SEEKING STRUCTURE: A RECONCEPTUALIZATION OF CASE MANAGEMENT

Research-in-Progress

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Abstract

Case management is an approach to work that inherently emphasizes the client experience and is, therefore, an important paradigm for work in our 21st century services-driven economies. It specifically accounts for unique, contextual information and allows for emergent activity, whereas operational process management places primacy on standardized information and standardized tasks performed in a deterministic sequence. As a result, case management has been characterized as involving "unstructured" processes and data, in contrast to process management of "structured" processes and data. Referencing information systems research on process management and organizational research on work and routines, I argue that this conceptualization of case management obscures the real nature of the work and inhibits design of information systems to support that work. Drawing on studies of various casework settings, I propose a framework highlighting the underlying structure of casework and revealing new possibilities for combining human expertise and digital technology in case management.

Keywords: Case management, process management, automation, work activities, decision making, digital technology, information technology

Introduction

During the first quarter of 2013, the United States of America's Department of Veterans Affairs (VA) faced a barrage of bad publicity. The Veterans Benefits Administration (VBA), the branch of the VA charged with administering disability and other benefits for US veterans, faced a backlog of over 900,000 claims and a chorus of disaffected veterans and frustrated congressional lawmakers. Despite processing over one million claims per year for the preceding three years, VBA efforts were dwarfed by the 50-percent increase in incoming claims; claims which contained 19 percent more medical conditions, making them ever more complex and laborious to adjudicate. The escalating demand was clearly overwhelming the organization's business processes. Dire stories about VBA staff being buried, literally, under mounds of paper claims circulated the Internet. In order to even come close to delivering the service it was mandated by the US Congress to perform, the VBA urgently needed a new approach to its work.

The VBA offers an extreme example of an organization whose central purpose is case management; specifically, the management of each and every veteran request for benefits towards a fair, accurate and timely decision. The challenges of the VBA's case volume and complexity suggest potential advantages of leveraging digital technology to automate case handling – and yet the perceived variability and knowledge intensity of this work seemingly pose limitations to automation.

Casework, like that of the VBA, takes many different forms, but inherently emphasizes the client experience, accounting for unique contextual information and customized execution of activities to solve the particular needs of a client at a particular moment in time (Biestek, 1957). The work can be complex, detail-intensive and often "artful" (Austin & Devine 2004; Hill et al 2006) requiring collaborative engagement of knowledge and judgment to reach decisions or decide on next steps (de Man 2009; Harris-Ferrante 2011; LeClair & Miers 2011; Richardson et al 2002; Swenson 2010). It is viewed as less structured than process-oriented work in terms of the steps it entails and the data it leverages (van der Aalst et al 2003; de Man 2009; Hill et al 2006). As a result, IT-enablement of casework is still immature in comparison to the ways information technologies support execution and management of more standardized process-centric operations (cf. Davenport 1993).

Case management should, however, be recognized as an important paradigm for work in our 21st century services-driven economies (Chesbrough & Spohrer 2011; World Bank 2000). Firms must increasingly compete on customer experience, offering "solutions" in lieu of standard services and off-the-shelf products (Gulati 2010; Spohrer & Maglio 2008). As the demand for customized services expands, innovative use of digital technologies -- such as automated workflow, data sensing and data-driven analytics—will be critical to delivering services on a case-by-case basis at the necessary scale and feasible cost. But, I argue, perceptions of a lack of "structure" to casework has thus far inhibited our thinking about technological possibilities to automate—and even optimize—that work.

This paper draws on both practitioner literature and academic studies of IT-enabled case management, and integrates insights from organizational theory on routines, processes, projects and knowledge work, to propose an alternative characterization of casework. Specifically, I propose shifting attention from *process* to *activity pathways,* and from *data* to *decisions*. This framework exposes an underlying structure to casework and reveals nuanced aspects of the work more tractable to digitization and automation. It also renews attention to aspects of the work that *do* remain critically dependent on the contributions of engaged, empowered professionals (i.e. knowledge workers). I envisage that this framework could help to evaluate new opportunities for applying advanced digital technologies to casework and can inform the design of future client-facing roles and case management systems.

Case Management and Case-Oriented Approaches to Work

The case management approach to work has its roots in health and human services, and a commitment to the recognition of each client as unique, not just as a typical member of a category (Biestek, 1957). Cases and case management can be conceptualized in a variety of ways, depending on the domain (Richardson et al 2002). I define a case as the set of circumstantial information associated with an external situation or request requiring resolution. As a "human-centered managerial approach" (Richardson et al 2002, p1), case management places primacy on *satisfaction and effectiveness for the particular client*, while still

aspiring to efficient performance. A case-oriented approach acknowledges unique, contextual information associated with a request, and involves an emergent and flexible yet coherent set of activities, often involving complex interactions among content, people, and institutional policies, in response to that request (de Man 2009; Harris-Ferrante 2011; LeClair & Miers 2011; Swenson 2010). Unlike an operations process that operates on a schedule and duration predetermined from within the organization, a case can be triggered or "opened" by an external event, and "closed" only once the problem or request has been resolved (de Man 2009; Kaan et al 2006). Progression of the case to resolution is controlled by the state of the information associated with the case, which can include unplanned or unanticipated events (e.g. Hill 2012; Singularity 2009; Swenson 2010), rather than by deterministic dependencies among the tasks involved (cf. Malone & Crowston 1994; van der Aalst et al 2003). Decisions are central to case management. Holistic evaluation of case-related information (the "case file") demands cognitive effort to reason, interpolate data, integrate information, and draw conclusions about what needs to be done and how to do it (Davenport 2005), as well as the need for collaboration and reciprocal coordination with other people, resources and processes (cf. Gittel 2000; Thompson 1967). As such, case management is often associated with "knowledge work" and "knowledge workers" (Cummins & de Man 2010; Davenport 2005; Davenport & Nohria 1994; Singularity 2009).

Case-oriented approaches can be contrasted with process-oriented approaches to work, which have their foundations in industrial environments, dating back to the total quality management (TQM) movement emerging from post-world-war II Japan manufacturing companies (Deming 1982). Emerging from the manufacturing domain, process thinking values *control, efficiency and consistent quality at scale,* with a generic customer in mind. The business process reengineering (BPR) movement of the early 1990s aimed to bring this same process orientation and its possibilities for improvement to the customer-facing side of organizations (Davenport & Short 1990; Hammer 1990). Central to a process orientation is the assumption that work can be described as a series of tasks, linked logically and temporally, which use the resources of the organization to collectively realize an organizational objective or goal (Davenport 1993; Hammer & Champy 1993; Hickman 1993; Leist & Rosemann 2011; van der Aalst & van Hee 2002). These tasks are sequenced deterministically on the basis of quantifiable conditions (de Man 2009; van der Aalst & van Hee 2002). Further, tasks can be decomposed into simpler, constituent activities, allowing for division of labor, specialization in performing those activities, and thus improvement through high-repetition learning-by-doing of simple activities and the ability to detect and remediate weak links in the sequence (Smith 1776; Taylor 1911). In pursuit of greater efficiency at scale, business process management (BPM), which includes any systematic, structured approach to the design, evaluation, execution and improvement and innovation of business processes (Elzinga et al 1995), has proliferated as a way of understanding and managing the work of organizations (Ho et al 2009; Skrinjar et al 2008).

Applications of Case Management

Despite the prevailing emphasis on managing business processes, case management is a common practice in sectors that must handle complex customer and service interactions with individual human clients. Examples of case-oriented approaches can be found in government agencies (e.g. licensing, permitting, benefits processing, child welfare monitoring and intervention, etc.), at financial institutions (e.g. processing of mortgage applications, insurance applications, insurance claims, accident compensation, etc.), in health care organizations (e.g. medical diagnosis; therapeutic interventions; home care plans; etc.) and within the law and criminal justice systems (e.g. handling legal cases; criminal investigations; risk assessments for bail, probation and parole, etc.) (Cadigan et al 2011; de Man 2009; Fiumara et al 2007; Goodman 2012; Hajkowicz et al 2013; Hill 2012; Lamont 2012; Richardson et al 2002; Rooze 2010).

However, businesses in other service-focused markets and industries have also recognized that client (and employee) satisfaction can be improved by organizing work more centrally around resolving a situation instead of focusing on tasks or individual steps of a process (Davenport & Nohria 1994; LeClair & Miers 2011; Hill 2012). The emergence of the case manager role, reconsolidating responsibility for client-facing decisions and tasks reaching across the organization, can be seen as a break from the conventional process-oriented approach and the division of work (Davenport and Nohria 1994).

Across industries generally, a case management approach can be advantageous wherever work is not easily decomposed into sequential tasks or resists codification as a process of well-defined, sequentially related activities. Examples include issue handling at call centers and helpdesks, handling invoice discrepancies, engineering to order, responding to and evaluating RFPs, customer and sales relationship management, facilities maintenance, audits, fraud investigations, public relations management, and emergency response management among other domains (de Man 2009; LeClair & Miers 2011).

Towards Information Systems for Case Management

Both process-oriented and case-oriented perspectives on client-facing work acknowledge the importance of achieving organizational objectives and producing value for an organization's clients. However, they differ in their origins and thus frame the achievement of organizational objectives in terms of different priorities and values, different actions, and different types of information; certain aspects of the work become salient and other aspects recede in importance. These distinctions persist in the design of information systems to support that work (cf. Orlikowski and Barley 2001).

Process-oriented systems emphasize standardization and control as a means to efficiency and quality at scale. They achieve this by representing work as a structured process (composed of well-defined tasks executed in a predetermined sequence) operating on structured data (i.e. inputs and outputs that can be well-defined in terms of variables and values), and (re)configuring these elements in the most efficient manner. As Davenport observes, "a time-honored way of improving any form of work is to treat it as a process. To treat something as a process is to *impose a formal structure on it – to identify its beginning, end and intermediate steps…*" (Davenport, 2005 ch4:1, emphasis added). Processes are considered *industrialized* when they are formalized enough to achieve consistent results largely independent of human users (Hill et al, 2006, p664). Over the last 50 years, this industrial approach, currently exemplified in business process management systems (BPMS), has succeeded in leveraging IT to automate, informate, sequence, track, analyze, integrate and disintermediate work resources and tasks (cf. Davenport 1993). Specifically, work that can be structured, or formalized, can be readily automated; repeated nature of the work justifies the investment in automation. Correspondingly, automation of such work is widespread, whether it involves manipulation of physical materials (e.g. use of robots and advanced manufacturing control systems) or the manipulation of information (e.g. in TPS, ERP and other BPM systems).

However, "[imposing] a formal structure" on the work, focuses attention on tasks that actually *can* be decomposed into simpler steps and sequenced according to quantifiable conditions. Sometimes circumstances demand a non-standard response, that activities be performed in a non-standard order, or that different information be taken into account. In such instances, the chosen responses are referred to as work-arounds, special cases, or exceptions – with the implication that they are rare and insignificant.

Casework (and knowledge work more generally) routinely exceeds formal description in terms of structured processes and structured data, since goals and methods can change quickly (Hill et al 2006), the content rather than the task can determine the outcome (de Man 2009; Hill et al 2006), important decisions are implicit "in people's heads" (Davenport 2005) and/or the work is collaborative and iterative and therefore difficult to structure (Davenport 2005). Alternative approaches to information systems design were prompted by recognition that, in some work contexts, "exceptions" and "special cases" are neither rare nor insignificant.

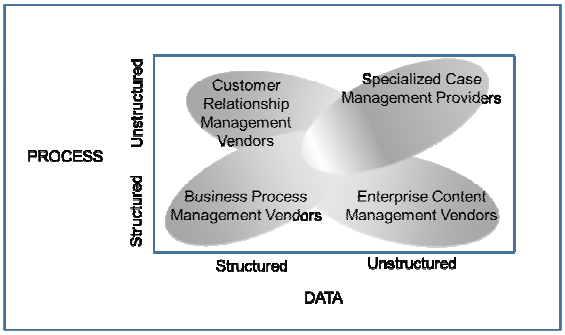
Thus early applications of IT for "knowledge work" valued content over control, with less emphasis on "structure." The first decision support systems (DSS) sought to use IT to support humans in *semi-structured decision-making* by providing more and more useful presentation of information, in contrast to the fully automated decision-making efforts (e.g. optimization models) coming out of operations research (Alter, 2004 p319). Later, electronic document management (EDM) systems and then knowledge management (KM) systems focused on supporting knowledge work by capturing, storing and indexing important or widely-relevant information in central repositories, from where it could be retrieved, referenced and (re)applied as needed (Alavi & Leidner 2001; Sprague 1995). These systems accommodate so-called "unstructured data" in the form of documents containing free-form text, graphs, figures, objects and images; sources which at that time could not be analyzed automatically.

Over time, case management systems (CMS) became associated with *unstructured* processes and data, in

contrast to business process management systems based on *structured* processes and data (Hill, 2012) (see Figure 1). Although some early case handling systems tried to account for every possible combination of activities and relevant information, these quickly became overly complex, rigid and limited to specific domains (Kaan et al 2006; LeClair & Miers 2011). In recent years, case management offerings have proliferated, promising increased worker productivity, decision transparency, improved compliance, enhanced collaboration among caseworkers, improved coordination, and better monitoring of case status (Hill 2012). While some are independent solutions for specific applications and/or industries, many CMS are add-ons to Business Process Management (BPM), Enterprise Content Management (ECM) and Customer Relationship Management (CRM) suites (Harris-Ferrante, 2011).

Adaptive case management systems (ACM) blend high-level automation of complex work flows with case-level support empowering the workforce to apply human judgment to complex situations (cf. Richardson et al 2002; Swenson 2011). Automation is evident in the high level process where technology is leveraged to monitor progress of cases, sequence and coordinate complex work flows among resources and contributors, and manage the interrelationships among high volumes of documents, data, collaboration artifacts and other information. At the case-level, however, the focus is still largely on *supporting* human decision-making by providing a centrally-accessible, integrated view of all pertinent information and helping individual workers select and track their own activities appropriate to each case.

Figure 1. Segmenting the Emerging Case Management Market (adapted from Hill, 2012)



Reframing Case Work as Decision-driven Activity Patterns

I contend that, by conceptualizing case management *in contrast* to process management, the IS field might overlook valuable aspects of casework that are more routinized and predictable. Similarly, by conceptualizing case management as simply as an *add-on* to process-centric work, we obscure understanding of important variability in the work. More importantly, if our models of work are inadequate, they can inhibit design of systems to support that work. Specifically, we can overlook opportunities to automate activities and decisions, or undervalue the moments when human judgment and insight should be incorporated.

Framing work as pure "case" overemphasizes variability and complexity at the expense of regularity and repetition. Routine, defined as a "repetitive, recognizable pattern of interdependent action, carried out by multiple actors" (Feldman & Pentland 2003), is clearly a feature of ongoing casework. Despite inevitable variation across cases, each case can be recognized as an instance of the routine. Further, even extremely complex casework is never entirely void of regularity and structure since, from case to case, the work effort is triggered in a similar way and oriented towards similar goals (e.g. resolve a problem, make a decision). The overall direction from request initiation to request resolutions is known even though many of the steps in between might be optional or unknown at the time of case initiation.

On the other hand, framing work as pure "process" overemphasizes structure, regularity and routinization and may hide substantive variability. So-called "routine work" is not always as stable and unchanging as it may appear (Cohen 2007); rather it comprises dual aspects (Feldman & Pentland 2003). The *ostensive* aspect embodies the work "structure" that enables people to guide, account for, and refer to specific performances of a routine – it is this interpretation of the work that is usually automated or otherwise implemented in information systems. The *performative* aspect embodies the specific actions, by specific

people, at specific times that bring the routine to life. In other words, the same process—assuming it is not constrained by too-rigid supporting technology—may involve slightly different data and activities each time it is enacted. The relationship between these two aspects of organizational routines creates ongoing opportunity for variation, selection and retention of new work practices and patterns within seemingly stable routines, and which, over time, can lead to a wide variety of outcomes. Brown and Duguid (1991) similarly identify a gap between organizational *processes*--the official, institutionally recognized way of doing things, and the work *practices* --the way the work actually gets done. Work practices, they found, entailed more variability, more complexity and hence the need for more context-specific interaction and collaboration with others, than the work process would have suggested. In short, process work in theory is often enacted as casework in practice. For example, at the VBA, in theory, making a claims decision involves a relatively straightforward sequence of decisions (aka "process") to assess whether a disability is service-related and, if so, its degree of severity. In practice, however, each decision can require consulting multiple parties and evaluating different sources of nuanced and qualitative information to estimate the severity of a disability (aka "case").

In addition, new technologies are blurring the distinctions between case-like and process-like work. For example, changing technologies and cultural norms mean that routine business processes are increasingly conducted via mobile, through social media, and in the cloud—encouraging behavior that is increasingly client-centric and case-like (Davis 2013). At the same time, many areas of activity previously considered "knowledge work" have, with technology, become more routinized, been reorganized into standardized, structured work tasks, and human jobs have been automated away (Brynjolfsson & McAfee, 2012).[1] Case management does still encapsulate a range of characteristics challenging for today's technologies, and new domains of knowledge work continue to emerge or remain highly labor-intensive.[2] However, as automated, remote and mobile sensing and analytic capabilities advance at an astonishing rate (e.g. Google self-driving cars, IBM Watson), new kinds of data become "structurable" and previously unimaginable automation capabilities may not be far off.

Collectively these insights suggest that both processes and casework exhibit degrees of variability and predictability. Put another way, both process-like characteristics (structure, regularity and repetition) and case-like characteristics (nuance, variability and unique client experience) appear to be essential realities of much work today. In the context of case management, the degree of variability vs. regularity and unpredictability vs. certainty are core concerns about what can be automated (Bess, 2013). With this in mind, I explored casework in a variety of contexts (e.g. health and human services, IT support services, banking and loan origination, benefit claims processing, criminal justice), deliberately seeking evidence of structure, regularity and repetition within the variability and nuance of each case setting.

In lieu of emphasizing the "unstructured process" associated with casework, I examined the specific selection and sequence of *activities* that make up the work (cf. Kaan et al 2006). In lieu of emphasizing the "unstructured data" associated with casework, I focused on how *decisions* are made using different kinds of data (cf. Brynjolfsson et al 2011; Klein 1998).

Attending to Activities and Activity Pathways

Different degrees of task variability can be distinguished across different knowledge work and casework settings (Davenport 2005; de Man 2009; Goodman 2012; Rooze 2010). In some settings, case management might be closer to a "factory" (or "production") model, in which workers are guided through the necessary activities or steps with little room for deviation. In other settings, a "service" (or "regular case") model is more appropriate, where the worker is offered suggestions but the worker largely chooses what to do and when. In "special cases," there may be very little prior knowledge available about how to proceed (Rooze 2010).

My research suggests that that activity *selection* (what to do) and *sequencing* (when to do it) are relevant

[1] For example, the broad "Sales and Office" category of jobs, as tracked by the US Bureau of Labor Statistics, has experienced a more than 20% decline in labor intensity since 2000; in other words, the amount of US economic activity that required 100 Sales and Office workers in 2000 now requires fewer than 80.

[2] The labor intensity of management has declined by only 10% since 2000, and that of the professions by about 5%. And "business and financial" jobs are more labor intensive now than they were at the turn of the century.

components of *all* case management settings. Noting different possibilities under which a given activity is activated, I propose that potential activities assume a *valence* as defined by the information state of the case at the time (see Table 1). The valence of each activity is dynamic, changing as the information state of a case changes.

Table 1. Dynamic Characterization of Case Management Activities

Activity Valence	Definition	Example
Required / mandatory	Given the current situation state, this activity is *mandatory*. It *must be* performed next. (Both selection and sequencing of activity is mandated)	If <service-eligibility is unknown> then do <seek veteran's service records> If <property assessment is due> then <obtain payment authorization>
Relevant / discretionary	Given the current situation state, one or more activities are appropriate. S*elect* one to do next. (Activities are selected but sequence of performance is discretionary)	If <disability is service-related> then select <get medical records from federal sources; obtain medical opinion; request external treatment records; …> If <credit score is sufficient> then select <get employment documentation; get tax return information; get statement of assets; …>
Revealed / exploratory	This is the current situation state. *Decide what* to do next. (No activities are selected or suggested. Chosen actions can be considered exploratory)	<Treatments X; Y; Z have not worked> Document what to try next.

This typology is valid for "factory" or "production" case settings involving deterministic pathways (e.g. opening a domestic bank account), where all possible activities are predefined and all possible paths are pre-determined or known in advance, no matter how complex the pathways are (Swenson and Palmer, 2011).[3] In such settings, there is little flexibility in either the selection or sequence of activities; the next activity is mandated or *required* on the basis of the information state of the case itself.

The typology is also valid for "service" case settings (e.g. applying for a loan or insurance) where there may be flexibility in either the selection and/or the sequencing of activities. For example, in the course of approving a mortgage, an applicant's payment authorization (e.g. credit card details) may still be *required* in order to initiate a property appraisal. But at other moments, worker discretion might be allowed in selecting what to perform next from a subset of currently *relevant* activities. For instance, for processing a mortgage application, it may be important to obtain various documents supporting evidence of, say, income, assets, and residency status, but, as long as they are eventually available, the sequence in which they are sought is not important. Or processing an insurance application may require confirmation of identity but permit alternative means of doing so (e.g. by relying on driver's license or a passport). Or the VBA, to assess disability, might require evidence from a selection of possible sources, such as treatment records, a medical examination, or an expert medical opinion, but might not need all these sources.

In "special" case settings (e.g. diagnosing and treating a rare disease), activities may be *required* and/or *discretionary* but not all necessary activity can be predicted. There will inevitably be instances of confronting an unknown or unforeseen situation state, when totally new responses must be accommodated as choices of action. For instance, a physician may offer a patient a novel combination of drugs after conventional treatment options have been found to be ineffective. Thus, in the absence of better suggestions, emerging, potentially viable activities can be *revealed* by the choices of human decision-makers.

This framework accounts for the iterative and non-deterministic nature of case management in that any particular activity can be *required* and/or *relevant* multiple times, depending on the case information

[3] Deterministic case management looks similar to conventional business process management, and older specialized case management systems might exhibit this design. From a business process perspective, any activity is determined by the preceding activity (i.e. current state of the process), but from a case management perspective, an activity is determined by the situation state of the case.

state. Further, by acknowledging and incorporating *revealed* activity, this framework also allows for the possibility to learn from both established and emergent human expertise.

Discerning Decision-making Modes

Since the information state of the case establishes the criteria for selecting and sequencing activities, it is also important to consider how that information state is evaluated. My exploration of case management situations suggests that different modes of decision-making are involved (see Table 2.). Decision-modes speak to the formality (tacit-explicit) and breadth of knowledge (individual-collaborative) that are involved (cf. Davenport, 2005, ch5 on knowledge worker types). Importantly, the viability of each mode of decision-making depends on the formality, completeness and precision of the data on which that knowledge is based.

Table 2. Different Approaches to Evaluating Case Information States

Decision Mode	Definition	Example
Causal reasoning	Logical relationship between a case indicator/s and a conclusion. Case indicator is based on a quantitative or categorical measurement of a case attribute	If <white blood cell count is greater than 12000> then <person has an infection> If <Veteran was ever in Vietnam> then <veteran is assumed exposed to agent orange>
Probabilistic reasoning	Algorithmic, probabilistic relationship between a case indicator and a conclusion. Case indicator may be based on multiple case attributes and external information (business rules.	If <white blood cell count is greater than 11000> then <person likely has an infection> If <veteran has condition X & Y and W> then <veteran is 20% disabled>
Heuristic reasoning	Relationship between a case indicator and a conclusion is established on the basis of limited information (e.g. a checklist) and/or qualitative information.	If <critical vital signs are in range> then <patient is stable> If <offender has these characteristics> then <offender is assessed as pretrial high-risk>

Causal reasoning involves decisions that invoke logical (T/F) arguments about categorical or quantitative data from the case information. For example, deciding "Is the applicant employed?" might be categorically answered as either "true" or "false" by a call to the documented employer. Or deciding "is this an infection" can be categorically answered true/false by comparing a quantitative case attribute (white blood cell count) with a global threshold value[4].

Probabilistic reasoning invokes calculations or algorithms using quantitative or categorical case information and perhaps additional global information such as business rules and policies, such as insurance schedules, or data from prior cases. For example, an evaluation of "Is the applicant for a jumbo mortgage an acceptable risk?" might be answered by comparing a subset of demographic and economic characteristics of the current application with the same characteristics of prior applicants who defaulted on their payments. Alternatively, the risk assessment above might be based on some weighted average of multiple indicators of the current applicant's economic viability (e.g. employment record; property location; savings and investments; etc.) and compared with a global threshold value. The VBA calculates a cumulative disability rating by successively evaluating the disability of a veteran's individual conditions against a global disability evaluation schedule.

In some case situations, information states are assessed through a more intuitive approach or by relying on *heuristics* rather than a clearly specified algorithm. Heuristic approaches may be appropriate if insufficient evidence is available at the time to evaluate the context more precisely, if relevant information is more qualitative than quantitative, and/or if relationships among case attributes are not well-understood. For example, a decision about "Can we operate on this trauma patient yet?" might assess a patient's stability by looking at blood pressure patterns; white blood cell trends; and other relevant indicators. Although these indicators cannot be lumped together in a single measurement, they can be

[4] A global threshold value is derived from extensive, prior empirical evidence or policy, and, for case purposes, can reasonably be considered the "true value" or "true indicator" of something.

considered collectively to provide a qualitative measure of the patient's stability.

Decisions are clearly a key element of casework. By examining the underlying nature of decision-making, we can start to discern how different approaches make differential use of the available data.

Implications and Contributions

The preceding framework for modeling and analyzing casework foregrounds the selection and sequence of activities and the nuance of decisions that coordinate progression among those activities. This conceptualization of case management as a decision-driven activity pathway can be contrasted with activity-based control paradigms (Berry 1998), which determine the next required activity from the prior activity, and which are the norm in process-centric systems. The current conceptualization might also be compared with artifact-based control paradigms (Bhattacharya et al 2007), which enable or constrain activities based on information about a business artifact. Decision-driven activation, however, goes beyond artifact-based control by explicitly recognizing variance in the formality, accuracy and precision of the information informing case-related decisions.

The underlying structure of activity valences and decision-making modes is derived from the nature of case management itself and is independent of technological implementations. However, this approach can expose particular elements of casework where technology might be applied to automate moments of casework. Specifically, by breaking work down into constituent activities, we can start to distinguish the objectives of different activities, and explore the implications of advanced technologies. For example data-gathering activities (e.g. effort to monitor patients with chronic diseases) might benefit from automatic sensing technology and/or mobile wearable devices; material movement activities (e.g. delivering correct prescriptions to patients) might benefit from automatic checking algorithms and mobile robotics.

Similarly, once different modes of decision-making have been identified, we can start to discern occasions where either more extensive, more precise, or simply different data could influence how those decisions are made. For example, if automatic sensing technology offered more precise data, a probabilistic assessment might evolve to being a more categorical decision. Or, the application of more powerful analytic capabilities might reduce the need for heuristic evaluations. As an example, in the federal criminal justice setting, historical records were used to build a pretrial risk assessment instrument, based on analysis of the relationships among offender pretrial behavior and a broad set of offender characteristics; this analytical assessment was able to predict pretrial risk more effectively than the more intuitive approach of human case officers (Cadigan et al 2011).

A central goal of information systems research is to develop knowledge describing, explaining, designing and predicting interactions among people, technology and organizations, with the intent to improve the effectiveness and efficiency of organizations. This research advances that goal because it reveals an inner structure to case management—a significant and increasing proportion of organizational activity—independent of any particular industry or domain, and despite the inevitable variability and unpredictability of the work. Through understanding the fine-grained detail of decisions that drive the activities comprising case management, we can better envisage the interaction of people and more powerful digital technologies, and how this combination might benefit organizations as they strive to deliver more customized services at speed and scale. Specifically, we can pinpoint opportunities to improve the efficiency of case management, by taking advantage of enhanced sensing and analytic capabilities and greater processing power to automate the more structured aspects of the work, while reserving critical human expertise for intervention in the remaining unpredictable but high value situations.

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