of note, the nurses that took this approach tended to be those with considerable experience and seniority.

^{cix} The current CPOE system was also being reconsidered. A group of administrators were contemplating replacing the newly deployed system. This could have contributed to diminishing the will of those that were tasked with discouraging the enactment of the old routine. Despite this, we believe that this effect may have been minimal. The lab technicians were the primary group that discouraged misuse of the CPOE system. In our interview with the lab administrator, there was no indication that this discussion of replacing the system was top of mind, or even known.

^{cx} Of note, we found interaction between this move and the “hold ground move”. Over time, as such moves were enacted more frequently and the pushback/reprimand for doing so diminished, this “frustrated” move resulted in less environmental tension (E+O).

^{cxii} This is reference to Kotter’s work on organizational change. In this case, it may be the use of an overly strong image, but it’s used to characterize the dialectic pattern where nurses, for multiple reasons, feel that enacting the old routine is not “right”, and will avoid this move; instead, they will explore a solution that uses the new system.

^{cxiii} “The burning platform metaphor is perhaps one of the most pervasive in the world of business. It was coined by consultant Daryl Conner more than 20 years ago, and popularized by Professor John Kotter of Harvard. It comes from the true story of Andy Mochan, a worker on the Piper Alpha oil rig when it exploded in July 1988, killing 167 of his colleagues” (Fuda, 2012).

Chapter 9: Discussion of Findings

The aim for this thesis is to contribute to our understanding of the dynamics of organizational routine disruption and renewal in response to technology introduction.

We began our research with two objectives:

- Contribute insights into the micro-foundations of routines
- Contribute to our understanding of technology initiated change (aka Technochange (Markus, 2004))

These objectives were focused on two guiding questions:

- How do organizational routines respond to technology initiated organizational routine disruption?
- How can we understand the process through which organizational routines renew and reform after technology initiated disruption?

The purpose of this Chapter is to discuss our findings within the context of our research goals and research questions. First, we address RQ1 by reviewing our findings on how an organizational routine was disrupted by the introduction of new technology. Secondly, we address RQ2 by discussing our analysis and findings of a routine disruption and renewal event from a dialectic lens, and how dialectic paths indicate agent driven patterns of organizational routine change.

9.1 RQ1: How do organizational routines respond to technology initiated organizational routine disruption?

We divide our discussion of findings pertaining to RQ1 into three sections. First, we discuss the representation of the routine across three structures – the original, espoused and enacted. Secondly, we use these representations to discuss further the divergence found between the espoused and enacted routines and identify properties of the enacted routine in practice. Lastly, we discuss the role of dialectic tension as a motivating force for agent driven change in the enactment of the routine.

9.1.1 Contrasting the original, espoused, and enacted routine

The following table provides a summary of key findings:

<ul style="list-style-type: none">• Changes proposed in espoused routine (numbers) were minimal, despite the positioning of the project as a significant change to practice.• Enacted routine in practice was significantly more complex than the espoused routine.
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Table 10 Summary of Findings from Original, Espoused and Enacted Routine Identification

Early in our analysis, we established the structure of the original routine (Figure 38, Original blood collection routine) and the espoused routine (Figure 37, Espoused blood

collection routine). Consistent with recent routines research, we found the espoused routine was used by TOH management both as a coordinating device (to align business expectations with design and deployment efforts (Stiles et al., 2015) and as a communication artifact (to communicate anticipated changes to users existing routines (Rerup & Feldman, 2011)). The espoused routine served as a target structure that guided developers and was used to produce the expected performance structure of new and improved routines. We identify the effectiveness of achieving the espoused routine by contrasting the espoused routine with that of the identified enacted routine (Figure 39).

Our findings indicate that, despite the positioning by TOH management that the CPOE system represented a significant change in healthcare practice (see Chapter 5), the espoused changes to the original routine significantly underrepresented the complexity and variation of the enactment of the routine in practice. This finding is best illustrated in Figure 44, “Espoused versus enacted routine structure” where we see that the enacted routine is a much more complex and varied performance of the routine in localized practice than described or anticipated in the project’s guiding espoused routine.

These findings are generally consistent with contemporary routines theory, where such divergence is used as compelling evidence to support calls that we need to understand better the emergent, agent directed performance that drives routine variation and change (e.g., Gaskin (2012), Pentland et al. (2012)).

Though our focus was on agent perspectives, our data collection process revealed a number of organizational issues:

- 1) “Simplification dilemma” – Our findings indicate the enactment of the routine in practice is significantly more complex than the espoused routine that serves as a guide for the information systems investment. “Maps are not the territory”, and their usefulness lies in their portability and ease of interpretation. To accomplish this, the “real world” must be simplified by excluding detail. This results in users of the system needing to “fill in blanks” and results in the individuals enacting the routine having to expend considerable time to sort out and fill in details surrounding how the system should be used within their local practice.

- 2) “Abstraction Bias” – Nurses (agents) did not participate in the process of defining the espoused routine. The construction of the espoused routine was therefore primarily driven by those involved in the design and deployment of the project. Defining the espoused routine necessitates the segmentation of the routine into expected actions and patterns of actions. This requires trade-offs about what are the important actions to identify and patterns of actions common to localized practice. Our comparison of the espoused routine and enacted routine indicate that agents enacting the routine indicate that they place focus on different areas than those that developed the espoused routine may deem important. In practice, agents exhibited a much more complex and detailed discretization process^{cxiii}, and see their performance through a much more complex and detailed lens.

- 3) “Representational bias” – Found within each of the three doctor interviews collected (Dr1, Dr2, and Dr3) were indications that the CPOE project team did not

sufficiently consider healthcare provider feedback. For example, Dr3 – who was an active member of the initial steering committee involved in this project – stated that “[the steering committee] is ongoing, but I don't participate much anymore because our input doesn't go anywhere... even when I was on the steering committee it wasn't like they asked “how should we do this” they were instead saying “OK, here's our solution look at it a little bit and tell us where you see the problem points [this forces us into their framing, which doesn't fit ours]”.

As Nelson & Winter (1982) discuss, routines are truces, they are the result of an agreement between the agents, and groups of agents, involved in the performance of the routine as to the structure and substance of the routine. In the case of the TOH espoused routine, our findings indicate that this was not a product of a “truce” but rather developed by management as a communication vehicle to help facilitate adoption and conformity.

- 4) “The prediction problem” – If we could overcome the simplification problem and identified abstraction and representational biases, the problem of prediction remains. As has been written about extensively, technical artifacts do not determine actions (Leonardi & Jackson, 2004; Leonardi, 2013; Orlikowski & Robey, 1991; Orlikowski, 1996, 2000). Similarly, the espoused routine associated with the deployed system does not determine behaviour in practice. Agents are unpredictable in their response to the introduction of a system. Human factors

always introduce unexpected variations in behaviour and outcomes (Leonardi & Barley, 2008).

The necessity of the simplification (#1) of the espoused routine is an inherent problem in the process of developing representations of the complex work arrangements and performances seen in practice (Latour, 2005; Tsoukas & Dooley, 2011; Willcocks & Mingers, 2004). Moreover, the abstraction bias (#2) and representational bias (#3) observations we present are similar to previous findings from Brown (2015), where Brown describes instances of “purposeful representational divergence” (p. 196).^{cxiv}

We see the prediction problem (#4) as related to a general lack of theoretical understanding of underlying organizational routine change dynamics. As Abell et al. (2008) indicate, to understand the dynamics of routine disruption, we must first make strides in understanding the underlying microfoundational processes which help identify how variations in performance are produced.

9.1.2 Properties of the enacted routine in practice

The following table provides a summary of key findings:

- | |
|--|
| <ul style="list-style-type: none">• The narrative network represents the set of enacted sequences in practice; each individual selects a subset of these actions to accomplish a task given the current environmental conditions |
|--|

- Agents “chunk” complex routines into subroutines – these serve as a means to reduce cognitive loading, and as a way to help facilitate communication and sharing between agents
- Though nurses exhibited a shared knowledge of normal performance pattern, much of their narratives focused on conditions that led to changes in their performance of the routine.
- Agents exhibit tendencies, or dispositions, to enact subsets of the entire routine identified within a narrative network.
- Hindsight may reduce an agent’s perception of complexity, as agents in our study exhibited a view where their current routine was seen as more complex as an old routine.

The narrative network structure seen in Figure 42 (and related figures 43 and 44) represents the “landscape” of potential actions that a group may engage in when performing the routine. The specific performance of the routine is the result of an agent constructing a sequential subset of these potential actions to perform the routine in situ. We identified five subroutines, and of these, three were identified as part of a typical or successful performance of a routine. Within each of these subroutines, we identified differing performance patterns. Nurses indicated that they hold a view of a normal expected performance pattern for each subroutine, but their narratives typically revolved around discussing and identifying exceptional performances – or disrupted – performance patterns.

Our findings show that the disrupted routine in practice is a complex arrangement of possible performances of the routine shared among those that perform the routine. Most nurses indicated the current routine, three years after technology introduction, was more complex than the original pre-technology introduction routine.

These findings lead to three key insights. The first is that agents tended to “chunk” their work into a number of smaller subsets of activities, or subroutines, that are wholly different than indicated in the espoused routine. This approach seems to reduce cognitive loading (Chao, 2016) and is also used to serve as a method of communicating with fellow nurses about aspects of their work (Markus & Robey, 1988).

Secondly, though the narrative network of the disrupted routine represents an expanded collective behaviour exhibited in the performance of the routine, in keeping with agency theory, individuals may have a predisposition to enact only certain subsets of action patterns. Our findings indicate that nurses exhibited a reactionary pattern when selecting their performances. We found that each performance is a reaction to environmental conditions – that is – a patient is febrile, a doctor hasn’t entered an order, a new order is requested, etc., but the actual performance enacted is influenced by certain pre-dispositional patterns and tendencies exhibited within subgroups of agents. These tendencies are illustrated in our analysis of dialectic paths, where we identified three key subgroups – the “resisters”, the “pioneers”, and the “followers”.

Lastly, agents tended to look to the past (pre-disruption) routines as simpler. Three years after the introduction of a new CPOE system, many nurses continue to see their “current”

routine as not fully rebuilt or renewed. Instead, these nurses indicate that they continue to view current performances as more complex, highly unpredictable, and to some degree, not correct. Though this could be explained by an actual increase in complexity, we also find that the past (old) routine performances were possibly over simplified in hindsight narrative reflections about them.

9.1.3 Dialectic tension as a force for agent driven variation in routine performance

- Disruption of the routine was initiated as an exogenous shock, where environmental changes caused agents to seek alternative performance patterns.
- Individuals motivated their selection of which alternative actions to choose based on dialectic tensions between their performance and the ostensive aspect of the routine and the environmental context in which the actions are performed
- Agents motivated and explored new, or divergent, performance patterns based on a) past experience and the subjective assessment of what a “correct” performance of a routine is, and b) predictions of how the alternative actions will fit the environment

Table 11 Summary of Analysis of Dialectic Content Within Narratives

Our findings indicate that agent’s direct changes in the performance of routines in response to dialect tension between the ostensive aspect of the routine and the environment in which

the routine is performed. Performances with high dialectic tension were unstable, as agents motivated by this tension sought changes in routine performance patterns, or avoided duplicating this performance if possible.

Moreover, we found that technology change is an exogenous disruption to local practice and serves to raise the dialectic tension in the performance of routines. This tension initiates a sequence of agent driven changes in the performance of the routine; which we later identify as dialectic moments and paths.

Our findings show how the introduction of technology into local practice results in a significant disruption of the local environment in which the routines are performed, and that this disruption can result in a period of significantly more complex routine performance. This change in environment introduces dialectic tension that is transformed into divergences in the performance of the routine by agents, as they seek alternative performances in order to avoid increasing dialectic tension. Lack of governance fortitude (as exhibited by the diminishing instances of reprimand directed at agents enacting the old routine) to mitigate divergent performance can possibly exasperate this problem in two key ways. First, it can result in increasing the period of time that complexity and uncertainty in performance outcomes persists, and secondly, it leaves the resulting agent navigation of this complexity to be rather random and uncontrolled. In the case of TOH, we found the emergence of a bifurcated routine that is significantly more complex than both the original routine and the anticipated routine.

9.2 RQ2: How can we best describe and model the process through which organizational routines renew/reform after such disruptions?

- Agents initiated changes in their routines in response to increasing dialectic tension
- Agents performed routines in tension with two key dialectics, one with the environment and one with the ostensive aspect of the routine.
- We identified all but two of the anticipated dialectic moments or moves indicated in our model:
 - ...difficulty was in identifying a “new routine”, instead we found a bifurcated routine
- We identified one “unexpected” move, exhibited by what we characterize as the “follower” path. Here, an agent regresses from exploration, holds, and then leaps from E^+O to $E+O^+$ with the assistance of others who have pioneered new performance patterns
- Of the dialectic paths we anticipated one pattern – a progression through each modality, with brief regressions to a previous modality along the way. Instead, we found four patterns of dialectic moves, of which none were identified as having resolved to, or “reached” the establishment of a new strong routine

To understand technology change via the organizational routines lens, it is essential that we understand routine microfoundations. Utilizing Van de Ven & Poole (1995), we identified dialectic theory as a means to view the underlying process of routine change as a dialectic process. Dialectic theory offers a promising yet underutilized model for describing the source of routine change. As dialectic theory holds greater alignment with the social constructivist episteme underpinning contemporary routines theory (i.e., Feldman & Rafaeli, 2002; Feldman & Pentland, 2003; Parmigiani & Howard-Grenville, 2011; and Iannacci, 2014), the paucity of its application is surprising.

Though a small number of recent works on organizational routine change have explored dialectic theory as means to understand routine change (e.g. Bledow, Frese, Anderson, Erez, & Farr, 2009, 2013, 2016), this work is preliminary. Moreover, we find fewer applications of dialectic theory in the emerging discussion on routine change in information systems (the one paper identified was Berente et al. (2016)).^{cxv} Though we believe these initial works are not sufficiently focused on technology initiated disruption and renewal, we are encouraged by the increasing interest in applying dialectic theory to better understanding routine change dynamics. Also, works in the more general field of organizational and social change would agree, as some have concluded, that existing organizational forms – such as organizational routines – provide the thesis, while the in-situ actions taken by individual agents provides the antithesis (Astley & Van de Ven, 1983; Bhaskar, 2014; Chanin & Shapiro, 1985). Similarly, work by organizational change theorists has repurposed the concept of the Hegelian dialectic to conceive of an implicit discourse between interacting actions within an organization, and thus identify dialectics

as permeating much of everyday efforts for organizational members to accomplish work (Mason, 1996; Nielsen, 1996; Putnam, 2015):

That is, the reason for being of organizational analysis is not just to explain random heterogeneity or the inevitable, but, more importantly, to also explain the intentional and choice- related actions of individuals and organizations. (Felin & Foss, 2011, p. 241)

Our work adapts the emerging work on dialectics of organizational change to conceive of dialectic change as a generator of variation and change within organizational routines and suggests that dialectic tension is a key driver of organizational routine change (Figure 12 & 13). Moreover, by integrating dialectic change theory with current organizational routines theory, we introduced two key dimensions of a possible dialectic lens of organizational routine change: the ostensive dialectic and the environmental dialectic. We coined the term and developed the model “Dialectic Modalities of Routine Change” in reference to the four combinations of dialectic tension that can occur in the performance and enactment of a routine.

9.2.1 A processual model of technology initiated disruption and renewal

Even under the issues with simplification bias (see Section 9.1.2), and governance related divergence (Brown, 2015), there exists the problem that the enacted routine in practice introduces divergences from the espoused routine. As Orlikowski (2000) states, “users may choose to do otherwise”.

Our model supports a preliminary understanding of organizational routine change dynamics by identifying dialectic patterns of organizational change that occurred in response to a technology disruption event. Our findings indicate that agents initiated changes in their routines in response to increasing dialectic tension. Moreover, agents performed routines in tension with two key dialectics, one with the environment and one with the ostensive aspect of the routine. Though each agent possessed a somewhat unique, subjective, interpretation of both the environment and the ostensive structure (schema), each follows an identifiable pattern of moving between different dialectic positions, generating performances that move between dialectic modalities.

The presence of performance assessment dialectic tension in both pre and post subjective agent assessment was a motivating force which caused agents to reflect upon, and seek, changes to their performance of a routine. Furthermore, through identifying and analyzing incidents where agents introduced divergent performances of their routine, we found that agents often anchored in a discursive context which was framed by how they subjectively assess their performance of the routine relative to two key aspects. The first tension was related to an ostensive assessment of their performance, consistent with their understanding of what a proper and correct performance of the routine is. Individuals often “made do” by enacting performances that they would assess, in some way, as incorrect. The second tension was related to their subjective assessment of how well their performance(s) fit the organizational environmental context (including system affordances and constraints, along with organizational incentives and structure).

We identified these contextual frames as dialectic modalities, whereby agents were simultaneously assessing whether their current performance was fitting, or not fitting the environment, and consistent or divergent with their view of what is a correct performance of the routine. Each of the anticipated modalities seen in Figure 21 were identified.

Our dialectic approach suggests that the random variation introduced by the performance of a routine can be understood as a product of an underlying dialectic structure that leads to an agent's generation of divergent performance. Similar conclusions are found within explorations of innovation, where Bledow et al. (2009) state:

a dialectic perspective emphasizes that creative processes and implementation are intertwined and mutually dependent activities.... [this] will lead to different outcomes depending on the specific circumstances of an organization as ideas interact with the environment in which they are implemented and transformed (p. 312)

In our model, agents introduce changes in their performance of a routine in response to dialectic tension within a given modality. This finding has parallels with previous work on organizational identity (Kreiner, Hollensbe, Sheep, Smith, & Kataria, 2014) where identity is formed from a social construction process where agents are involved in a simultaneous dialectic process of maintaining distinctiveness (rejecting) and endurance (assimilation). In our dialectic modalities model, one dimension demonstrates the activities of agents performing work are in tension with the (local) conception of the task, while the another dimension where the activities of agents are in tension with the (local) environment in

which the routine is performed. These two interacting dialectic dimensions help to explain why past research has shown that agent performance of a routine maintains less than optimal fits with the environment in which it is being performed (Faber, 2003), and why the environment cannot fully determine behavior (Pentland & Feldman, 2005).

9.2.2 A temporal model of dialectic moves

A rather unexpected result of our temporal analysis was the complexity and variety of dialectic paths through which nurses altered and tested variations in the performance of their routines. This finding indicated that our proposed temporal model (Figure 70 & 72) is only one of possibly many possible paths (as illustrated in the dialectic paths found in Figure 73 “Hold Ground”, 74 “Pioneer”, 75 “Follower”, and 76 “Anomaly”) and may represent an ideal or limit that is not always, and possibly rarely, witnessed in practice. This is in contrast to our expected model of “marching” forward through a number of progressing dialectics, with only brief periods of regression.

This unexpected finding initially presented us with a problem – that is – if the patterns themselves were varied and undetermined, then we may have simply recreated the problem of randomness that we see as the shortcoming of the evolutionary theory. Further analysis of our data, however, revealed that agents seemed to exhibit a number of similar patterns in these dialectic moves. With further analysis, we identified four such patterns and characterized these based on our reflection of the model of a typical nurse representing these patterns (taken from our reflective notes we constructed along our analysis journey):

1. We found one dialectic path that we characterized as the “hold ground” strategy, where nurses endured a period of rather high environmental tension, with the expectation that this would diminish future tension as a result of their continued enactment of the old routine. We found evidence of this, in that continued inappropriate enactment of the old routine eventually “wore down” environmental tension and made performances acceptable;
2. A second dialectic path is what we characterized as a “pioneering” strategy, where nurses endured high ostensive and environmental dialectic tension during an exploratory phase – where they were unsure of the environmental features and were not following any ostensive structure. We found that nurses did so under the expectation of a payoff, in that they would find ways to perform the routine that would produce less dialectic tension; and
3. The last pattern indicated what we characterized as a “follower” strategy, where nurses held a position of high dialectic tension with the environment until peers explored and identified solutions and were appropriated to help “leap” into enacting routine performances that were alignment with the environment.

A fourth possible dialectic path, that we identify as the “anomaly” pattern, is one found exhibited in all three identified paths. This dialectic pattern is engaged when the agent becomes sufficiently frustrated either during the exploration of the new features of the environment or in response to some environmental change that disrupted the agent’s performance of the routine.

Through our identification of these dialectic patterns, our analysis demonstrates the usefulness and applicability of the proposed dialectic modalities lens (Figure 78, Dialectic modalities of routine disruption and renewal) by enabling us to identify the underlying expression and motivation of agents as they introduced variation in their performance of a routine.

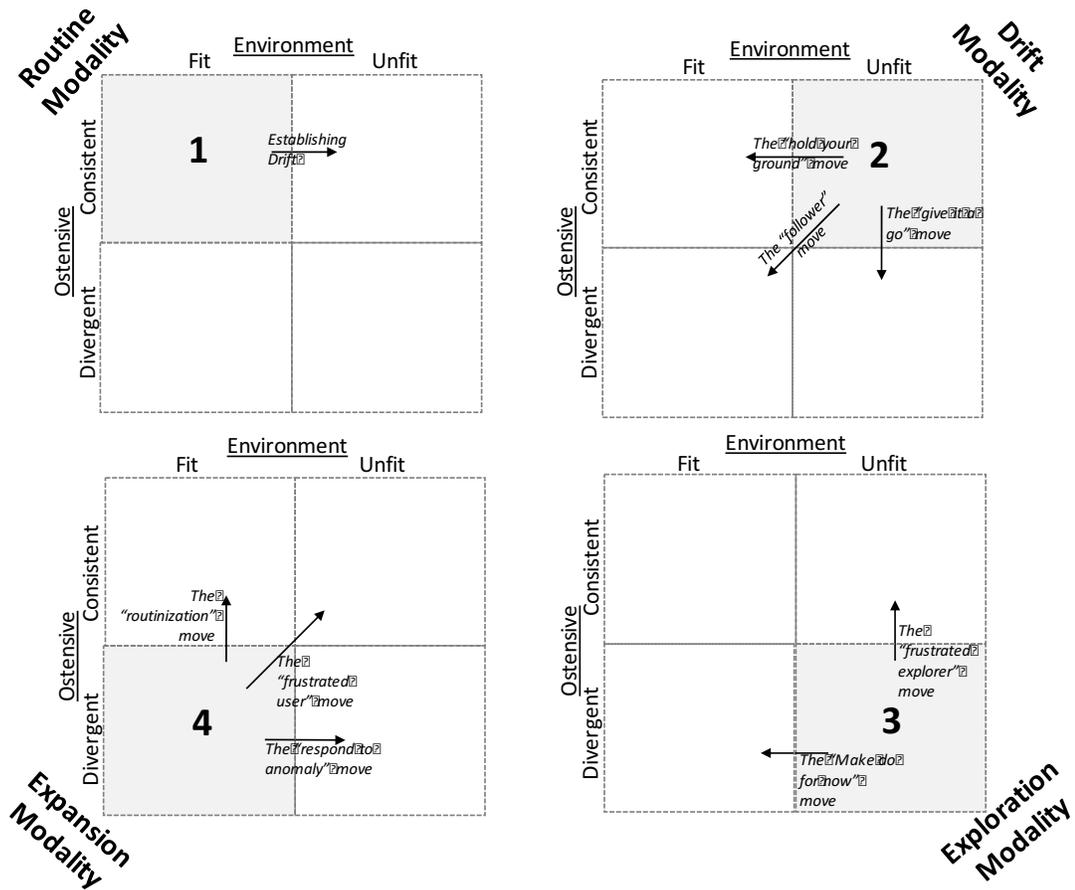


Figure 77. Dialectic modalities of routine disruption and renewal.

9.2.3 Situating the “Dialectic Modality” model with the value generation literature

The significance of our model is that we introduce a view of technology initiated change through a dialectic change “engine” that underpins technology initiated routine disruption and renewal. We demonstrated, through our identification and illustration of dialectic moves, the underlying complexity of responses to routine disruption and change initiated by managers in organizations. We situate these findings within the Soh & Markus' (1995) model to create an extended processual model of IT introduction (see Figure 78).

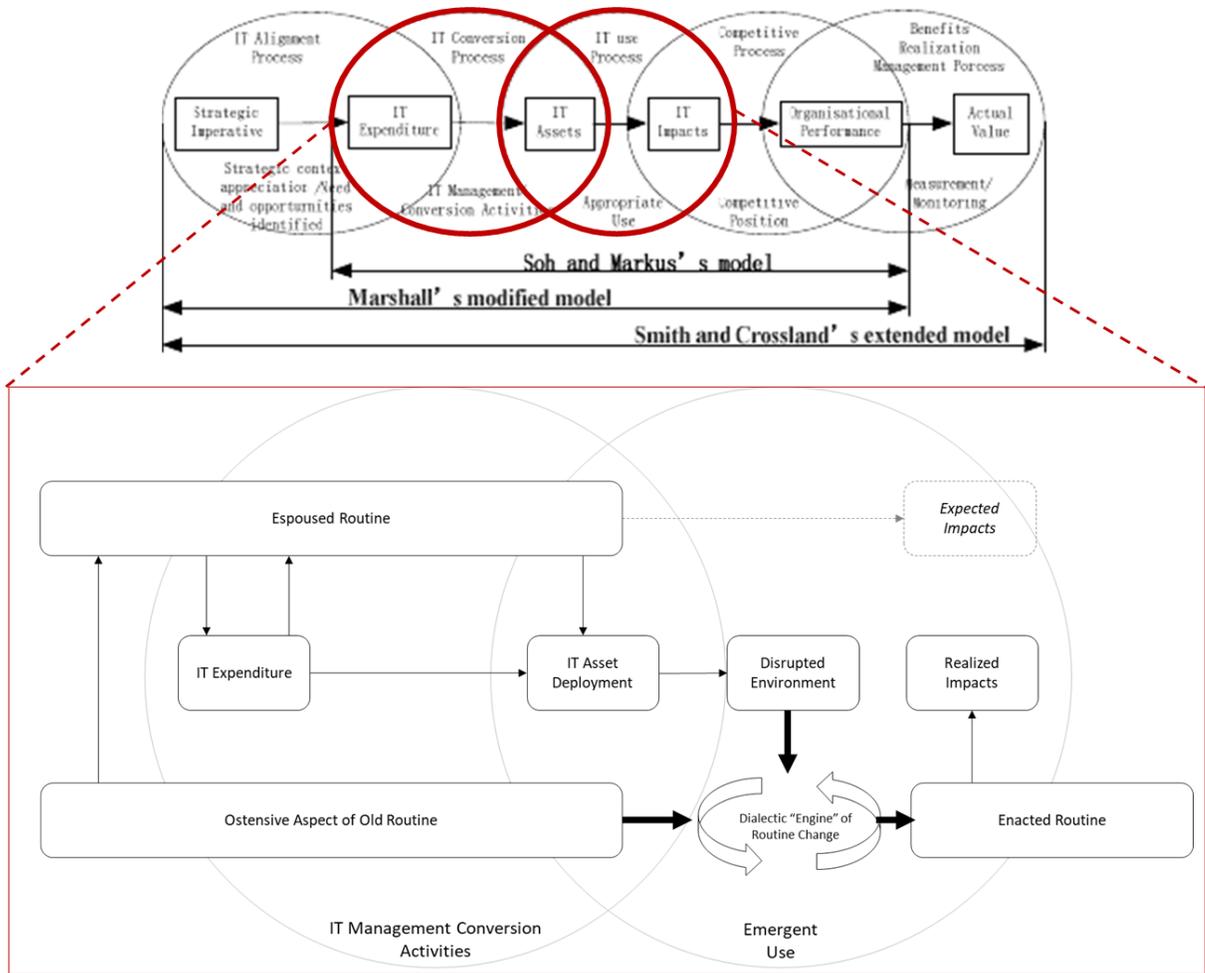


Figure 78. Extended Soh and Markus (1995) model.

This theoretic lens helps to fill in gaps in our understanding of the disconnection that is often exhibited between the IT management conversion process and the emergence of “appropriate” use that results in the formation of a value generating asset. As we illustrate in Figure 78, our extension of the Soh and Markus based processual models describes how realized impacts are a result of emergent can be analyzed using our dialectic lens of routine disruption in renewal. The dialectic lens provides insights into the process of agent

generated variation in the repairing and renewal of disrupted organizational routine post technology-disruption.

Developing such theoretic models is a worthy endeavor as they provide a valuable lens through which differing contexts can be understood (Bostrom, Gupta, & Thomas, 2009). Our response to RQ2 is, therefore, best summarized as the development of a lens to serve as a “theory for analysis and description” (Gregor, 2006, p. 619) technology initiated routine disruption and renewal, specifically through the lens of dialectic discourse as a source of variation.

9.3 Other insights

As part of our efforts address the research questions, we identified a number of related insights.

9.3.1 Grounded coding versus narrative coding

Grounded coding attempts to decompose texts into independent codes, or tags, for items of interest. A subtle, possibly under-discussed in literature, result of taking a grounded approach to coding is that this approach may inadvertently strip away information from higher level structures which cannot later be identified through aggregation or reassembly process from these fragments.

Our original analytical approach for our dialectic content analysis was to take this former approach – decompose narratives into coded narrative fragments which in turn could be organized to identify dialectic transition sequences that resulted in motivating nurse directed routine change. In practice, we found that such an approach resulted in removing valuable information from the narrative structure, a structure that could only be identified by a holistic reading of the corpus. To address this issue, we adjusted our technique to review a nurse’s account in its entirety. This finding is consistent with recommendations by Riessman (2008), who also claimed this problem:

Narrative study relies on (and sometimes has to excavate) extended accounts that are preserved and treated analytically as units, rather than fragmented into thematic categories as is customary in other forms of qualitative analysis, such as grounded theory. This difference ...is perhaps the most fundamental distinction: in many category-centered methods of analysis, long accounts are distilled into coding units by taking bits and pieces— snippets of an account often edited out of context. While useful for making general statements across many subjects, category-centered approaches eliminate the sequential and structural features that are hallmarks of narrative. (pp. 11–12)

By contrast, a more decompositional “grounded” approach worked very well in helping to identify the narrative networks of performances and variations in the performances. However, when we attempted to understand the higher phenomena of dialectic tension and change, such an approach revealed itself as being too limiting. Though the application of

narrative analysis approaches as documented by Riessman,(2008) may be rather new to IS research, we recommend that future IS researcher consider using this approach when looking to identify change patterns in disrupted routines.

9.3.2 Ostensive dialectic tension: A constant source of variation?

Our data indicates that although nurses consider the old paper requisition a strongly established “routine” even three years after the introduction of a new CPOE system, nurses see their “current” routine as not fully rebuilt or renewed. Instead, nurses indicate they continue to view current performances as more complex, highly unpredictable, and not correct - thus indicating tension with their ostensive structure of the routine. We also found a number of “camps” in which the enacted patterns are somewhat unique from other subgroups (see Figures 73 thru 76). Considering this, we are compelled to wonder if routines are considered by agents as strong and stable only after they have been seemingly replaced, and that a current routine is held in constant dialectic tension. With only one case examined, we cannot claim that this is the general case, but if it were, it would open up new ways to explain routines as “generative”

9.3.3 Governance processes that do not address disruption can result in a routine that leaves the organization worse off

Governance processes that are deficient in performance monitoring and control can result in producing a more complex and varied routine in practice than was anticipated by management. This conclusion is evidenced by our identification of an enacted routine in

practice that encompassed many more activities and variations than was describe by management in the espoused routine. This evidence further suggests that post development governance processes may play a key role in generating value from technology investment. Such governance processes must identify and respond to a significant divergence in the performance of a routine, but also avoid quelling the natural exploration process that is necessary for agents to form localized usage patterns that serve as the basis of a new routine performance. We found that, despite significant training, agents still required a period of exploration that naturally introduces significant disruption in the performance of organizational routines. Practice requires practice; it can't be taught. Therefore, we must understand governance as a herding force that effectively “nudges” the development of new localized routines required for a localize practice to be re-established. These findings indicate that the re-establishment of a routine in localized practice is not a random process, but none-the-less, is one that must be cultivated by management through effective performance monitoring and control.

9.4 Summary

In this chapter, we have discussed our research questions and specifically, how our study provides valuables insights and answers to them. We believe that technology introduction can result in significant disruption in routines, beyond what is what is often anticipated by management. We also see dialectic tension as a source of organizational routine disruption and change, and the introduction of technology as an exogenous event that initiates a chain of dialectic moments. We suggest that this research provides both a theoretical and

practical contribution to the fields of technology adoption, IT use, IT value generation, and organizational routines. Our exploratory study indicates that a dialectic model or routine change is appropriate, theoretically sound, and explains well the specific outcomes of our case. We believe that this dialectic model is versatile enough to be applied in other technology introduction settings, both in healthcare, and in other industries.

^{cxiii} In mathematics, discretization concerns the process of transferring continuous functions, models, and equations into discrete counterparts. Our use of the term refers to the agent's transformation of a continuous stream activity into discrete actions.

^{cxiv} In Allen Brown's (2015) findings, this divergence is the result of representational bias of the target routine due to internal governance and design processes – which we see most closely aligned with what we identify as the “Abstraction Bias”. The representational bias we identify is driven by the need for stakeholders to downplay the significance of changes, as by most accounts from nurses and doctors, the initial introduction of the system was a politically charged and sensitive matter.

^{cxv} One interesting recent paths by Jessica Luo Carlo, Kalle Lyttinen and Richard Boland (Carlo et al., 2012) that seems to be motivated by collaborate work focuses on dialectics of mindfulness – but the literature proceeding this initial intriguing work has progressively focused more on the mindfulness aspect of the discussion (as evidenced by the authors citation analysis of the citations for this paper.)

Chapter 10: Conclusion

In this chapter, we conclude our research contribution by identifying the theoretical contributions to two key fields; IT usage and technology initiated change, and organizational routines. Moreover, we discuss our contributions to practice, which include identifying the importance of performance monitoring and control processes, and the potential pitfalls of a slow, incremental, deployment strategy. We close this chapter by elaborating limitations and detail opportunities for future research.

10.1 Theoretical Contributions

Seminal works on appropriation (i.e., DeSanctis & Poole, 1994) and enactment (i.e., Orlikowski, 1996) have shown that agents make continuous adjustments and improvisations as they develop usage patterns in response to a newly deployed system. During this process of work practice alteration in response to new information systems introduction, users actively engage in decision-making about how new technologies are applied in practice, and through repetition, collectively establish the organizational routines required for individual agents to conduct work (Zollo & Winter, 2002). Our goal is to identify an underlying dialectic structure that motivates these variations in performance.

Our approach can be argued as interpretative. By contrast, the post-positivist ontological position is that a single objective reality exists. Our view is grounded in the belief that

individuals experience and interpret their reality in unique ways. As we approached our analysis and the findings presented in this chapter, we have taken the position that each individual nurse's experiences are a subjective evaluation of their world, past events, and performances. Our goal is not to identify a single "world", but instead, to focus on the dialectic processes through which individuals motivate their organizational routine performances.^{cxvi}

10.1.1 IT Usage and technology initiated change

To obtain a greater understanding of continued and deeper use of IS, it is critical to understand the evolving nature of individuals' IS use (Kim & Malhotra, 2005). Understanding change in use, that is, how individuals revise their use of the IS features, is paramount in advancing the post-adoption agenda (Sun, 2012). As Orlikowski (2000) articulated, "recognizing that the possibility to change technology structures is inherent in every use of technology allows us to understand when, where, how and why people choose to reinforce, ignore, enhance, undermine, change, work around or replace their existing structures of technology use. (Tennant, 2014, p. 24)

Information systems literature has continued to expand and refine the concept of IT usage and adoption, and the issues surrounding it. As the conception of IT usage has progressed from early measures of usage frequency and duration to richer conceptions of adoption and appropriation, the literature has developed to understand emergent use from a processual

perspective better. Our model provides a new theoretical lens to understand usage as a dialectic process where agent behaviour is under constant dialectic tension with the technology and the structure of how they see their work being performed.

As we have seen illustrated in the TOH case, organizations justify technology investment with the expectation of achieving some target outcome of behaviour. What is most desirable for the organizational deployment of technology is for groups within an organization to develop patterns of usage that embrace technology (Burton-Jones & Gallivan, 2007), but in ways that generate value for the organization. Our contribution demonstrates how usage requires agents to seek balance between consistency and meaning against the demands of environmental contingencies and the requirement for novelty. Our view contributes to the process perspective of IT usage (Burton-Jones et al., 2014, p. 4) by modifying the Soh and Markus model (Figure 1) to extend the conception of realized impacts of technology to view realized impacts as an output from a dialectic engine of routine change. Moreover, we describe how this change engine is driven by dialectics between agent performance of the routine and both the disrupted environment and the ostensive aspect of the old routine (See Figure 78)..

10.1.2 Organizational routines

We provide three contributions to the research on organizational routines: First, we introduce a new understanding of the microfoundations of organizational routines as a dialectic process. Secondly, we develop a new technique utilizing narrative networks to analyze agent narrative accounts of system usage, and thirdly we introduce a dialectic

notation to assist future analyses of organizational routines using a dialectic lens. We elaborate each of these contributions in the following three subsections.

10.1.2.1 Microfoundations of organizational routines

Organizational routines theory asserts that every individual performance is an occasion to introduce variation (Feldman et al., 2016; Feldman, 2000). From an evolutionary theoretical perspective, this variation serves as the underlying engine of change (Van de Ven & Poole, 1995) as a “change motor” (p. 527), with each variation selected for future repeated performance, or not:

In our evolutionary theory, these routines play the role that genes play in biological evolutionary theory. They are a persistent feature of the organism and determine its possible behavior (though actual behavior is also determined by the environment); they are heritable in the sense that tomorrow’s organisms generated from today’s (for example, building a new plant) have many of the same characteristics, and are selectable in the sense that organisms with certain routines may do better than others, and, if so, their relative importance in the population (industry) is augmented over time. (Nelson and Winter 1982, p. 14)

The dominant evolutionary view of organizational routine change leaves gaps in the understanding of the micro-processual structure through which routine variation emerges. Researchers have called for further investigation into the underlying microfoundational

process which underpins organizational routine change and renewal (Felin et al., 2012; Felin & Foss, 2011, 2012; Foss et al., 2012; Foss, 2010; Rerup & Feldman, 2011).

Drawing on the seminal work on organizational change by Van de Ven & Poole (1995), in Chapter 3, we proposed a dialectic change “motor” as an alternative change engine to the evolutionary view of change. We then described how dialectics might play an important role in further developing our understanding of the underlying dynamic process which produces variation and change in organizational routines. Dialectic views of change “...addresses how human social order is premised on tensions and contradictions that underlie apparent cohesion and that point to potential social change and transformation” (Mumby, 2005, p. 22). A key contribution of this dialectic view is that it brings agents to the center of routine change. Through our proposed dialectic modalities lens, we investigate the dynamics of organizational routine change not based on random variation but rather as agent-directed variation motivated by dialectic tension.

Our work responds to calls within the routines theory literature (i.e. Felin et al., 2012; Felin & Foss, 2011, 2012; Foss et al., 2012; Foss, 2010; Rerup & Feldman, 2011) to explore and identify the underlying micro-foundations of organizational routine change. We introduce new theoretical insights to describe IT introduction as an exogenous event that adds energy to an agent-driven process of organizational routine change. Our dialectical model identifies this introduction as an exogenous event that generates dialectic tension, which in turn motivates a cycle of agent-initiated change in the performance of the routine. Furthermore, our findings indicate that any single instance of IT usage may be tenuous and

fleeting, and under constant revision, as agents continue to introduce variations in performance in response to changing dialectic tension.

Recent work by Laumer, Maier, Eckhardt, & Weitzel (2016) introduced the concept of the established routine as an “object of resistance”. Their work is compelling, and our findings confirm that agents can continue to utilize an “old” routine as a referent for new behaviour. But we see statements like this as propagating a view that organizational routines are atomic objects, and thus questions concerning how routine properties come to exist are left out of consideration in many organizational routine studies. Our research answers fall within the routines literature to explore routine micro-foundations, and our dialectic model introduces a novel analytic lens to explore new avenues of investigation as to the underlying microfoundation of routines.

10.1.2.2 Narrative Networks

The application of narrative networks to investigating technology introduction remains a rather novel approach. Though we find increasing use of network approaches within literature, existing works have primarily focused on collecting and analyzing field observational data (Chao, 2016; Yeow & Faraj, 2011) or more general ethnographic approaches (Danner-Schröder & Geiger, 2016). Such field observations and ethnographic approaches make it difficult to apply the narrative network approach in sensitive research settings, such as the one we found in The Ottawa Hospital setting. Without an alternative data collection technique, the breadth of research settings that can be analyzed using this valuable technique is limited.

Our contribution to applied narrative network analysis was to introduce a technique of collecting narratives from user experiences to identify the routine structure. The technique is arguably more consistent with original work on narrative networks which utilized written accounts of life stories (Bearman & Stovel, 2000), literary works (Bremond & Cancalon, 1980), and conversation (Schnitman, 1996). We collected individual narrative accounts of user experiences resulting from a significant information system introduction and change event, and applied in vivo coding technique to identify actions and patterns of actions expressed in agent narratives as they discussed their work and experiences. The temporality of such narrative accounts also allows us to identify key transitional events within the performance of a routine. We believe our approach of using narrative interviewing as a source of data to identify a narrative network provided us with a richer dataset than if we were to ask users “what they did” more directly, or observed only a brief set of performances in the field.

10.1.2.3 Dialectic Notation

The other significant contribution of our research was the introduction of an organizational routine notation. To assist in our capacity to analyze aspects of an organizational routine, we needed to develop a way to organize our findings relative to the organizational routine theoretical model (see Figure 6). Despite the well-established understating of routines as a tripartite view of structure (ostensive), performance, and material, we found no analytical notation to represent the alignments between these aspects of a routine. We adapted and extended recent work in this area by Berente et al. (2016) to develop our E+O notation,

which provided a powerful means of organizing our analysis of the interacting aspects of a routine (see Table 8).

10.2 Contributions to Practice

Practitioners can benefit from the findings of this thesis in three key ways. First, the development of the espoused routine can introduce bias in expectations, and the accuracy of the espoused routine must be tested by ensuring that it is sufficiently documented and reviewed for input by those enacting the routine in practice. We suggest that by using a narrative network approach, practitioners can more clearly identify key structures in the existing routines from the agent's perspective, which can further serve as an artifact to guide facilitated discussion with users and create more fruitful dialogue.

Secondly, though the introduction of technology is often seen as a major source of change that moves agents to more efficiently conduct their work, slow migration can result in the emergence of a more complex hybrid of both new and old routines. These findings indicate that practitioners would be wise to avoid introducing systems that support only portions of the existing routine, as each progressive system change will result in initiating multiple independent disruption and renewal cycles across individual localized practices. Generating such a situation would further exasperate the predictability problem identified in chapter 2, as each progressive update will result in generating new variations in routine performance that fit only transitory system features yet linger and manifest in a new

emergent process. This can result in producing less predictable outcomes, and a more complex, and possibly less efficient, routine in practice.

Finally, our data indicates that the performance of routines in practice cannot just be left to emerge without sufficient monitoring and intervention. Lackadaisical organizational governance can result in producing more complex routines and unexpected bifurcations. This can lead to “failure to achieve expected outcomes” and could embed new and potentially destructive and debilitating behaviours into organizational memory making it more difficult to carry out future technology-driven interventions in the future.

10.3 Limitations

Three limitations of this study need to be addressed in future investigations.

First is the issue of single-case inductive studies (Eisenhardt, 1989; Yin, 2013). Though there are recognized issues with empirical generalization from such work, we also are encouraged by the number of significant works within the organizational literature that build off a single case to focus on theoretical generalization (e.g., M. Feldman (2000), Weick (1993), and Gersick & Hackman (1990)). We believe we have taken reasonable steps to address issues of theoretical generalization by documenting and remaining true to the tactics that we outlined in Section 4.6. We see empirical generalization as a goal for follow-up research (see limits of generalizability in theory development Whetten (1989)).

The second issue concerns the “theater” of the interview process. A key source of data for our analysis was that collected narratives provided through nurse reflections; these narratives can be influenced by any objectives that participants may have regarding the outcomes. For instance, there were a number of nurses interviewed early in the data collection process who exhibited a strong tendency to move the conversation back to their judgments and problems, and recommendations for system fixes. With this apparent goal in mind, these nurses provided information (the selection of stories, the embellishments, the details) they felt would most benefit their goals, and likely altered their narratives to “send a message” to management. To address this specific issue, we altered the introduction of the interviewing process to clearly articulate that the study was not for management purposes, nor presented to management as recommendations, and their honest accounts would help us understand future introductions of health technology at other institutions. After this change, this issue became less noticeable in later interviews.

Finally, it’s important to note inherent limitations in our use of post reflective accounts as expressed in collected narratives.

Glick, et al. (2000) identify and compare four main data collection methods used when investigating organizational change; 1) direct observation, 2) compiled records by organizational members, 3) panel designs, and 4) retrospective accounts. Though direct observation can provide an accurate account of a change event it requires the observer must be present when a critical change event occurs, and thus, important change events can be missed. The second approach, compiled records by individuals as they experience the change event, requires the individual participants to allocate significant time to log their

experiences frequently. The third approach, panel design, is like “time-lapsed photography” (Glick et al., p. 302) where change processes can be inferred by analyzing differences across a series of snapshots. Though panel designs can be quite effective, if the duration between snapshots is long relative to the speed of the change processes, key data can be missed. Increasing the frequency of the snapshots can alleviate this problem, but the execution of this approach can quickly become cost and time prohibitive. Finally, retrospective reports from those experiencing the change can be an effective means of collecting change event data, but may suffer the problem of individual perspective. Individuals providing the reports can have a limited, and situational view, and thus present a perspective that may not be shared by the larger organization.

Though the retrospective account was most suited for our particulate research context, we must admit that such approaches capture individual bias.

10.4 Future Research

We recommend six areas for further research.

First, we have concern that the “ostensive” aspect of the routine is being stretched too far and diverges somewhat from the routines literature. We recommend that future research more clearly identify a distinction between routine schema and the ostensive aspect of the routine.^{cxvii} Similarly, introducing a conception of environmental schema would help firm up current views on the material aspect of routines found within current routines theory.

Secondly, though we have presented a unique contribution to both IS research and routines theory, the techniques and dialectic lens we have presented will need to be tested across various empirical contexts. We have taken precautions surrounding claims of external validity and therefore call for further replication of this approach and analysis in differing empirical contexts. We propose two general targets: the first is to vary the organizational context but remain in the healthcare setting, choosing a different hospital and user group. The second is to explore the effects of introducing an enterprise system in a large organizational setting, further broadening our understanding of technology initiated routine disruption and renewal in more general settings.

Thirdly, we recommend using our proposed narrative network approach to assist the development of simulation studies. Our narrative network approach could be used to complement existing techniques surrounding data collection to help refine model assumptions that guide simulation model development. This approach could also be used to help increase the relevance of the model to participants in the process, and thus assist in increasing engagement and impact on simulation results on the users of technology in practice.

Fourthly, our dialectic model conceives of the exogenous influence on routine formation as stemming from environmental triggers. Davidson & Chismar (2007) argue that technology initiated change is triggered by institutional and technology-driven change processes. We recommend that future research explore the environment as consisting of these two interacting aspects – that of institutional triggers and technology triggers. Such

an approach would help advance the usefulness of the dialectic modalities model to assist IT project governance in practice.

Fifthly, the effects of technology use mediation (TUM) resources on dialectic tension may represent a particularly fruitful direction for the future theoretical development of the dialectics model. Davidson and Chiasson (2007) note that normative pressures within professional groups, such as found within healthcare practice, may create the need to exert extra effort in the use of technology use mediation to assist in the transition from old processes to the establishment of new patterns of work. David and Chiasson's findings could indicate that the use of mediation resources, such as the use of nurse trainers, though effective, may require long-term use that exceeds that of a typical technology deployment project. We see a particularly interesting area to understand is the effect TUM's may have on dialectic tension - and the role TUM's may play in reducing user-driven divergence from espoused routines.

Lastly, we'd recommend further exploration of the issue of bias in the espoused routines development process. Issues of "who gets a say" in developing such representations, what simplifications are necessary, and how differing roles introduce bias can help open new avenues of research into technology design and governance.

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Appendices

A. Email/Letter to Nurse Supervisors

Hello Mr./Ms. (supervisor name)

My name is Tim Smith, and under ethics approval <<>> under the sponsorship of <<TOH project/research sponsor>> I am conducting interviews with your nursing staff to support my PhD research in health information technology usage and organizational disruption. With your permission and support, I would like to schedule a number of one-on-one interviews with your nursing staff.

Candidates for this interview are nurses that have worked prior to, and since, the introduction of new CPOE/Bridge systems and with significant experience during this time with the specimen collection process. Each semi-structured interview is expected to last approximately 30 minutes, and no longer than 35 minutes. The interview will be semi-structured format, and will consist of number of open-ended questions regarding the nurse's experience with the introduction of the new system into their daily practice. Interviews will include nurses recounting previous collection routine processes, through to initial introduction to CPOE/Bridge project, through training, and through to finally using the system in practice.

In addition to the information gathered to complete my PhD thesis, the Ottawa Hospital will be provided with an analysis report on areas of success and potential improvement

with future system deployment projects. This information will help improve your experience with future technology deployments.

To accommodate the busy schedule of your nurses, I will block off a number of potential interview times, varying across early morning, afternoon, and evening timespans. Please let me know which blocks of time works best for your nurses, and I will follow up with you to help identify individual participants from your group.

Thank you very much for your support

Tim Smith, PhD candidate
Sprott School of Business, Carleton University
613-447-0960
Tim.Smith@carleton.ca

B. Introduction for Interview Participants

Realizing Technology Impact: A dialectical theory of technology initiated routine disruption and renewal

This research is being conducted by researchers from the Sprott School of Business, Carleton University, Ottawa, Canada as part of a PhD Thesis report

Principle researchers are:

Tim Smith	PhD Candidate, Sprott School of Business
Dr. Gerald Grant	Associate Professor, Sprott School of Business

In this research, we seek to understand how established healthcare routines are disrupted and renewed in response to a significant information technology introduction. By understanding the generalized process through which individual users respond to the disruption of established routines, and in what ways their actions are required to re-establish renewed routines, we hope to learn how to better deploy similar technology in the future. This research is expected to have a positive impact on how hospitals plan, and manage future introductions of new technology into medical practice, and more specifically, provide a better understanding about how nurse practice is affected.

Your participation in this study would involve a face-to-face interview that will take approximately 30 of your time, and will be scheduled at your convenience and with your supervisor's support. The purpose of this interview is not to identify any specific personal

information, nor is it to report your specific complaints, criticisms, praise, or any other judgment of the recent deployment of technology into your work (the Bridge system). The purpose is to identify general group experiences in how technology has disruptive existing routines, and how such disruptions have been addressed by those regularly using the system.

While there are no anticipated emotional or psychological risks associated with your participation in this interview, **the interview questions will require you to reflect deeply on the nature your work and discuss examples of when you were frustrated with the process of introduction of the new technology, uncomfortable with its use, or when you had to take actions to improve the process.** The potential for any social or economic exposure associated with your answers is taken seriously and is mitigated by ensuring the anonymity of your participation and responses. I would like to make it clear that, if you agree to participate, you will not be obligated to answer any question with which you are uncomfortable. Furthermore, you are entirely free to stop the interview at any time and may drop out of the study at any time, before **(DATE)**, without question.

We will maintain the anonymity of your responses by assigning you an identification number that is linked to your name and contact information only on a master list accessible solely to the principal researcher. This list will be destroyed once the findings have been analyzed and reported. **Your answers will not be shared with anyone in your organization.** With your permission, we would like to digitally record the audio of the interview in order to accurately capture your ideas. The start of and end of the recording for the interview will be clearly indicated. Your name will not be mentioned on the

recording, nor will any identifying information other than your ID number be associated with the recording. Any audio recordings of the interview will be destroyed once all of the reports from the present study are completed.

Furthermore, your name and personal information will not be divulged in any report of the findings of this study. Results will only be reported in the aggregate so that no individual's responses can be linked to the individual. Any quotes from your interview that are used in reports will be cited in such a way as to maintain your anonymity. This project has been reviewed and received ethics clearance through the Carleton University Research Ethics Committee and The Ottawa Hospital Ethics board. If you have any comments or concerns regarding the ethical administration of this study, please address them to the chair of the Carleton University Ethics Board:

Chair
Carleton University Research Ethics Committee
Tel: 613-520-2517
E-mail: ethics@carleton.ca

Chair
Ottawa Hospital Research Ethics Board
Phone: 613-798-5555, extension 1490

Thank you for your time. We look forward to your participation.

Sincerely,

Tim Smith

C. Field Protocol

Before Entering Research Site

- Send introductory email (Appendix A), to nurse supervisors and follow up through email to confirm interview dates, times and location. Provide research overview as part of the email.
- Make contact with each nurse supervisor prior to arriving at agreed time to re-confirm time and location. Ensure that the interview candidates are still available to meet during the allocated time.
- Arrive 15 minutes early to prepare informed consent forms, interview protocols, recording device and ensure that the meeting room is appropriate.
- Prepare list of participant codes and associated preliminary information sheets.

During Interview Period

- Researcher introduction, confirm that participant is comfortable, confirm that the participant is available for a 30-45 minute session.
- Sign and date duplicate copies of the Informed Consent form.
- Provide introductory script (overview of the background of the researcher and the project, an outline of how the researchers were sponsored by TOH and provide assurance that all responses will remain private and confidential).
- Confirm that the candidate is ok with being recorded, allow for any questions.

- Highlight that researcher will be taking notes during the session.
- During interview, allow time for interviewee to respond, do not lead the discussion, but rather facilitate (i.e. no leading questions).
- Allow time at the end for any additional discussion (leave recorder on).
- Thank participant. Reconfirm steps taken to ensure anonymity and ask about the potential of a follow-up discussion if needed.
- Ensure all documentation and recording information is securely stored for transport prior to leaving the interview location.

After Interview Period

- Move audio file to personal laptop. Store securely.
- Write up Field Notes within 24 hours – store securely.
- Schedule any follow up meetings, or follow up on any leads from interview.
- Send for transcription.

D. Interview Protocol – Preliminary

Group: Nurses

Template Version: DRAFT

Part 1: Interview and Participant Tombstone Information

Interview Date and Time	
Interview Location	
Participant ID code	
Confirm participant has significant experience with the routine both prior to, and since the introduction of CPOE	

Part 2: Introduction Checklist

Completion of Introduction Script	
Provide Participant Information Form	
Complete Participant Information Consent Form	
Verification Recording Device is on	
State the Participant ID, date, and time (for recording)	

Part 3: Guiding Questions

General questions...	Guidance to interviewer...	Look for...
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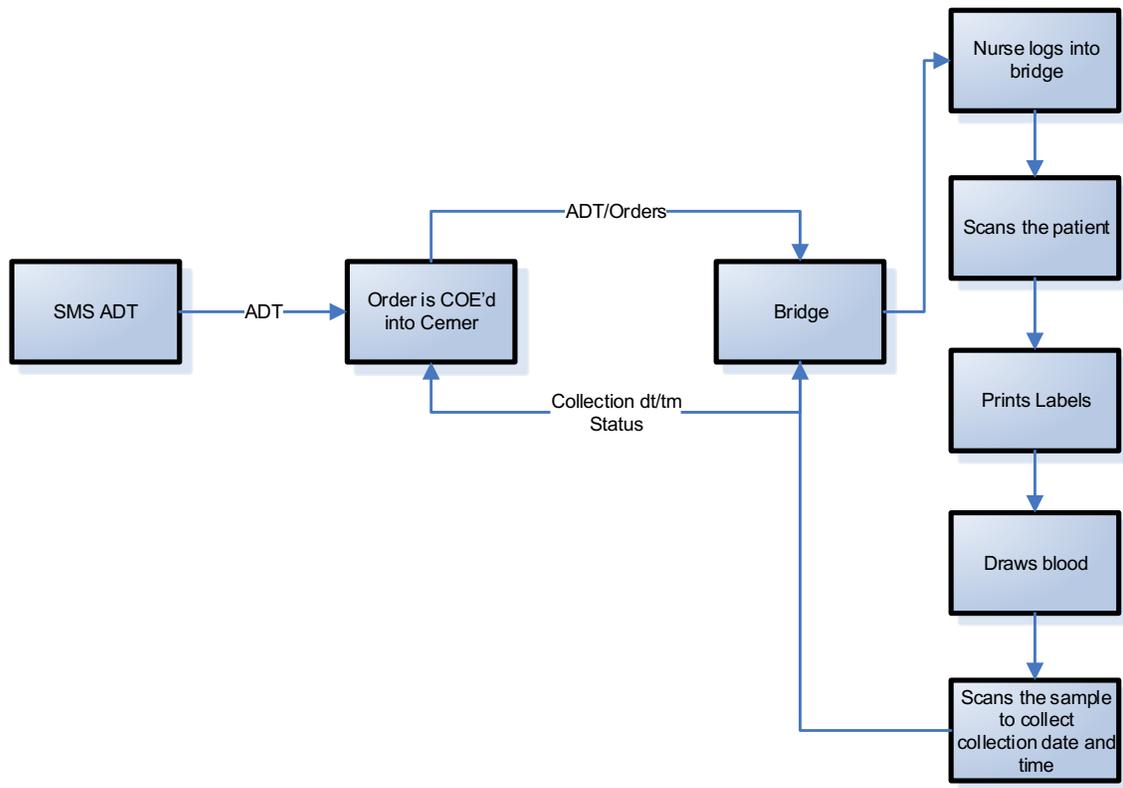
<p>Initiate and prime interview by asking participant to tell the story about their experience with the specimen collection routine prior to the recent system introduction.</p>	<p>Situate the users thinking within the frame of the specific routine under investigation.</p>	<p>Indication of experience, what role the routine plays in their daily work, and how they perceive this work.</p>
<p>Ask participant to tell the story about how they were introduced to the system, how their experience has been through this introduction.</p>	<p>Encourage user to prime their thoughts, experiences and relationship with the system.</p>	<p>General indications of their experience in the role, organization, and with the system.</p>
<p>Prompt the participant to describe an incident when he/she began to use the CPOE system in new way. Be sure to encourage both good incidents and incidents he/she felt/feel were a mistake/error.</p>	<p>While listening to him/her describe incidents, be sure to prompt for factors that cause him/her to use the system in this new way. What affordances make this easy, what constraints make this more effortful.</p>	<p>Triggers and factors enabling/affording this variation</p>
	<p>While listening to him/her describe incidents, be sure to prompt for evaluative factors that resulted in accepting or rejecting the new variation as good or bad.</p>	<p>Triggers and factors constraining/inhibiting this variation from happening</p>
	<p>While listening to him/her describe incidents, be sure to prompt for evaluative factors that resulted in accepting or rejecting the new variation as good or bad.</p>	<p>Factors that influence any positive evaluation</p>
	<p>While listening to him/her describe incidents, be sure to prompt for evaluative factors that resulted in accepting or rejecting the new variation as good or bad.</p>	<p>Factors that influence any negative evaluation.</p>

	Ask participant is they still do things this way/or continue to make similar mistakes. Prompt user to identify factors for this variations continued execution/usage.	Factors of continued support/inhibition for this variation.
Prompt participant to describe an incident when he/she wanted to use the system in a particular way but did not.	While listening to him/her describe incidents, be sure to prompt for factors that cause him/her to CONSIDER using the system in this new way.	Factors enabling/affording this consideration
		Factors keeping this variation from happening
	While listing to him/her describe incidents, be sure to prompt for evaluative factors that underpinned him/her CONSIDERING or rejecting the new variation as good or bad.	Factors that influence any positive evaluation
		Factors that influence any negative evaluation.
Prompt user to reflect on how this system has affected his/her work, and what role they and their peers, have played in the filling in of details surrounding the use of the system for their particular needs.	While listening to him/her, but sure to prompt for observations on changing attitudes, work practice, roles, org. structure, incentives, etc.	Factors of continued support/inhibition for this consideration.

Part 4: Conclusions and Thank You

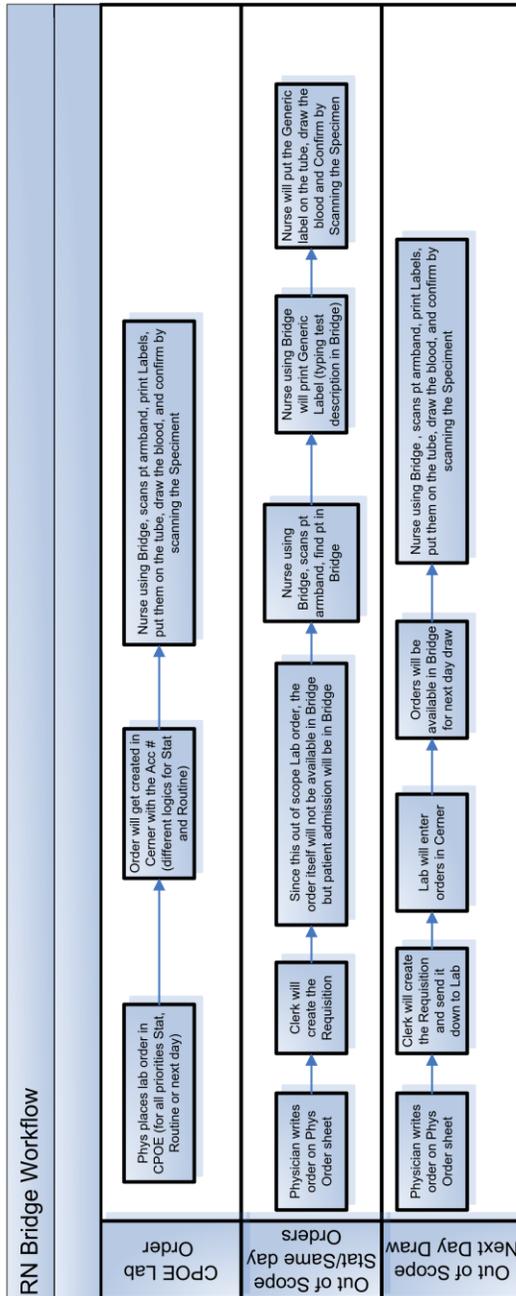
Notify Completion of Interview	
Turn off Recoding Device	
Record Recording Information (file, or other identification)	
Thank Participant for Their Time	
Remind user of activities to ensure anonymity	
Allow for Participant Q and A	

E. High Level Blood Collection Workflow



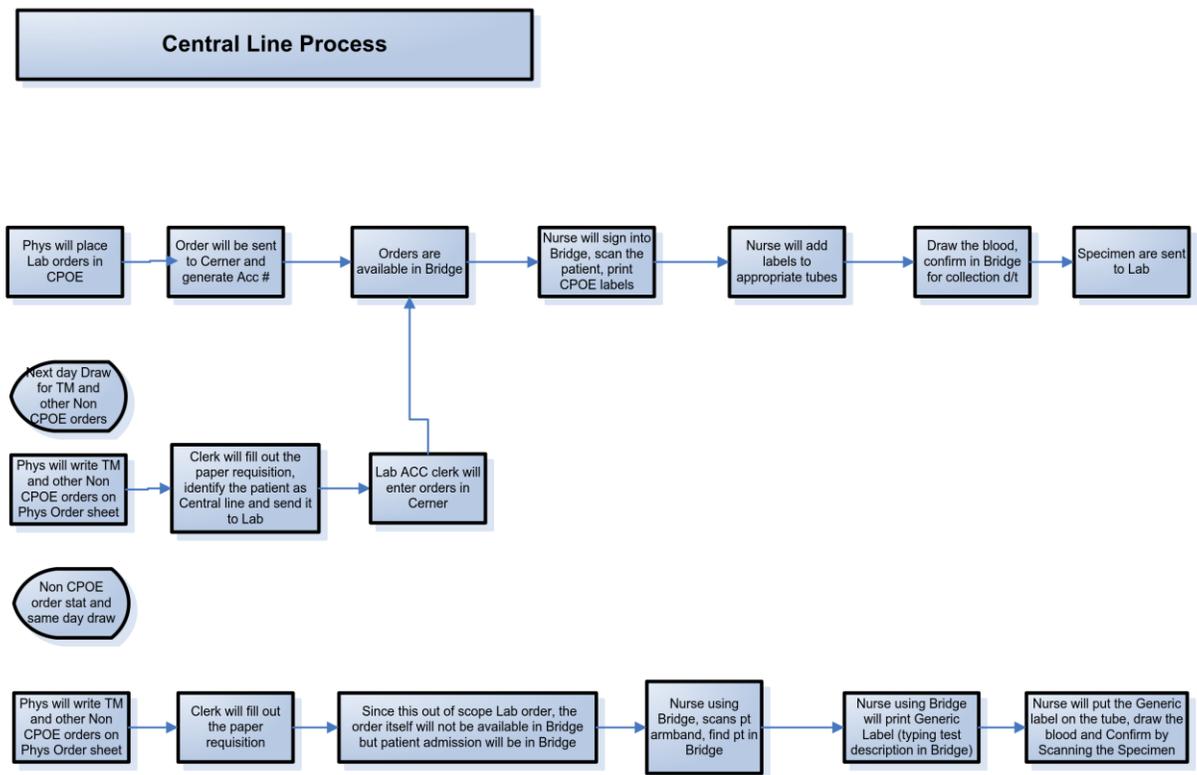
F. RN Bridge workflow

The RN Bridge Workflow was an artifact produced in the design and planning process at TOH.



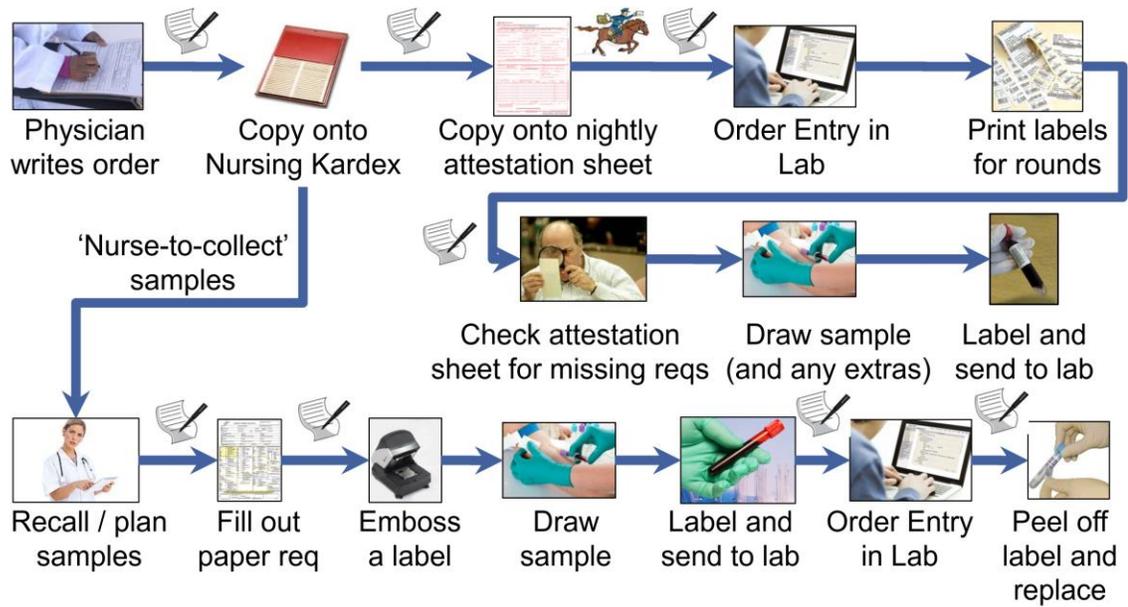
G. Central Line Process

The Central Line process diagram was part of the design and planning process documentation produced by the CPOE project team.



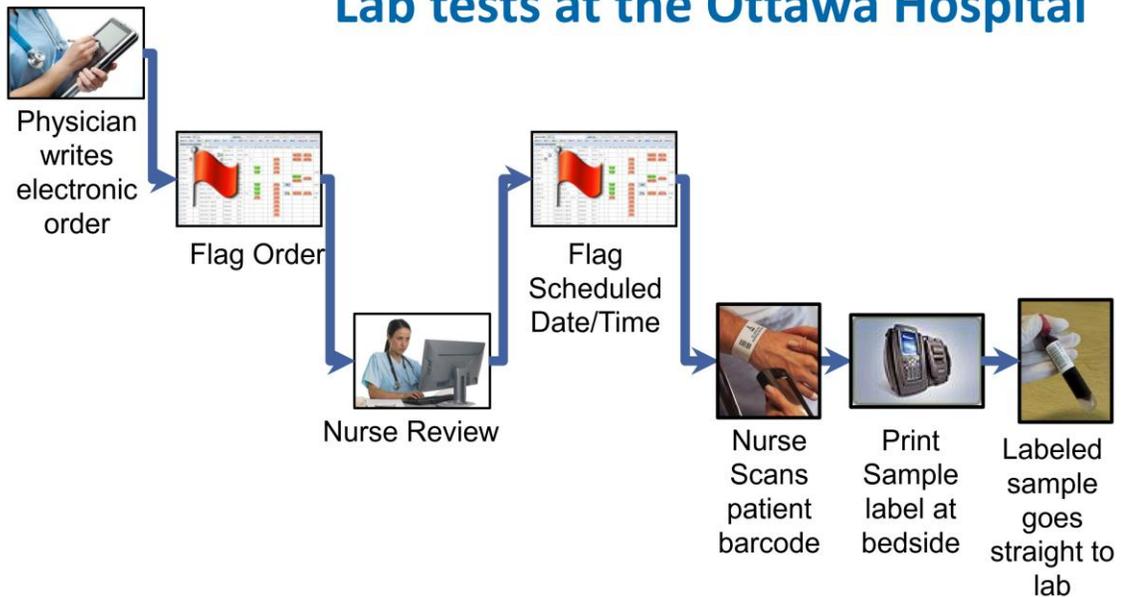
H. The old routine: Characterized

Manual Lab Test Ordering



I. The New Routine: Characterized

Electronic Ordering Process for Lab tests at the Ottawa Hospital



^{cxvi} Some may argue that since we have proposed a dialectical model, we've taken a post-positivist position. We counter this. A contradiction we find with many interpretivist views is that they apply an analytical lens that can be argued as requiring an "objective reality" on the part of the researcher and reader. Therefore, we use the "dialectic lens" as an interpretive frame. Although our assertion that we are taking an interpretive stance may be considered by some as taking liberties with our use of interpretivism, this frame's usefulness will be proven by our ability to use it to frame and analyze individual accounts of organizational change process.

^{cxvii} It is interesting to note that recent research by Rerup and Feldman (2011) introduce the concept of routine schema and use it to represent what has arguably been the domain of the ostensive aspect of the routine.