

NDM and organizations: reviewing pragmatic science

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Abstract

This article examines the similarities and differences between the traditions of Naturalistic decision making and Organizational decision making. Illustrative examples of successful NDM inquiry in healthcare organizations are reviewed, highlighting an area where these two pragmatic research paradigms overlap. Not only do researchers in these areas aim to improve our understanding of decision making, they provide practical and realistic alternatives to laboratory-based research on decision making. The article presents a number of propositions for future research on NDM and organizations.

Key words: Naturalistic decision making, organizations, pragmatic science

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Introduction

A central theme of organization theory is the attempt to understand the decision making of individuals, groups and organizations. The study of decision making within organizations is underwritten by many scientific traditions including: anthropology; sociology; psychology; economics; and management theory. This multi-disciplinary approach spans decades of research across continents, and has afforded a plethora of models and descriptions of organizational decision making (Beach 1997; Shapira 1997; Bazerman 1988; March 1988; Allwood & Selart, 2001; Jaffee 2001) . The primary aim of this article is to explore the question: *how* can the similarities and differences between naturalistic decision making (NDM) and organizational decision making (ODM) inform NDM researchers who wish to study decision making in organizations? This exploration has commenced as a result of a reconsideration of Orasanu and Conolly's (1993) characterization of decision making in naturalistic settings which has as its eighth and final factor "organizational goals and norms". To date this factor has received the smallest amount of research attention of the factors examined within the NDM tradition and this article therefore begins to address this. The other factors which have been explored in more detail include: 1. Ill-structured problems; 2. Uncertain dynamic environments; 3. Shifting, ill-defined or competing goals; 4. Action/feedback loops; 5. Time stress; 6. High stakes, and 7. Multiple players (Orasanu & Conolly, 1993).

As authors of this article our common academic research interests lie within occupational and applied management psychology. As members of management and psychology schools, through our teaching, research, consultancy, editorial and reviewing responsibilities we are familiar therefore with a diverse range of literature

which spans management and organizational research. The review presented here is furnished by a qualitative mode of inquiry, which was to an extent we admit, serendipitous in nature similar to the rationale of Yates' (2001) review of NDM as an "outsider": essentially, we *thin-sliced* our way through the literature. ("Thin-slicing" refers to "the ability of our unconscious to find patterns in situations and behaviour based on very narrow slices of experience" (Gladwell 2005:23). The intention of this article is therefore to identify the kinds of observations and developments within organizational research which could potentially influence or complement further NDM inquiry.

The article is divided into three main parts. First, we provide an overview of NDM theory for readers new to the area and as a starting point for comparison with developments to ODM theory. Second, we examine ODM and alternative suggestions made to date which provide questions to be considered by NDM researchers who wish to explore decisions within organizations (Beach 1993; 1997; Schmitt 1997; Shapira 1997; Connolly and Koput 1997). We also note the importance of sensemaking (Weick 1995) to ODM and NDM. In addition here, we examine the puzzling question of why since the majority of NDM studies are conducted in organizational settings, NDM is not simply classified as a subsection of ODM-? Third, we present a comparative analysis of NDM and ODM providing illustrative examples from the extant literature of NDM research within health care organizations. The illustrations aim to provide an insight into the pragmatic, realistic nature of NDM inquiry. We adopt the 'pragmatic' definition as being "concerned with actual practice" (Oxford English Dictionary 2004-). The paper concludes with a summary of our key considerations and presents a number of propositions for future research.

1. Naturalistic Decision Making

The development of the NDM framework is now well documented (Montgomery et al 2004; Lipshitz et al 2001; Salas & Klein 2001; Zsombok & Klein 1997; Beach & Lipshitz 1995; Lipshitz 1995; Klein 1993), and a generation of researchers and practitioners in a range of domains have been energised by this pragmatic, realistic approach to understanding decision making. The NDM framework is regarded as “a loose grouping of non-standard models of individual decision making” (Connolly & Koput 1997: 285). The NDM models and theories are generally regarded as radical and have evolved from an initial rejection of subjective expected utility (SEU) theory and decision research which has been primarily based in laboratory settings. Put simply, NDM theorists suggest that classic decision theory, including SEU has done little to aid our understanding of decision making in real world contexts (Schneider & Shanteau 2003).

In their overview of the NDM perspective, Pliske and Klein (2003) note that NDM has been defined as the study of how people use their experience to make decisions in field settings (Zsombok & Klein 1997). They also note that when defining NDM Zsombok (1997) identified four criteria which contrast NDM to more traditional types of research:

1. the characteristics of the task and setting (context rich)
2. the nature of the research participants (most usually experts)
3. the intention of the research (describing the strategies people use)
4. the point of interest within the decision period (pre-choice processes, e.g. situation awareness).

Pliske and Klein (2003) suggest that NDM inquiry has taken a ‘second path’ distinct from that taken by Kahneman and colleagues (Kahneman et al 1982; Tversky and Kahneman 1974), which has led to the identification of a wide range of heuristics and

biases. This work inspired a vast array of suggestions for improving decision thinking; managing heuristics and techniques to avoid decision traps which have become popular within management education and business contexts (see Russo & Schoemaker 1989; Bazerman 1998; Maule & Hodgkinson 2002; Leonard and Swap 2004). The second path, which the NDM movement is following they argue, is the close examination of the heuristics and the study of expertise in order to learn more powerful heuristics (Pliske & Klein 2003:579). The first path can be seen to be looking for what people do wrong, whilst the second is looking for what they do right.

An increasing body of researchers suggest that our understanding of decision making and the importance of the use of experience whilst negotiating uncertainty has therefore been greatly enhanced by the adoption of NDM (Klein 1998; Orasanu & Connolly; 1993; Flin et al 1997; 2002; Schneider & Shanteau 2003). Conversely, whilst the NDM framework has continued to illuminate our understanding of decision making, the approach it is not without criticism. For example, a current debate, which no doubt will continue to exist focuses upon whether or not the NDM framework truly represents a paradigm shift (Yates 2001). The general consensus however, amongst the NDM community appears to be that a paradigm shift in decision-making research has occurred (Cannon-Bowers et al 1996). This unresolved debate runs alongside calls for more rigour in methodological tools, techniques and analysis. The NDM community notably has always, it appears deliberately considered its methodological foundations (Beach et al 1997) and has actively encouraged the development of a dialogue between related research lines.

Within the NDM community one of the first references to organizations can be traced back to the influential work of Beach (1990; 1993; 1998) who provides a descriptive Image theory of individual decision making for personal and

organizational decisions. The image theory position is that decision makers have three images which guide or limit the decisions that they make: (1) a set of values and beliefs; (2) specific goals to which the decision maker/ organization is striving; (3) defined operational plans for reaching the goals. Similar to the NDM framework Beach stresses goal orientated behaviour; he also however, recognises the importance of merging individual decision making with other organizational stake holders.

Complementing Beach's work, Schmitt, (1997) noted the 'peculiarities' of decision making in the context of business & industrial organizations and summarises a discussion panel of Beach, Martin, Rouse and Sneizek presented at the Second Conference on Naturalistic Decision Making (NDM Dayton, OH, June 1994). Schmitt reported that, "the notions that there are many involved decision makers, that decisions are often made in steps with feedback at each step, and that organizational norms and goals are important, reaffirm the early characterisation of NDM" (Schmitt 1997:93). Nevertheless, the recognition that decisions are only really one part of a change process in which many other elements of a people nature are equally important was highlighted as being key within large organizations. As a result of the discussion, new research directions were suggested and the importance of the group and climate of organizations was stressed. Importantly, this group of researchers noted the need to evaluate decisions in terms of outcomes but that the measurement of significant criteria would remain problematic. Seven years on, this still remains a challenge. Discussions within the NDM community at this time also included the importance of problem-solving (Smith 1997) echoing elements of the bounded rationality concept of Herbert Simon. Also, the exploration of heuristics (Selart et al 2000) within organisations which relate to cognitive rules of thumb in decision making processes has been examined.

Other organizational decision research which has been discussed within the NDM community has included a focus upon management decision making (Gotein 2000; Gotein & Bond 2003; Gore & Riley 2004) and has also emphasized the importance of the social environment and learning within organizations (Allwood & Hedekin 2000; 2004; Allwood & Selart 2001). This work highlights that managers are often challenged by factors identified by the NDM framework, *i.e.*: ill-structured problems; uncertain, dynamic environments; shifting ill-defined or competing goals; action/feedback loops; time stress and high stakes; organizational goals and norms (Orasanu & Connolly 1993). Elements of NDM and in particular, Klein's (1997) Recognition Primed Decision making model are evident within these studies. However, the researchers who have explored managers within organizations at the level of individual, group and organization all commonly appear to recognise that different strategies of decision making are required for organizational effectiveness. It appears that within the context of the organization, and in particular the business world, decision making inquiry requires a broad approach in order to fully understand decision complexities. Recent evidence of this broadening of research inquiry is evident in Helen Klein's (2004) research which begins to explore the complexities of cultural differences and cognition.

2. Organizational Decision Making (ODM) and New organizational theory(NOT)

Organizational decision making can be examined from various different perspectives and has followed the dominant traditions of behavioural decision theory and organizational decision making (*a detailed examination of each of these traditions is provided by Shapira 1997*).

Behavioural decision theory (BDT) has predominantly been developed in laboratory settings. Shapira (1997:3) notes that over the past 50 years BDT “produced a remarkable set of findings of individual choice behaviour”, neglecting however, the effects of social, emotional factors and conflict in decision making (Kahneman 1991 in Shapira 1997).

The development of research within ODM has evolved from the seminal work led by Simon (1947; 1955) and the Carnegie school who located information processing and decision making as central elements for examining both the structural and process aspects of organizations. Other researchers of organizations have however, explored decision making in the context of relation to alternative areas including studies of power, escalation processes, commitment, communication etc. rather than as the central focus of analysis.

March and Simon’s *Organizations* (1958) and Cyert and March’s *A Behavioural Theory of the Firm* (1963) from the Carnegie approach culminated in March’s research agenda which focused on alternative aspects of ODM, notably pertaining to alternative notions of rationality (March 1978); decisions as random processes (‘The garbage-can model’ - Cohen et al 1972); attention allocation (1988); and the role of myths, rules, obligatory action in ODM (March & Heath 1994).

The analysis of individual and organizational decision making can be seen to cover common ground because many decisions within organizations are made by individual managers. The two traditions of BDT and ODM therefore overlap to an extent in the examination of the complexities of organizations (March 1997; Smith et al 2003).

Shapira (1997) outlines some of the characteristics of organizational decision making which are distinct from the type of individual choice based decision making

observed in laboratory settings. The characteristics include: 1. ambiguity; 2. a longitudinal context; 3. incentives; 4. repeated decisions; 5. conflict. Here we see some similarities with NDM, the rejection of choice in favour of rule-based decision making and stories; ambiguity; and repeated decisions. The differences between ODM and NDM however, are more marked. NDM and ODM focus upon different decision processes. NDM models reflect cognitive processes and ODM models mainly look at social processes which are heavily constrained by organizational goals and norms.

New Organizational theory

Connolly and Koput (1997) review five streams of research evident within NOT including the importance of: resource dependence; transaction-cost economics; organizational ecology; institutional theory; and network approaches. Essentially, these frameworks have focused upon different perspectives on the environment and its characteristics.

The study of resource dependence acknowledges the importance that all organizations are dependent upon others for resources. Organizational decision makers therefore work within this framework and often are required to negotiate to strengthen positions of power (Pfeffer 1982). Transaction-cost economics is also concerned with resource exchange and uncertainty (Williamson 1991) and bounded rationality pervades decision making. Their review notes that empirical support however, in this area is unclear. Similarly, organizational ecologists also highlight the importance of resources, both physical and social and argue that management decisions are constrained by internal controls, norms and incentives; scarcity of resources; pressure from competition and limitations on rationality (Hannan &

Freeman 1989). Initial work in this area suggested that there was very little scope for management decision making, more recent research in this area however is moving away from this view. The importance and use of legitimate power (as a resource) and adaptive interconnectedness which can aid the mobilisation of resources is noted as a feature of institutional (Powell and Dimaggio 1991) and network theory (Davis and Powell 1992).

Connolly and Koput's 'thumb-nail sketch' concurs with the rhetoric of the study of organizational decision making, i.e. the environment in which decisions are made is key. Not simply, they argue as a setting but as an embedded entity which forms both 'substance' and 'arena' for the strategic actors. In summary, they provide a creative line of research questions for integrating NOT and NDM but before doing so note that in both NDM and NOT "partial views abound" (1997:295), therefore a complete understanding of decision making is not expressed by either camps. Their questions for thought include the focus on central organizational decisions and are worthy of repetition here as they form potentially incisive lines of research inquiry.

Questions for NOT:

- where do senior decision makers focus their attention?
- what time frames are utilized?
- do critical issues always require rational analysis?
- will senior decision makers acknowledge the need to justify their actions to internal and external audiences?

Questions for NDM:

- how flexible are decision makers across domains?
- at what level is expertise found?
- what feedback mechanisms are conducive to learning decision skills?

- to what extent do NDM models recognise the importance of background experience and knowledge?

Notably, each of the NOT lines of inquiry which Connolly and Koput identify adopt a primarily sociological perspective, a macro approach which rarely includes or acknowledges cognitive theorising. One framework for inquiry which has, to an extent connected these two perspectives is that of the concept of sensemaking (see Weick 1995 for an extensive review) within organizations. To a degree this work has run parallel to the NDM framework and Weick has provided much interesting discourse at previous NDM conferences.

Sensemaking

Most sensemaking research has focused on how people come to understand those events in which they are currently, or have in the past, participated. These studies have greatly expanded our knowledge on how individuals and groups attempt to 'structure the unknown' (Waterman 1990:41) by placing stimuli into cognitive frameworks (Starbuck & Milliken 1988). Sensemaking refers to the processes of interpretation and meaning production whereby individuals and groups reflect on and interpret phenomena and produce intersubjective accounts (Weick 1995). It is by means of sensemaking that the social world is enacted, 'creating' organizations and their environments (Berger & Luckmann 1966).

Analyses of different types of sensemaking and sensemaking situations, such as newcomer socialisation (Louis 1980), policy making (Feldman 1989) and decision-making in life-threatening contexts (Weick 1993) have clarified the extent to which sensemaking involves creative authoring on the part of individuals and groups, who

construct meaning from puzzling and troubling data (Weick 1995). We also know that people's sensemaking activities are prone to distortions resulting from incomplete or inaccurate information processing (Levitt & March 1988) and the operation of ego-defences (Argyris 1982).

Sensemaking can be understood as a narrative process (Bruner 1990; Weick 1995) and as such can be seen in similar terms to NDM. The close examination of heuristics and expertise here however, is explored through storytelling, not explicit cognitive task analysis or in-depth knowledge elicitation techniques (Hoffman 1998). Boje (1995:100) referred to organizations as collective storytelling systems 'in which the performance of stories is a key part of members'. Sensemaking therefore, acts as a means to allow actors to supplement individual memories with institutional memory'.

Beguilingly, narratives have been described as 'a blueprint that can be used to predict future organisational behaviour' (Martin 1992:287) and the means by which individuals organise their experiences (Weick 1995). Narratives 'make the unexpected expectable' (Robinson 1981:60) and allow us to comprehend causal relationships so that they can be 'predicted, understood, and possibly controlled' (Sutton & Kahn 1987). In addition, they enable organizational 'participants to map their reality' (Wilkins & Thompson 1991:20).

Again as in other previously examined areas of NOT, the importance of power within the organizational context is highlighted. Given the view that organisations are fractured and hierarchical systems in which individuals and groups are implicated in asymmetric power relationships, some are more able to extend their hegemony than others (Pettigrew 1992). In short, some voices are more privileged and it may often be more appropriate to describe sensemaking as a power effect rather than a negotiated consensus (Weick 1995). This is a cautionary note for the NDM community's focus

upon experts who often have very powerful roles within organizations. Whilst this spotlight on expertise is one of the key characteristics of NDM the results from both sensemaking and other NOT inquiry imply that by exclusively focussing upon privileged voices, the entire story of decision making within organizations will remain incomplete.

3. Illustrative connections in health organizations

Our use of the health care context to illustrate how NDM inquiry has, and can, furnish fresh insights into ODM (as opposed to other equally fruitful contexts) is in part because it has a historic root in the study of medical expertise (e.g. Bogner & Klein 1997), and in part because this is a focus of investigation that has gathered renewed momentum in recent years. Moreover, it is a focus of inquiry that raises a particular challenge to NDM models that have yet to address the issue of decision making accuracy and in particular, how to avoid error that could have potentially fatal consequences. Consideration of the incentives and penalties surrounding the decision space sits well with the remit of ODM, particularly insofar as the decision space may be highly ambiguous, involving multiple parties each with different degrees and levels of accountability, making multiple decisions over sometimes very extended periods of time (as for example, in instances of chronic disease management).

Medical research has otherwise been slow to acknowledge both the conceptual and the practical benefits of the NDM approach to understanding and supporting clinical decision making. This may be attributable to an understandable preoccupation with ‘optimal treatment decisions’ involving error minimisation or elimination and, due to a cultural imperative to practice medical science with objectivity and rationality. Indeed, the imperative to make accurate decisions is a very real one given

growing research highlighting that “physicians decisions too often...lead to adverse consequences for a patient” (Patel et al. 2002: 1).

An impetus for NDM inquiry in the health care context was spawned nonetheless from the inadequacies of CDM models for understanding how, for instance, viable treatment decisions can be made (even under emergency conditions) despite appearing “sub-optimal” when judged against the “decision theoretic norm of thoroughly evaluating all possible options” (e.g. Denig et al 2002: 137). It is ironic (given the preoccupation with rational accuracy), that it is the increased realisation of the fallibility of clinical decision making that researchers have considered the merits of NDM for investigating ‘what is good’ about how physicians *actually make decisions* rather than judging how ‘bad’ they are against the dispassionate gold standard. Nursing science has taken the lead in this respect, with a burgeoning interest not in only in the fact that nurses do actually make decisions (many with critical implications for patient survival on a par with those made by medics), but that they do so expertly and with good effect, though not in accordance with the theoretic norm.

For example, Currey and Botti (2003) report on a study on of critical care nurses’ decision making about patients’ cardiovascular status in the immediate period after pulmonary bypass surgery. Such decisions are said to be crucial to patient recovery, because there is a very real risk that they can “suddenly and catastrophically deteriorate”. Decisions to intervene are “rapid and complex” (i.e. there are numerous alternatives to consider each with numerous attributes, and within a short time) and moreover, there is a lot of ambiguity surrounding the predictors of deterioration and no explicit assessment guidelines to support the decision making process. Yet despite this Currey and Botti (2003), report “experienced nurses can assess and respond to episodes of cardiovascular instability rapidly and accurately”.

This, and other similar research conducted in the *actual care environment* (as opposed to simulation or laboratory based work), consistently demonstrates how nurses' can and do make quick and accurate decisions all the time. They do so by developing mental heuristics for using and prioritising certain perceptual cues about a patients' medical status, discarding some as irrelevant or inaccurate (e.g. Aitken 1997; Benner & Tanner 1987; Crandall & Calderwood 1989). Such cues are implicitly or intuitively acknowledged as important or otherwise (and may not be the cues formally documented to be the most important).

Denig, Witteman, and Schouten (2002) report on a study looking at the cognitive processes of general practitioners (GP's) when making prescribing decisions. In general, GP's did not actively consider all possible relevant information and 40% of decision instances could be described as 'habitual' (i.e. without contemplation), all irrespective of experience. Whilst the processes were limited in the 'alternatives' considered, deviations were not necessarily problematic for the ultimate prescribing decision (independently benchmarked as either first or second choice): over 90% of GP's made first-choice decisions.

Thus, research on clinical decision making framed by a NDM approach has generated some important insights into how 'good' decisions can be made despite not being made in accordance with normative rules. Yet, herein lies the paradox of NDM. As noted earlier, some decisions made by clinicians are 'sub-optimal' when judged against patient needs and requirements (rather than the normative model). For example, in the study of GP's prescribing decisions by Denig et al (2002), up to 10% of prescribing decisions were independently judged as inappropriate for the patient. Arguably, this was because not all pertinent patient or drug information was considered. A recent report from the Institute of Medicine (IOM 2004) indicates that

more people die from medical errors in hospitalization than from motor vehicle accidents, breast cancer, or AIDS.

Clearly then, the minimisation of error is, and will continue to be a central concern in the endeavour to ensure 'safe' and accountable patient care (Patel et al 2002). Additionally, with rapid technological advancement and the ever increasing complexity of modern medicine, this poses a huge contemporary challenge for clinicians. NDM then has afforded major insights into the way decisions are *actually made* in clinical practice, pointing also to the fact that the use of certain non-analytic, non-logical heuristics and strategies (to deal with uncertainty and time pressure, for example) may actually be adaptive and productive to decision making when evolved through experience in the field (Patel et al 2002). However, its inability to provide a solid means of evaluating decision quality has been an impediment to its widespread uptake in health care research and practice. The context specific nature of the 'naturalistic' strategies identified in NDM studies is also problematic for generalised decision support, and not always amenable to precise translation into applicable practice.

On the other hand, decision support systems underwritten by the conventional gold standard (i.e. involving a systematic evaluation of all relevant alternatives) have rarely made any real practical difference to the way clinical decisions are made (e.g. Borstein & Emier 2001). This has been attributed to the largely acontextual and prescriptive rather than 'augmenting' nature of the typical decision system, out of tune with clinician needs and requirements (Purves 1998). The saying that 'you can lead a horse to water, but...' scenario rings most true in this instance (Poses et al 1995). NDM thus has a potentially very important 'ecologically sensitive' contribution to make in the formulation of decision guidelines that "mediate decisions

in a manner consistent with the temporal flow of clinical reasoning...tuned to specific types of user” (Patel et al 2003). For instance, decision support guidelines could end up actually undermining the optimality of the naturally sophisticated decision processes employed by domain experts. Thus one important line of research, conceptual and pragmatic development for NDM inquiry is to address the question not only of how it can furnish evidence that can be used in training and decision support but how to tailor different types of support to different types of user.

The tension then for clinical practice, arising from the application of a more ecologically valid framework for decision making surrounds some the following issues: a) conceptualising, studying and minimising error; b) the use of evidence and expertise and the implications of this for clinician training; c) the largely collaborative nature of many health care decisions.

a) The ecological complexity of health organizations decision scenarios suggests that a more naturalistic stance on errors would conceptualise them as having multiple sources. NDM could potentially contribute in a substantial way to our understanding of *how and when errors can arise and what their consequences are, particularly the penalties incurred*. In so doing, this research could afford critical pointers for intervention whether through education, training, and/or in-situ decision support. Here, therefore we concur with Lipshitz et al’s (2001) review, noting that NDM researchers have worked at the ‘macro level to the understanding of errors; entailing concerns for application’.

b) The use of the NDM model to improve the quality of health care decisions requires a detailed understanding of skilled or expert performance and in particular the transition process from novice to expert (Patel et al 2000). Given that by definition, expert knowledge is domain specific and thus not necessarily transferable,

it is critical to understand the more generic process of becoming 'expert'. The question for NDM is then 'how can this expertise be trained?', 'Can the learning required be accelerated or is it something that can only be acquired through experience?' There may well be instances where conceptual knowledge may on the other hand promote misunderstanding and sub-optimal decision making, but we know very little about these instances and when they can arise.

For educational and training purposes, NDM then needs to reckon with the question of how such conceptual knowledge is acquired, how it can be acquired, whether it can be trained and if so, how, and when it works and when it does not, in the process of decision making. It is also important to recognise that there are different types of knowledge to be acquired and to investigate the differential impact this has on decision making at different stages in the learning process. It might be possible thus to develop a set of benchmarks for training (e.g. Yale & Patel 1999). In short, whilst expertise may be the 'gold standard' for judging the quality of the decision, we need to know a lot more about what this constitutes, how it can be acquired and how we can tell when someone *has* become 'expert'.

c) The third consideration arising from the need to develop decision support is the social and collaborative nature of many health care decision making scenarios (Patel et al 2000). For example, in an ethnographic study of critical care, Chase (1995) described a hierarchy of nurses who all helped to solve problems, with experienced staff providing support for less experienced staff. The latter also commonly called upon their more senior colleagues for help in making decisions. Some have argued that a 'distributed cognition' approach is most suited to understanding decision processes in a collaborative context, especially insofar as one of the key facets of this context may be artefactual rather than human (i.e. medical

technology must be considered to be part of a single indivisible cognitive system as a whole) (Hutchins 1995; Salomon 1993). To inform decision making at this higher order level of analysis, NDM approaches will benefit from a consideration of the 'distributed' nature of the decision making process, and how in particular, decisions are jointly negotiated by participants potentially all differing widely in their degree of expertise.

Conclusions

It is clear from our review that one commonality which is embedded within the rationale of researchers who explore decisions within organizations is - pragmatism. Decision researchers aim to apply their findings to the actors within organizations, offering a practical understanding of decision making which is often unobtainable from laboratory-based research inquiry.

In part, the question of what can the NDM framework learn from organizational decision research has emerged from this review. Essentially, it appears in the past decade that within organizational behaviour research concerned with decision making a number of macro and micro perspectives have become apparent. This has included a continued concern for the environment, the use of power and legitimacy within organizations, and sensemaking as a narrative story telling process of decision making, enabling participants to map their reality. On the one hand, selected organizational research communities, for example healthcare appear to have absorbed the NDM framework as a fairly successful form of research inquiry. However, there are many further research questions which require investigation here, not least reconciling how we can tell when someone has become an expert or how NDM approaches can explore distributed cognition.

A research thread in the organizational literature is the current movement away from hierarchy and the vertical organization toward projects, horizontal structuring, and self-managed teams. These changes may raise doubts about the degree to which generic norms and scripts affect decision making. The routines, roles, and expectations that allow for the operation of decision making seem to be giving way to intimacy, discretion, close proximity, and smaller sized communities of practice where people work primarily as collaborators rather than as experts. If organizations keep changing their mission, size, and composition, then the impact of generic rules upon decision making becomes meaningless. This suggests that we need to pay close attention to the microdynamics such as those associated with close relationships (Berscheid et al 1989) and how they might influence the study of NDM. Moreover, it suggests that we need to know what happens to decision making when it is organized horizontally rather than vertically. Are there changes in the impact of generic rules and scripts and controlled processing? If so, how do these changes affect other processes such as selection and scanning?

One of the difficult things we need to know more about are the boundary conditions for some of the decision making processes, such as self-fulfilling prophecies, enactment, behavioral commitment, labeling, innovation, and the management of meaning. NDM research needs to pay more attention to three things in relation to organizations: constraints imposed by context; distributed information; and differentials in power and vested interests. Thus, we need to know what happens to NDM when these three sources of constraint vary.

In sum, our review concurs with and extends Connolly and Koput's (1997) sketch of NDM and NOT. We, like them were excited by the way in which these

theoretical areas clearly stimulate each other. This conversation may still at present, be serendipitous but is now set to continue for some time.

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