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**On the Relevance of Cognitive Continuum Theory and Quasirationality for Understanding
Management Judgment and Decision Making**

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Abstract

‘Quasirationality’ (i.e., the combination of intuitive and analytic thought) is increasingly considered to be widespread and beneficial in management. This paper provides an overview of this concept as it is defined by Cognitive Continuum Theory (Hammond, 1996, 2000), and highlights the relevance of the theory for studying managerial judgment and decision making. According to Cognitive Continuum Theory, there are multiple modes of cognition that lie on a continuum between intuition and analysis. Quasirationality is the prevalent mode of cognition. Cognitive (managerial) tasks vary in their ability to induce intuition, quasirationality or analysis, and performance is contingent on the correspondence between task properties and cognitive mode. Using Cognitive Continuum Theory, management researchers can identify tasks requiring different modes of thought, and recognize when quasirationality may outperform analysis and intuition. Researchers can also utilize Cognitive Continuum Theory to iron out some identified anomalies in the strategic management literature and to provide a more refined theoretical framework in this context.

Keywords: Management judgment and decision making, Cognitive Continuum Theory, Intuition, Analysis, Quasirationality.

Introduction

Most contemporary research on judgment and decision making has focused on the strengths of analytic cognition and the limitations of intuition (see e.g., Cabantous & Gond, 2010; Gilovich, Griffin, & Kahneman, 2002). However, there is an emerging trend towards acknowledging the benefits of intuitive thought (see e.g., Dane & Pratt, 2007; Gigerenzer, 2007; Gigerenzer, Todd, & the ABC Research Group, 1999; Hodgkinson, Sadler-Smith, Burke, Claxton, & Sparrow, 2009; Hodgkinson, Langan-Fox, & Sadler-Smith, 2008; Sadler-Smith & Sparrow, 2008; Salas, Rosen & DiazGranados, 2010). Although management scholars now recognize that intuition is both an important and necessary cognitive tool for managing an organization, they also recognize that it is not sufficient: Effective managers have to employ a combination of intuition and analysis, as appropriate to particular situations (Simon, 1987). Unfortunately, research has tended to focus on one or the other of these modes of cognition and there is a dearth of research directed at their shared use or the middle-ground between intuition and analysis (i.e., “quasirationality”; Hammond, 1996, 2000). This is a crucial omission because if managers focus too strongly on, say, analytic techniques, at the expense of using intuition in a context where substantial use of the latter is likely to be beneficial, then not only is the optimal decision outcome unlikely to be achieved but this process is likely to prove very expensive for the organization (Forbes, 2007). What is needed, therefore, is research designed to determine the most efficient combined amounts of intuitive and analytic thought to be used by managers in particular decision situations.

The main aim of the present paper is to introduce the relevance of Hammond’s (1996, 2000) Cognitive Continuum Theory and the concept of quasirationality for understanding the combined use of analytic and intuitive thought in management decision contexts. Using the

theory, management scholars can more clearly define and measure the properties of managers' 'quasirational' thinking, as well as their intuitive and analytic thought processes. Management scholars can also use Cognitive Continuum Theory to predict the conditions under which managers are likely to move from one mode of cognition to another, as well as the level of performance they are likely to achieve in doing so.

The present paper is divided into three sections. In the first, we note how the traditional appeal of normative models of judgment and decision making stressing the value of rational (or analytic) thinking have been challenged in the management context. We discuss how recognition of the importance of non-analytic or intuitive thinking has more recently moved to a consideration of the relevance of managerial quasirationality or a middle-ground between intuitive and analytic thought. In the second section, we outline the development and main tenets of Cognitive Continuum Theory, describing how it defines the middle-ground between intuition and analysis (i.e., quasirationality). We identify the tasks in which quasirationality is likely to be most effective. We also review the small body of emerging literature that tests this theory, and identify emerging criticisms and limitations of Cognitive Continuum Theory. In the final section, we provide examples of how quasirationality may be a frequent and appropriate mode of cognition in the management context. Here, we also suggest directions for future research applying Cognitive Continuum Theory to managerial judgment and decision making, and we highlight the potential challenges faced by researchers attempting to apply the theory.

Modes of Cognition in Management

The Normative View: Analysis

The economic approach to rationality (e.g., Savage, 1954; von Neumann & Morgenstern, 1947) makes distinct assumptions about individual cognitive capacity and task characteristics,

and prescribes a particular procedure for choosing a course of action. It is stated that an individual should attach values and probabilities to the costs and benefits of a course of action; weight the values by their probabilities; integrate these for the costs and benefits; and then choose the course of action that maximizes utility. Thus, to behave rationally, a manager would have to be aware of all the available decision alternatives as well as their potential costs and benefits, and be able to attach correct values and probabilities to the costs and benefits, multiply and then integrate this information, and compare the utilities across actions so as to choose the best course of action.

These assumptions can be easily undermined. For instance, when making decisions, managers seldom have all of the relevant information available to them or the time to carefully think about this information. In addition, managers (like other people) do not necessarily possess the cognitive capacity to process the information as required. Nevertheless, economic theorists would argue that this is how managers should *ideally* behave when faced with a decision.

Proponents of the economic approach to rationality have mostly been guided by a “coherence” approach to cognition where competence is defined in terms of internal consistency (Hammond, 1990; see also Hastie, 2001). Here, an individual’s performance on a cognitive task is assessed against normative benchmarks such as expected utility theory and probability theory. The main finding of research testing the economic approach, however, has been that people do not typically use pure analysis as represented by the normative models, and that intuition or non-analytic modes of cognition exemplified by use of heuristics lead to systematic biases and suboptimal performance (see e.g., Edwards, 1961; Einhorn & Hogarth, 1981; Gilovich et al., 2002; Kahneman, Slovic, & Tversky, 1982; Slovic, Fischhoff, & Lichtenstein, 1977). Researchers have sometimes followed up such work by creating prescriptive decision tools for

altering the judgment and decision making process to increase the use of analysis and thus improve performance (see e.g., Edwards, Miles, & von Winterfeldt, 2007). In this sense, while analysis is applauded and strived for, intuition is reviled and banned (Sinclair & Ashkanasy, 2010).

In the management context, Simon (1957) challenged the economic approach which assumed that managers make consistent, value-maximizing calculations. He argued that managers are bounded in their rationality because they are constrained by the complexity of organizations and by their own restricted information processing capacities. Simon noted that instead of engaging in extensive analytic decision making activities, people usually settle for a decision which is ‘satisfactory’ – one that is good enough. However, as noted by Bazerman and Moore (2009), although the concept of bounded rationality highlighted that managerial decision making deviates from the assumptions of rationality held by economists, it failed to identify just how this might be.

The Descriptive View: Intuition

Later, Kahneman and Tversky’s (1972, 1973, 1979) ‘heuristics and biases’ research program demonstrated some of the heuristic principles that managers may rely on to simplify the complex task of assessing probabilities. In some circumstances, however, the use of heuristics leads to systematic and predictable biases. For instance, managers using the ‘availability’ heuristic tend to assess the frequency or probability of an event by the ease with which instances or occurrences can be brought to mind. When the retrievability of instances is not associated with their probabilities, the resulting judgment can be biased. Similarly, managers using the ‘representativeness’ heuristic make a judgment about an occurrence (or object or a person) by the similarity of that occurrence to previously formed stereotypes. This leads them to ignore

important but non-salient information. Finally, managers using the ‘anchoring and adjustment’ heuristic make estimations by starting at an initial value and adjusting from this to reach a final value. However, this adjustment tends to be biased by the value of the initial anchor. The heuristics and biases program led to the view that management judgment was largely influenced by these unconscious processes. For example, Barnes (1984) and Schwenk (1984) discussed the prevalence of various biases in a strategic management context and Miller and Sharpia (2004) discussed them in relation to real option valuation.

Intuition, defined as “a capacity for attaining direct knowledge or understanding without the apparent intrusion of rational thought or logical inference” (Saddler-Smith & Shefy, 2004, p. 77), is a concept that, according to Hodgkinson, Langan-Fox and Sadler-Smith (2008, p. 1), “has truly come of age”, finally being recognized as a viable construct. By contrast to emphasizing the benefits of analysis and the pitfalls of intuition in the coherence tradition of the field of judgment and decision making, research by management scholars in the field of organizational decision making has increasingly focused on discerning the positive aspects of non-analytic modes of cognition such as intuition (e.g., Agor, 1989; Eisenhardt & Zbaracki, 1992; Khatri & Ng, 2000).

Dane and Pratt (2007) reviewed several studies on intuition in the management context and identified a number of situations in which intuition is likely to be an effective cognitive mode, such as when the task requires judgmental rather than intellectual thought. Sadler-Smith and Sparrow (2008) discussed a wide range of research conducted from a number of different perspectives that adopted a particularly positive view of intuition. One such perspective views intuition as an ability, such as that involved in appraising situations holistically and interpreting patterns (e.g., Klein, 2003; Showers & Shalrin, 1981). Other positive views include seeing intuition as a way of processing complex information (e.g., Payne, Bettman & Johnson, 1993), as

an awareness of thoughts and feelings associated with a deeper perception and understanding of an issue (e.g., Sadler-Smith & Shefy, 2004), or as a competing and inductive way of knowing something (e.g., Davis-Floyd & Arvidson, 1997).

However, as emphasized above, although a number of management scholars have argued that intuition is a necessary cognitive tool for managing an organization they acknowledge that it is not sufficient (e.g., Simon, 1987). Consider the following quote:

It is a fallacy to contrast ‘analytic’ and ‘intuitive’ styles of management...Every manager needs to be able to analyze problems systematically (and with the aid of the modern arsenal of analytical tools provided by management science and operations research).

Every manager needs also to be able to respond to situations rapidly, a skill that requires the cultivation of intuition and judgment over many years of experience and training. The effective manager does not have the luxury of choosing between ‘analytic’ and ‘intuitive’ approaches to problems. Behaving like a manager means having command of the whole range of management skills and applying them as they become appropriate (Simon, 1987, p. 63).

More recently, researchers have focused on the idea that managers may move back and forth from intuitive and rational or analytic thinking (Sadler-Smith & Sparrow, 2008). In situations that require only routine decisions, such as the selection of a staff member to carry out a particular task, intuition can be sufficient. But, when more demanding decisions are being made, such as in an optimization task, analytic thinking is argued to become involved. This usually enhances decision making, but it can fail if the demands of the task are beyond human information processing capacity. Therefore, although it is recognized that managerial judgment and decision making is not always fully rational (in a normative sense), management scholars

hold the view that managers may nevertheless use rational (or analytic) processes on occasions. It is unclear, however, the conditions under which this ‘switch’ might occur, and why one mode of cognition may outperform the other.

Between Intuition and Analysis: Quasirationality

Indeed, there are many situations where either analysis or intuition cannot be easily employed (Hammond, 1996). For instance, beyond the argument that pure analysis can only be employed by those trained in it, some tasks may be ill-structured thus outside the scope of the application of pure analytic models. Similarly, although intuition is potentially available to everyone, it may be considered unjustifiable in some contexts. In the management domain, there are many obstacles and challenges to the use of pure analysis and pure intuition. Therefore, upon observing the characteristics of management tasks, it is clear that intuition and analysis alone cannot explain how managers perform these tasks. Successful managers must use a combination of the two (Simon, 1987), and so the notion of quasirationality is necessary to our understanding and assessment of managerial judgment and decision making.

An issue in strategic management research, which is highly relevant to the idea of using a combination of analytic and intuitive judgment, is whether the degree of “comprehensiveness” i.e., the extent to which organizations “gather and analyze environmental information in order to prepare strategic decisions” (Brinckmann, Grichnik & Kapsa, 2010, p. 28) influences improved decision making. Forbes (2007) reviewed the literature published on this issue since 1990 and identified two contrasting views – one asserting that instability in the environment enhances the benefits of adopting a comprehensive decision making approach and the other arguing that it decreases the benefits. In his analysis of the previous research, Forbes developed a 2 x 2 model of the value of comprehensiveness as moderated by the level of environmental uncertainty and

found that, in three out of the four conditions, decision quality was not influenced by comprehensiveness. The only condition where comprehensiveness had a positive affect on decision quality was when the quantity and determinacy of information were both high.

However, Miller (2008) found the situation, with respect to more stable environments, to be more complex than previously recognized. Specifically, comprehensiveness and performance were connected through an inverted U-shaped function in more stable environments. Thus, when comprehensiveness is beneficial to performance it is only likely to be so up to a point and, thereafter, the added value arising from systematically gathering and processing information from the external environment is likely to diminish relative to the costs of making decisions in this manner. Accordingly, there is a need to determine the most cost-effective cut-off point for using a comprehensive decision strategy in a given context. One way to do that is to apply the notion of “quasirationality” (i.e., the combination of analytic and intuitive thought used in decision making). Cognitive Continuum Theory defines quasirationality, and can be used to investigate strategic management decisions, thus enabling researchers to more precisely measure and evaluate the appropriateness of comprehensiveness levels in specific circumstances.

Cognitive Continuum Theory

Cognition as a Dual Process Versus a Continuum

Typically, theories on modes of cognition have focused on the dual processes of intuition and analysis (e.g., Epstein, 1994; Evans & Over, 1996; Sloman, 1996). In the field of reasoning, dual process theorists have argued that there are two separate cognitive systems: System 1 is generally considered to be an automatic, associative, holistic, fast process, requiring little cognitive effort that is acquired through evolution, development and experience. System 2 is generally characterized as a relatively-slow, controlled, rule-based, analytic process that is

cognitively demanding and is learned via formal tuition. In the field of judgment and decision making, System 1 refers to intuition and System 2 refers to analysis (e.g., Kahneman, 2003). Although there is some empirical support for dual process accounts (e.g., Stanovich & West, 1998; 2000; 2003), these theories have been criticized for their limited explanation of how the two systems (or modes of cognition) may interact (for an exception see Epstein, Pacini, Denes-Raj & Heir, 1996). The argument that people rely on intuitive and rational processes at the same time was also recently stressed in a strategic management context by Hodgkinson and Clarke (2007). For the most part, however, dual process theories consider that the two modes of cognition are in competition or conflict (an ‘either-or’ approach), but few details are provided on the nature of this relationship.

One of the most important recent developments in the field of judgment and decision making is the recognition that analysis and intuition can be integrated into one coherent theoretical framework. Beyond that, there is a slow recognition that the traditional view of two modes of cognition—either analytic or intuitive—is a false dichotomy. Both of these developments are inherent to Hammond’s (1996, 2000) Cognitive Continuum Theory which provides a comprehensive view of modes of cognition by identifying modes of cognition that lie in-between intuition and analysis (and which rely on a combination of each). In fact, the theory emphasizes the prevalence of quasirationality, as opposed to pure analysis or pure intuition in human judgment and decision making. Cognitive Continuum Theory also highlights the importance of the interaction between cognition and the task for judgment and decision making.

Theoretical Underpinnings of Cognitive Continuum Theory

Cognitive Continuum Theory is founded on the principles of Brunswik’s (1943, 1952, 1956) theory of probabilistic functionalism, and on social judgment theory (Hammond, Stewart,

Brehmer, & Steinmann, 1975). After pointing out that the environment is not always perfectly predictable, Brunswik argued that psychological processes are adapted to the environments in which they function, and so should be described and assessed in these environments (see Dhimi, Hertwig, & Hoffrage, 2004). In his research, Brunswik (1944) sought to describe the nature of environments and cognitive processes, as well as the match or mismatch (correspondence) between them. In an effort to understand this correspondence, he recognized the benefits of both analysis and intuition while acknowledging the limitations of both. He introduced the notion of quasirationality as a compromise between the use of pure analysis and pure intuition.

Social judgment theory, which is founded on Brunswikian principles, provides a framework for research on human judgment and decision making (Hammond et al., 1975). There are four basic goals of such research: (a) to analyze judgment tasks and cognitive processes, (b) to analyze the structure of achievement of environmental criteria (e.g., accuracy in forecasting sales) and agreement between individuals' judgments, (c) to understand how people learn to achieve and agree, and (d) to find methods for improving achievement and agreement (see Brehmer & Joyce, 1988). The model of the environment thus serves as a benchmark for assessing performance, and indicating how judgment can be improved (Hursch, Hammond, & Hursch, 1964). Here, individuals' performance is measured relative to some environmental criterion. For example, Ashton (1982) measured how well executives, managers, and sales personnel predicted advertising sales for a magazine based on a set of cues (pieces of information).

All of these theories (i.e., Cognitive Continuum Theory, probabilistic functionalism, and social judgment theory) are guided by the 'correspondence' (as opposed to coherence) approach to cognition where competence is defined in terms of empirical accuracy (Hammond, 1990). Performance may be enhanced by cognitive feedback and cognitive (decision) aids (Todd &

Hammond, 1965; Balzer, Doherty, & O'Connor, 1989). Here, individuals can be provided with cognitive feedback about the formal properties of the task such as the redundancy and predictive validity of information, as well as the properties of the individual's judgment policy such as their use of information, and the match between properties of the task environment and the individual's judgment policy such as level of achievement of the criterion (e.g., accuracy of an individual's sales forecasts). Importantly, improvement of performance does not necessarily require greater use of analysis (or use of all relevant and available information), but rather as some would argue (see Gigerenzer et al., 1999) the appropriate use of the most predictively valid pieces of information.

Main Tenets of Cognitive Continuum Theory

Emerging from the above correspondence tradition in the early-1980s (Hammond, 1978a; 1980; 1981; 1986; 1990; Hammond, Hamm, Grassia, & Pearson, 1987), Cognitive Continuum Theory has since grown in depth, breadth, and precision of coverage (Hammond, 1996, 2000). The theory explicitly rejects a dichotomous view of intuition and analysis, and states that there are modes of cognition which can be arranged along a continuum ranging from pure intuition at one pole to pure analysis at the other. The modes of cognition that lie in between these poles include a variable combination of both intuition and analysis, and are referred to as quasirationality. Most judgments involve some mix of both intuition and analysis. In addition, cognitive tasks can also be arranged along a continuum in terms of their ability to induce intuition, quasirationality, or analysis. When performing a task, cognitive activity moves back and forth along the continuum. Success on a task inhibits movement (or change in cognitive mode) while failure stimulates it. Movement along the cognitive continuum is oscillatory or alternating, thus allowing compromise between intuition and analysis (i.e., quasirationality).

The theoretical framework provided by Cognitive Continuum Theory affords specific predictions of task-motivated cognitive behavior which, as argued by Mahan (1994, p.90), “is likely to provide a more detailed examination of human cognition over the more traditional approaches of applying normative standards in the assessment of cognitive efficiency.” It consigns the cognitive behavior of managers into general organizing principles from the first mode which includes strong analytical activity to the last mode which features the most intuitive form of cognition (see, for example, Hammond, 1978b; see Figure 1). These principles are used to guide research predictions and their efficacy can be tested by a variety of appropriate research methods (e.g., lens model analysis; see Hammond et al., 1975).

INSERT FIGURE 1 ABOUT HERE

One important prediction of Cognitive Continuum Theory is that performance is contingent on the correspondence between the task properties and the individual’s cognitive mode (Hammond, 1988). Thus, pure analysis need not be the ceiling for performance.

Modes of cognition along the cognitive continuum can be quantitatively differentiated from one another based on a set of properties. Some of the defining properties of intuition and analysis are presented in Table 1 (see also Doherty & Kurz, 1996). Quasirationality involves a varied combination of the properties of intuition and analysis. There are different degrees of quasirationality as measured by different combinations of analysis and intuition in terms of nature and degree. In this sense, quasirationality may sometimes lie closer to the intuition end of the cognitive continuum and sometimes closer to the analytic pole. Quasirationality is a dominant mode of cognitive activity, and it is rare for any task to involve pure intuition or pure analysis.

INSERT TABLE 1 ABOUT HERE

Cognitive tasks along the task continuum can also be quantitatively differentiated from one another with regard to their properties or their tendency to induce intuition, quasirationality, or analysis. Table 2 presents some of the task properties that are theorized to induce intuition and analysis (see also Doherty & Kurz, 1996). A task comprising either intermediate levels of these properties or a combination of the properties that would typically induce pure intuition or pure analysis will instead induce quasirationality. The cognitive mode induced will depend on the number, nature, and degree of task properties present. Depending on the demands of task, quasirationality may imply a combination where there is greater use of intuition than analysis or vice, versa.

INSERT TABLE 2 ABOUT HERE

Tests and Criticisms of Cognitive Continuum Theory

Although Cognitive Continuum Theory is a relatively recent theory there is emerging supporting evidence. First, with regard to the differentiation of modes of cognition, it has been reported that cognitive control which is the ability to consistently apply a judgment policy is higher under analytic than intuitive cognition (Dunwoody, Haarbauer, Mahan, Marino, & Tang, 2000; Hammond et al., 1987). A nonlinear organizing principle producing judgments is indicative of analysis whereas linearity is indicative of intuition (Hammond et al., 1987). The error distribution of judgments is more peaked and has longer, fatter tails (than would be the case in a normal distribution) under analytic than intuitive cognition (Dunwoody et al., 2000; Hammond et al., 1987). Under analytic cognition, confidence in the way the judgment is made is higher than in the actual judgments, whereas under intuition confidence in method is lower than confidence in the outcome (Dunwoody et al., 2000; Hammond et al., 1987). Faster response rates are indicative of intuition whereas slower responses are indicative of analysis (Dunwoody et al.,

2000). Self-insight into a judgment policy is greater under analysis than intuition (Dunwoody et al., 2000).

Second, there is also evidence to support the idea that different task properties induce different modes of cognition (Dunwoody et al., 2000; Hamm, 1988b; Hammond et al., 1987; see also Mahan, 1994). Depth properties of the task refer to the associations between variables that are not immediately available to the individual. The depth properties that have been studied include number of cues, redundancy among cues, cue weights, standard deviation of cue weights, availability of organizing principle, degree of nonlinearity in the organizing principle, and environmental predictability. Surface properties refer to the display of task variables available to the individual, and those which have been examined include different ways of displaying or representing information (i.e., iconic, film, numeric, formula, and bar graph). The modes of cognition induced by these properties are as in Table 2 (e.g., redundant cues induce intuition whereas independent cues induce analysis).

Third, Hamm (1988b) showed that cognitive mode can shift during a task. The rate of alternation between intuition and analysis is dependent on the stringency of task standards, and the overall cognitive mode is affected by the tendency of the task to induce intuition. Hamm (1988b), however, found little relationship between alternation of cognitive mode and success or failure in a task.

Finally, the prediction that performance is contingent on the correspondence between task properties and the individual's cognitive mode has received empirical support. Hammond et al. (1987) found that achievement was greater when cognitive mode matched that induced by task properties (see also Dunwoody et al., 2000). Furthermore, they demonstrated that pure analysis does not always provide a ceiling for performance. In an unpublished thesis, Reese (2005) also

found some evidence for the idea that task properties induce particular modes of cognition, and that matching the mode of cognition to specific properties of the task will improve performance. However, an individual's initial cognitive mode is influenced by his/her preferred thinking style (an individual difference variable) as well as the task properties.

There is also some indirect evidence to support the assumptions made about the impact of task properties on the mode of cognition listed in Table 2. For example, studies support the idea that experts are more likely than novices to use non-compensatory simple heuristics, which are akin to intuitive processing (e.g., Garcia-Retamero & Dhami, 2009). Memory research also suggests that it may be more difficult for people to consciously process more than 5 pieces of information (e.g., Miller, 1956). There is evidence to support the idea that high time pressure leads to use of non-compensatory simple heuristic strategies (e.g., Rieskamp & Hoffrage, 1999).

However, there is also evidence contrary to the assumptions made in Table 2. For instance, literature on simple heuristics (considered to be more akin to intuitive processing) indicates that people using simple heuristics can also use sequential search of information (e.g., Dhami & Ayton, 2001; Gigerenzer & Goldstein, 1996). Emerging evidence suggests that visual representation of risk information may actually lead to more analytic thought (e.g., Garcia-Retamero & Dhami, 2011). Finally, the assumptions about the impact of familiarity with the task and prior training/knowledge of the task are in opposite directions, even though the two properties are similar. This point is also true for the assumptions about feedback availability and outcome knowledge. Thus, further thought and research are needed to identify the task properties that may induce different modes of cognition, and quasirationality in particular.

Cognitive Continuum Theory has also been criticized on other grounds. For instance, some tasks are not easily amenable to deconstruction in terms of their properties, and the

objective properties of tasks may be subjectively construed differently by the decision maker, thus limiting the applicability of the theory (Doherty & Kurz, 1996). Cognitive Continuum Theory also does not specify the number and degree of variation in task properties that would induce a shift in cognitive mode (Dunwoody et al., 2000). Although Cognitive Continuum Theory goes further than other approaches in defining specific properties of intuition and analysis (see Table 1), these definitions are limited and do not include a sufficiently precise definition of quasirationality.

Nevertheless, a few applications of Cognitive Continuum Theory have already emerged in the examination of expert judgment in several contexts, such as in those relating to management (Mahan, 1994), nursing (Cader, Campbell, & Watson, 2005; Offredy, Kendall & Goodman, 2008; Standing, 2008), engineering (Hamm, 1988b; Hammond et al., 1987), clinical decision making (Kam, Chismar, & Thomas, 2004; Hamm, 1988a), and retail (Mathwicka, Malhotrab & Rigdon, 2002). In one study, Cognitive Continuum Theory was applied to the management context, and we review this in the next section.

Modes of Cognition in Managerial Judgment and Decision Making

Application of Cognitive Continuum Theory to Management

Mahan (1994) used Cognitive Continuum Theory to evaluate and measure the effects of various stressors on the performance of complex decision tasks in an occupational context. He found empirical support that two occupational stressors—task duration and task uncertainty—induce a shift in cognitive mode towards intuition and away from analytic decision making. However, this shift towards intuition had a negative impact on performance. Clearly, an important challenge for managers involves overcoming stress inducing variables in the workplace in order to maintain appropriate decision making strategies. Here, Cognitive Continuum Theory

can be used as a framework to identify potential situations where performance is likely to decrease, and suggest ways in which the workplace can be adapted to minimize such performance decrements.

To-date, Mahan's (1994) is the only published study of Cognitive Continuum Theory in the management context. Nevertheless, it is clear that this theory may be particularly useful for our understanding and assessment of several areas of managerial judgment and decision making. Managers, in common with other types of experts, make decisions under risk and uncertainty, which can have important consequences for others as well as themselves. Their decisions may be on repeated (routine) tasks as well as one-off (novel) tasks. Managers may make decisions alone or in groups, and sometimes with the aid of a support system. Examples of managerial decisions include, among other things, staff recruitment, scheduling, appraisal and promotion, product selection, inventory management, sales forecasting, as well as budgeting and pricing. These tasks may be characterized by properties which induce analysis, intuition or quasirationality. It is generally agreed that many important management tasks involve, for example, relevant information that requires processing beyond the cognitive capacity of the unaided mind, limited information, uncertainty about the relevance of available information, uncertainty about the outcome, risk, scarcity of resources, time pressure, stress and anxiety, and the need to justify decisions on grounds of legality and practicality (Bazerman, 2005). These are precisely the types of situations where analysis and intuition alone would be difficult or inappropriate to apply, and thus situations that require the middle ground of quasirationality.

Quasirationality in Management

In fact, there are a few emerging examples of published research showing the appropriateness of quasirationality in the management context, although they do not apply

Cognitive Continuum Theory. For example, Blattberg and Hoch (1990) studied the efficacy of quasirationality in forecasting under situations where managers must process ever-increasing amounts of information when making decisions, which is one of the contemporary challenges of management. Blattberg and Hoch (1990) compared the performance of a quasirational model against managerial intuition (expert) and application of a statistical (analytic) model in five forecasting tasks (i.e., two tasks concerned buyers' predictions of catalog sales of fashion merchandise and three tasks involved brand managers' predictions of coupon redemption rates). They found that the quasirational model which combined managerial intuition with a statistical model repeatedly outperformed both pure intuition and pure analysis. This study adds to the body of emerging literature demonstrating that forecasting is generally more effective when combining the forecasts of experts and statistical models (e.g., Conroy & Harris, 1987). Expert intuition and analytic models each have their strengths and weaknesses. To some extent analytic models and intuitive management are substitutable as they take into account much of the same relevant information, but in other ways they are complementary: The former combine data in a consistent and unbiased manner, while the latter are flexible and have insights about the task environment that models fail to incorporate. The quasirationality approach thus benefits from the strengths of both intuition and analysis.

Given the emphasis that many organizations place on participative management and democratic or consensus based decision making, it is important to extend Cognitive Continuum Theory to the group level of analysis. Hamm (1989) has shown that the mode of cognition induced when groups work face-to-face is different from when they do not. In addition, Cognitive Continuum Theory can be used to classify the mode of cognition typically used by groups, and to identify tasks where group decision making would correspond to the task properties inducing that

particular mode of cognition, thus increasing group performance. Furthermore, Cognitive Continuum Theory can be used to create and organize groups comprising individuals whose preferred cognitive modes can compensate for one another thus making them more adaptable, or comprising individuals with compatible cognitive modes thus making them more harmonious. The notion that different managers have different “decision styles” is already commonplace in the field of management (e.g., Fox & Spence, 1999), and Cognitive Continuum Theory could be used to more precisely define these “styles” in terms of modes of cognition. This type of analysis also extends past research attempting to identify the optimal characteristics of top management teams in terms of demographic characteristics, experience, and personalities by introducing another individual difference measure namely preferred cognitive mode (e.g., Kauer, Waldeck, & Schaffer, 2007).

Finally, in an age of information technology, managers performing some tasks may have the opportunity to use decision support systems to aid them in their judgment and decision making. There is evidence, however, that executive support systems are shunned by managers who prefer to apply non-analytic modes of cognition (Elam & Leidner, 1995). This has led some to argue for the development of support systems that combine analytic and non-analytic approaches to judgment and decision making, and even to develop systems that help the user alternate between different modes of cognition by changing the way the task is presented (Kuo, 1998). Cognitive Continuum Theory can provide a useful framework for the development of support systems that enable and encourage quasirationality by identifying the task properties which induce this mode of cognition and by defining the properties of intuition and analysis that ought to be combined in order to have the most appropriate degree of quasirationality. Cognitive

Continuum Theory can further be used to increase the correspondence between cognitive mode and task properties so that the ceiling level of performance in a particular task is achievable.

Directions and Challenges for Research on Cognitive Continuum Theory and Quasirationality in Management

Although it is clear that quasirationality is a prevalent and appropriate mode of cognition for many common and consequential management tasks, to-date, few researchers have studied the structure of management tasks and the cognitive processes of individuals performing these tasks from either the Brunswikian or social judgment theory perspective (Dhami et al., 2004; Karelaia & Hogarth, 2008). Even fewer have applied Cognitive Continuum Theory to the management context. This is particularly disconcerting since the findings of such research can have potentially profound practical and policy implications for management. Cognitive Continuum Theory offers an operational definition of the concept of quasirationality, and so it would be valuable to determine the appropriate nature and degree of this combination in particular management tasks. There are several avenues for research when applying Cognitive Continuum Theory to managerial judgment and decision making, following from the review of the theory in the previous section, and in addition to the fruitful areas of application of the theory to the management context described above.

Given that Cognitive Continuum Theory requires a precise language to describe both tasks and cognition, it is useful to deconstruct the properties of common management tasks. However, deconstruction of the properties of management tasks will not be easy given that a comprehensive theory of cognitive tasks is largely lacking in the psychological and management literatures. One approach (see also Table 2) would be to distinguish between what Hammond (1966) called the substantive and formal task properties. The former focuses on the surface

content of the task (e.g., recruitment) and the latter focuses on underlying features that may be common across various tasks (i.e., amount of information, values of pieces of information, distribution of these values, intercorrelations among pieces of information, and predictive validity of information). These underlying features can have an impact on the decision strategies employed.

Once properties of common management tasks have been identified, it is then useful to classify those that would induce intuition, analysis, and quasirationality. For the most part, this will entail searching the psychological and management literatures for studies demonstrating the effects of specific features of tasks on individuals' decision strategies. The challenge here would be to ensure one has a clear and comprehensive definition of the various modes of cognition so that specific strategies can be unambiguously categorized as falling into one mode or another. Unfortunately, whereas theorists have been precise about defining analysis, they have not always been as clear about the definition of intuition. Table 1 provides one attempt at a definition of these extreme modes of cognition, and although Figure 1 illustrates the middle-ground of quasirationality, there is as yet no precise definition of the various modes of quasirationality.

A clear definition of the different modes of cognition available to managers as well an understanding of the precise properties of different management tasks, can make it possible to discern which mode of cognition managers prefer to use generally (e.g., akin to a 'management decision style'), and which they prefer to use when performing specific management tasks (e.g., akin to the notion of an 'adaptive manager'). This would help explain their level of performance in a task and highlight the degree to which their cognitive mode needs to be altered in order to increase performance. In the context of strategic management, it would also prevent managers from embracing or avoiding costly analytic practices exclusively on the basis of environmental

stability levels. These specific advantages have the potential to make further advances in the strategic management issue of comprehensiveness, for example, building on the recent findings of Miller (2008).

Indeed, the fact that Cognitive Continuum Theory highlights the relationship between the task and cognitive mode has implications for the methods used by management researchers. To-date, research involving Cognitive Continuum Theory typically presents participants with scenarios that vary properties of the task such as information presentation format (e.g., pictorial or numerical; see Table 2). This has enabled researchers to test predictions about the level of cognition that participants might employ in order to make judgments about the scenarios. However, Dhimi et al. (2004) argue that researchers must use representative tasks or stimuli in order to enable an accurate description of cognition as it is applied in the individual's natural setting (e.g., management task) and thus to enable generalization to that setting.

Finally, it is worth noting that the management context itself can contribute to the development of Cognitive Continuum Theory in several ways. For example, in order to effectively and comprehensively apply the theory to managerial judgment and decision making, the theory needs to be expanded to account for the modes of cognition used by teams/groups as well as the properties of tasks when they are performed by more than one person. Cognitive Continuum Theory also needs to be expanded to include an understanding of the impact of information technology and support systems on the task and cognition.

A successful manager is often judged on the basis of his/her decision making ability. Indeed, management competency is often equated with being a competent decision maker. Researchers have traditionally been preoccupied with analytic cognition and its merits. Recently, however, there have been calls for research into intuition as a promising strategy for managerial

judgment and decision making (Dane & Pratt, 2007). To these, we add a call for further research into the utility of quasirationality in management. In particular, the opportunities that Cognitive Continuum Theory has to offer with regard to our theoretical understanding of management cognition in general, and managerial quasirationality in particular, remains to be explored. Cognitive Continuum Theory can be used to develop a dynamic theory of managerial judgment and decision making by allowing researchers to track movement back and forth along the cognitive continuum during a task and enabling them to explain patterns of shifting cognition in terms of, for example, success and failure on the task and the dynamic features of the task.

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Table 1. Some Defining Properties of Intuition and Analysis (adapted from Doherty & Kurz, 1996)

Property	Intuition	Analysis
Area of brain activity	Mostly right hemisphere	mostly left hemisphere
Consistency/reliability of judgments or cognitive control	Low	High
Awareness of cognitive activity	Low	High
Speed of cognitive activity	High	Low
Memory	Little encoding	Complex encoding
Metaphors used	Pictorial, qualitative	Verbal, quantitative
Information use	Flexible	Consistent
Confidence in judgments	Low	High
Errors in judgment	Many but small and normally distributed	Few but large and non-normally distributed

Table 2. Some Properties of the Task that Induce Intuition and Analysis (adapted from Doherty & Kurz, 1996)

Task Properties	Intuition	Analysis
Familiarity with task	Familiar	Unfamiliar
Prior training/knowledge of task	None	Some
Amount of information	>5 pieces of information	<5 pieces of information
Information presentation order	Simultaneous	Sequential
Information presentation format	Pictorial	Quantitative
Inter-relation of information	Redundancy	Independent
Interpretation of information	Subjectively	Objectively
Number of response options	Many	Few
Time pressure	High	Low
Feedback available	Little/none	Cognitive feedback
Outcome knowledge	Available	Unavailable

Figure 1. *Modes of cognition along the cognitive continuum*