A PRIMING / TEMPERAMENT MODEL
OF SYSTEM 1 AND SYSTEM 2 DECISION MAKING PROCESSES

DISSERTATION

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ABSTRACT

Research on judgment and decision processes has demonstrated two general decision modes: an intuitive, efficient, cursory process (System 1), and an analytical, high-effort, deliberative process (System 2). These two decision strategies have been assumed to be associated with controlled and automatic cognitive processes, respectively. It is unclear whether this is always necessarily the case – as automatic processes (e.g. priming effects) at the meta-decision level may lead an individual to become either more or less deliberative in examining information in order to form a judgment or make a decision. In four studies, the influence of priming effects upon decision behavior is investigated. Furthermore, this research provides an examination of how individual differences in decision making strategy use may similarly produce differences in information search strategies, as well as in decision outcomes. A model is tested across these studies in order to describe how the impact of priming influences and temperament may both stimulate information processing and choice behavior - a priming / temperament model of information processing in decision making.
Dedicated to the most loving and supportive people on the planet:
Mom, Dad, James and Michael
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CHAPTER 1

INTRODUCTION

The focus of research in human judgment and decision making, generally speaking, is dedicated to examining how people combine their desires (e.g. utilities, values, goals, etc.) and their beliefs (e.g. expectations, knowledge, means, etc.) to choose some course of action (Hastie, 2001). The study of judgment and decision making holds far-reaching implications across many diverse disciplines, and is applicable in virtually every discipline in which judgment and choice may play a key role. The behavioral research tradition in judgment and decision making emerged from two separate branches of research in the 1950s, which are reflected in the name of the discipline (for a review, see Goldstein & Hogarth, 1997). One of these thematic areas, judgment, is inspired by research on perception and prediction. In this research tradition, investigators seek to determine how people integrate various incomplete, imperfect, and sometimes incompatible cues to make sense of what is happening in the world. The other primary area of concentration, decision making, is inspired by the work of mathematicians and economists. This tradition is highlighted by a desire to understand preferential choice and corresponding decision behavior, namely in seeking to determine how people choose
what action to take in order to achieve complex, and often competing goals in an
certain world. Over the past 50 years, these two traditions have combined to a large
degree, reflecting the awareness that both judgment and decision processes must be
examined in order to fully appreciate human decision making behavior.

Historically, judgment and decision making research has reflected the assumption
that decisions are the product of conscious cognitive processes, through which
information is processed and subsequently transformed into judgments and decisions by
using specific inference rules. In 1954, Ward Edwards presented a ground-breaking
review of economic and statistical literature concerning individual decision making,
which paved the way for the psychological study of judgment and decision making. In
this review, Edwards outlined economic theories of riskless choice which assumed a
model of “economic man” as a completely informed, infinitely sensitive, and “rational”
being. For economic man to be considered rational, he/she must be able to put all
available states into a weak ordering (e.g., prefer B to A, A to B, or be indifferent), and
transitivity must hold within this ordering. The second requirement of rationality is that
economic man must make choices in a way allowing him/her to maximize something -
namely, utility in riskless choices, expected utility in risky choices. In his discussion of
riskless choice literature, Edwards provided some insight into how psychologists may
have important impact on decision theory. According to Edwards, psychologists should
be cognizant of the fact that human beings are neither perfectly consistent nor perfectly
sensitive – that, for example, indifference curves are observable as indifference regions or
probability distributions of choice around a central locus.
Along with outlining models of riskless choice, Edwards also reviewed economic and statistical literature concerning risk and uncertainty in this paper. This review has had a profound impact upon the decision making research produced by the psychological community today. Edwards provided a thorough discussion of research on expected utility maximization, beginning by delineating the traditional formula for calculating expected value:

\[
EV = p_1S_1 + p_2S_2 + \ldots + p_nS_n,
\]

where \( p \) is probability, \( S \) is the value of an outcome, and

\[
p_1 + p_2 + \ldots + p_n = 1.
\]

Edwards presented the fact that, although economists believed that individual choice behavior was dictated by expected value, observable behavior demonstrates that people are not value-maximizers (notably by Bernoulli’s demonstration of the St. Petersburg paradox). The famed St. Petersburg paradox led Daniel Bernoulli to suggest that we may not act to maximize expected value so much as to maximize expected utility (EU), having observed the declining marginal utility for money. This work set the stage for other theories of choice behavior, the most famous of which is expected utility theory work by von Neumann and Morgenstern.

Von Neumann and Morgenstern (1944) proposed expected utility theory (EUT) as a “normative” theory of behavior, providing an explicit set of assumptions that underlie rational decision making – these in turn could be used to compare mathematical predictions of EUT to the real behavior of decision makers. A set of axioms for EUT covers principles of ordering of alternatives, dominance, cancellation, transitivity,
continuity, and invariance. Von Neumann and Morgenstern mathematically demonstrated that when these principles are violated, the decision strategy does not maximize expected utility. Savage (1954) enlarged the scope of expected utility theory through proposing a model of subjective expected utility theory (SEUT), by including gambles based on more uncertain events rather than outcomes of well-understood gambles. According to the SEUT model, the individual produces a subjective expected utility (SEU) for each decision alternative, and subsequently chooses the alternative with the highest SEU. In both of these models (EUT and SEU), rational decision making occurs if the outcome of the decision conforms to some normative criterion (e.g., EU, SEU) and if the decision maker uses normative rules in order to arrive at the outcomes. In the choice literature in economics, it has been generally assumed that the decision maker does act as a rational agent with transitive preferences, making decisions in such a way to maximize utility or expected utility. This assumption would become an area of much debate in the field of judgment / decision making. Edwards seemed to foretell this future debate, by noting that some economists proposed “relaxing” the assumptions held about the limitless rationality of humans.

Research in judgment and decision making has since demonstrated that human decision making is often not “rational” in the manner proposed by these early theories. The economic theories covered in Edwards’ paper, including expected utility theory, have proven to be important and useful models of normative behavior, describing how rational actors would behave if assumptions were met. However, over time it has become obvious that utility theories in general are not the most accurate descriptive theories of
decision making. The next wave of historical development in the field of decision making took the form of proposed alternatives to expected utility theory to account for paradoxes in rationality that could not be explained by expected utility theory (e.g., Ellsberg paradox, Allais paradox, preference reversals).

In 1955, Herbert Simon first introduced the concept of bounded rationality, now recognized as one of the most influential developments in the field of judgment and decision making (Goldstein & Hogarth, 1997). Simon argued that utility theory reflects assumptions about human information processing that are beyond the scope of people’s cognitive abilities. Therefore, he proposed an alternative conceptualization of human decision making, now known as bounded rationality. In this model, humans make intelligent use of limited cognitive resources. By allowing for the idea that humans are not necessarily efficient utility maximizers, this model provided a more suitable guide for judgment and decision making research to follow. Simon was also one of the first to suggest the notion of heuristics, or rules of thumb, that are used by decision makers to achieve a state of bounded rationality. For example, Simon proposed the concept of satisficing – in which a decision maker accepts the first alternative encountered that meets minimal criteria for acceptability – rather than optimizing choices. Simon recognized that while conventional economists maintained that people make rational choices to obtain the best commodity at the best price, inescapable limits on knowledge and analytical ability force people to use shortcuts in decision making. These shortcuts include choosing the first option that "satisfices" or that meets minimal criteria, whether one is buying a loaf of bread or choosing a spouse. The proposition that humans use
“rational mechanisms” in order to quickly approximate more costly rational decisions set the stage for a wealth of future research, notably Kahneman and Tversky’s prospect theory (1979) and research on heuristic use in judgment and decision making (1974).

Although more recent developments in the judgment and decision making literature have accommodated the view of a “boundedly rational” decision maker, many models of decision making such as Kahneman and Tversky’s prospect theory (1979) are still fairly “cognitive” in their view of the decision maker (e.g., in the proposition of complex cognitive decision making processes - editing processes and weighting functions used in the formation of preferences). Many current models of decision making posit that the process of decision making assumes a form of cognitive appraisal involving a fairly complex process of deliberation - in which a person ponders their options, weighs them against one another, and then chooses an option which may be the best. One may question the descriptive range of cognitive models of choice such as these, especially when one considers literature in the heuristics and biases tradition (e.g. Tversky & Kahneman, 1974; Gigerenzer, Todd & the ABC Research Group, 1999) as well as literature on the influence of automatic (i.e., unconscious or preconscious) mechanisms in judgment and decision making.

Automatic processes in judgment are generally conceptualized as those processes that occur outside awareness, without intention, are uncontrollable, and are highly efficient in their use of cognitive resources (Kunda, 2001). For example, Zajonc (1968; Kunst-Wilson & Zajonc, 1981), one of the early investigators to demonstrate such effects, found that individuals will prefer objects merely due to their repeated exposure -
the mere exposure effect - even when one was never aware of having seen the object.

This result indicates that people’s preferences can be influenced by factors for which they are not conscious. Zajonc wrote, (1980, p.155) “We sometimes delude ourselves that we proceed in a rational manner and weigh all the pros and cons of the various alternatives. But this is probably seldom the actual case. Quite often, ‘I decided in favor of X’ is no more than ‘I liked X.’…”

In fact, there is a good deal of evidence supporting Zajonc’s hypothesis about our lack of insight into the factors influencing our judgments (e.g., Murphy & Zajonc, 1993; Nisbett & Wilson, 1977). This lack of awareness has even been found in situations in which we might hope a decision maker should be able to clearly explain the reasons for their choices, such as in stockbroker’s investment preferences (Slovic, 1969) and in doctors’ medical diagnoses (Kirwan et al., 1986). Therefore, the belief that most decision behavior reflects complex processing of information prior to forming a judgment and/or making a decision is an inaccurate one. It seems that the most likely state of affairs is that there exist some decision contexts or environments that facilitate more succinct information processing strategies, and others from which more thorough processing strategies emerge. A vast literature on dual-process models of information processing behavior supports this idea. One particular form of environmental influence that has been relatively neglected in the literature deals with whether subtle cues in the environment of which a person is unaware (i.e. priming effects) might influence a person’s likelihood of using either more or less effort in information processing while making judgments and decisions. It is clear that automatic processes may impact a final judgment or decision
that is produced, but whether priming might impact the strategy that one takes in making a decision remains to be seen. It also seems apparent that people may have a predisposition to process information in making a decision either more thoroughly, or by using less cognitive effort, as evidenced in research on individual differences in information processing (e.g., Stanovich & West, 1998; Cacioppo & Petty, 1982). However, there is little research that has demonstrated the impact of specific temperament differences upon decision making behavior.

The current research is designed to answer some of these questions about the basic nature of human decision making processes. Specifically, four studies were designed to investigate how subconscious processes, specifically priming effects, may impact decision behavior - either leading one to be more or less deliberative in processing information in order to make a decision. An interesting facet of this investigation lies within the possibility that automatic processing, which many have assumed to be tied to more effortless forms of decision behavior, may in fact also bring about more effortful information processing. In other words, this research will determine whether individuals may be primed in manners that lead to either more or less thorough information processing when facing a decision. Furthermore, this work will allow for investigation of how individual differences in decision making strategy use might interact with priming effects to produce differences in information search strategies, as well as in decision outcomes. A priming / temperament compatibility model of information processing is tested across these studies in order to describe how the impact of temperament upon the influence of priming may combine to effect information processing and choice behavior.
What strategy of decision making will lead to the best decision? Although this question seems relatively straightforward at first glance, this is hardly the case. The original answer to this question was assumed to consist of identifying the actions that would maximize desirable (and minimize undesirable) outcomes under unnatural, idealized conditions. However, an historical shift has taken place - with emphasis more recently placed upon the generality, robustness and accuracy of decision making methods, given the incomplete and uncertain nature of information in our natural environment (Hastie, 2001). So, how might one determine how the “best” decisions will be made? Hastie (2001) proposed three possible approaches to this question of enormous proportions and import. One approach to this question involves using simple undisputed cues to detect irrationality (e.g. looking at whether a logical contradiction is found in behavior, or whether a person is unhappy with their decision outcome). Another approach to determine the efficacy of decision methods involves examining the success of various decision rules, algorithms and heuristics in simulated choice environments (e.g. through the use of computer models of choice behavior – see the work of Gigerenzer
et al., 1999 for examples). A final method of examining the utility of a decision method lies within exploring the adaptive success of decision habits within natural environments. This method may involve examination of environmental and contextual impacts upon decision making (Klein, 1998), of the typical manners in which people go about making decisions in naturalistic situations (Klein, 1997), as well as studies of global individual differences in everyday decision making habits (Stanovich, 1999). The current proposal would fall most clearly into this final category. One natural question to follow asks, what are the typical systems through which people make decisions?

2.1 Dual Process Theories of Decision Making

For approximately two decades, researchers in various areas of psychology have developed dual-process models of information processing. These models have been applied in studies of social attitudes, person perception, memory, judgment and decision making. Although these different models and theories differ on a number of dimensions, (e.g. domain of application and specific aspects of their definitions) they all share the basic assumption that two quantitatively and qualitatively different modes of information processing operate when one makes decisions and judgments. The common distinction made in this literature is between a “fast, associative information-processing mode” and a “slow, rule-based information processing mode based on high-effort systematic reasoning” (Chaiken & Trope, 1999, p. ix). A primary concern to investigators of these dual processes concerns the roles of these modes of thinking in information processing, in forming judgments, and in making decisions. Reid Hastie (2001) has proposed that one
of the challenges to investigators of judgment and decision making today is to determine
the roles of both intuitive (e.g. implicit, associative, or automatic) and analytic (e.g.
explicit, rule-based, or controlled) cognitive processes in decision making. Similarly, in
his Nobel Prize lecture, Daniel Kahneman (2002) advocated for increased investigation
into how and when individuals use “intuitive” versus “controlled” forms of decision
making. Understanding when and why these decision making processes occur provide
guidance for how we may make human decision making more effective and efficient
across many decision making contexts. Both forms of these cognitive processes are
involved in any deliberate, goal-directed decision (Hastie, 2001).

There are a number of proposed dual-process models of information processing
that differ in their details, but that share the assumption that people alternate between two
modes of thinking: an “analytical” type of mode and an “intuitive” type mode. In other
words, sometimes individuals will engage in careful, detailed, elaborate processing of
information. In other cases, individuals will use a more cursory, quick, automatic form of
processing in forming a judgment or decision (See Chaiken & Trope, 1999; Evans &
For example, when people encounter a persuasive message, they may either carefully
contemplate the strengths and weaknesses of the argument, or to respond to more
superficial cues, such as the credentials of the speaker (e.g., Eagly & Chaiken, 1993;
Petty & Cacioppo, 1986). Apart from well-known literature investigating the impact of
dual-processes upon message persuasiveness, dual-process literature has also been used
to investigate explanations given for others’ behavior (Gilbert, 1989), as well as how
impressions are formed about others (Brewer, 1988; Fiske & Neuberg, 1990). From this body of well-known literature, it is apparent that people tackle many judgment tasks through either careful, elaborate processing, or through more cursory, spontaneous processing.

Perhaps because it may seem obvious from an individual’s personal experiences that we are sometimes more deliberative, and sometimes more intuitive in our judgment processes – many have examined similar forms of such dual-process models. Stanovich (1999) has proposed a terminology to account for the similar models that people have suggested, noting that, “[a]lthough the details and technical properties of these dual-process theories do not always match exactly, nevertheless there are clear family resemblances” (p. 144). Stanovich labels “System 1” as encompassing the processes of “interactional intelligence” – or those processes that are more automatic, largely unconscious, and relatively undemanding of cognitive effort. Stanovich notes that System 1 processing “conjoins properties of automaticity and heuristic processing as these constructs have been variously discussed in the literature.” System 2, on the other hand, is comprised of the various characteristics that have been viewed by most as “typifying controlled processing” (p. 144). This system accounts for the processes of “analytic intelligence” examined by information-processing theorists. The most important difference between the two systems, according to Stanovich, is that they tend to lead to different types of task construals. Therefore, we can expect that how one views and approaches a task will be impacted by the use of these two systems. Table 2.1,
adapted from Stanovich (1999, p.144) presents how a number of well-known dual-process theories fall into the “System 1 / System 2” conceptualization, highlighting general points of agreement across the different theories.

<table>
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<tr>
<th>Dual Process Theories</th>
<th>SYSTEM 1</th>
<th>SYSTEM 2</th>
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<tr>
<td>Sloman (1996)</td>
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<td>Rule-based system</td>
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<tr>
<td>Evans (1984, 1989)</td>
<td>Heuristic processing</td>
<td>Analytic processing</td>
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<tr>
<td>Evans &amp; Over (1996)</td>
<td>Tacit thought processes</td>
<td>Explicit thought processes</td>
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<td>Reber (1993)</td>
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<td>Epstein (1994)</td>
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<tr>
<td>Pollock (1991)</td>
<td>Quick &amp; inflexible modules</td>
<td>Intellection</td>
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<td>Hammond (1996)</td>
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<td>Analytical cognition</td>
</tr>
<tr>
<td>Klein (1998)</td>
<td>Recognition-primed decisions</td>
<td>Rational choice strategy</td>
</tr>
<tr>
<td>Petty &amp; Cacioppo (1986)</td>
<td>Peripheral route processing</td>
<td>Central route processing</td>
</tr>
<tr>
<td>Chaiken (1987)</td>
<td>Heuristic</td>
<td>Systematic</td>
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| Properties            | associative                    | rule-based                    |
|                       | holistic                        | analytic                       |
|                       | automatic                       | controlled                    |
|                       | relatively undemanding of      | relatively demanding of       |
|                       | cognitive capacity              | cognitive capacity             |
|                       | relatively fast                 | relatively slow               |
|                       | acquisition by biology,        | acquisition by cultural and   |
|                       | exposure, and personal          | formal tuition                |
|                       | experience                      |                               |

| Task Construal        | highly contextualized          | Decontextualized              |
|                       | personalized                   | depersonalized                |
|                       | conversational and socialized  | asocial                       |

| Type of intelligence indexed | interactional                       | analytic                        |
|                             | (conversational implicature)       | (psychometric IQ)               |

Table 2.1: Dual Process Theories and System 1 / System 2 Distinctions
Much of the research on dual-process models has focused upon the impact of different forms of decision behavior upon judgment outcomes. In fact, some of the most famous of dual process type models in social psychology – Petty and Cacioppo’s Elaboration Likelihood Model (1986) and Chaiken’s Heuristic Systematic Model (1987) - have attempted to assess the extent to which persuasion is influenced by effortful consideration of information. Perhaps the most popular procedures for doing so are based on Richard Petty and colleagues’ research (1976). In this research, the qualities of arguments contained in a persuasive message are varied in order to gauge the extent of message processing upon effects on attitudes. The purpose of the argument quality manipulation in the Petty studies is to provide a methodological tool that will allow for the examination of the impact of some other variable (e.g. personal relevance, source expertise, etc.) on message processing. For example, Petty and colleagues determined that conditions which are proposed to promote high elaboration to be associated with more thoughts being generated, and/or a difference in the contents of the thoughts generated such that generated thoughts better reflect the quality of the issue-relevant information presented (e.g., Harkins & Petty, 1981). For example, low elaborators with an initial unfavorable attitude were found to produce two favorable and three unfavorable attitudes following a message, reflecting their general unfavorable attitude regardless of the quality of an argument with which they were presented. High elaborators with the same initial unfavorable attitude however, have been found to produce three favorable and two unfavorable attitudes after hearing a strong argument, and one favorable and four unfavorable arguments after exposure to a weak argument. In other words, those who
were induced to have higher elaboration were more likely to be influenced by the strength of arguments presented to them, as opposed to those with lower levels of elaboration, who maintained their original attitude regardless of the strength of a persuasive argument (Petty & Wegener, 1999).

It is evident that there are factors that may either increase or decrease information processing, and perhaps indirectly, judgments and decisions. For example, factors shown to decrease a person’s motivation to process information include making a person a part of a group, rather than a sole actor, responsible for evaluating a message (Petty, Harkins & Williams, 1980). Another manipulation related to lowering information processing is the presentation of overly complex messages (Hafer, Reynolds & Obertynski, 1996). Individual differences in need for cognition have also been related to information processing, with those low in need for cognition engaging in lower information processing than those high in need for cognition (Cacioppo, Petty & Morris, 1983).

Other factors that have been demonstrated to increase the processing of information when making a judgment include enhancing personal relevance of the judgment (e.g. Petty & Cacioppo, 1979), and motivating accuracy goals (e.g., Kruglanski, 1980). Tetlock and Kim (1987) provided a compelling demonstration of the degree to which accuracy goals would increase the complexity of thoughts produced. Participants were shown responses made by three people to 16 questions about their personality, and then were asked to write a brief biographical sketch of the three individuals, and to predict how each of these three people would respond to 16 additional personality
questions. Some participants were motivated to be accurate by being led to believe that they would have to explain their thinking and judgment to researchers. Other participants were told that their judgments would remain confidential, and therefore were not manipulated to have accuracy goals. Those participants who were motivated by accuracy goals were more likely to write cognitively complex descriptions of the respondents, were shown to rely on a greater number of attributes to describe each person, were more likely to note contradictions within a person’s character, and were more likely to form an integrated view of the person by making elaborate connections between distinct attributes of their personality. Interestingly, this increased attention to detail resulted in more accurate predictions about how the respondents would answer the second set of questions — believed to be due in part to the increased complexity of their impressions.

Other research has similarly indicated that people who are motivated to be accurate are less likely to show a variety of cognitive biases (Kruglanski & Freund, 1983; Freund, Kruglanski & Shpitzajzen, 1985). People may be motivated to be accurate because they expect to be evaluated, to have to justify their judgments to others, expect their judgments to be made public, or because they expect their judgments to have a real impact on others. Specifically, Kruglanski and colleagues found that accuracy-motivated participants were less likely to show a primacy effect in impression formation, were less influenced by irrelevant target cues, and less likely to anchor on irrelevant numbers when making probability judgments. Kruglanski has proposed that individuals who had strong accuracy goals showed less bias because they engaged in more deliberative processing when making a judgment. To support this conjecture, they found that when people’s
ability to engage in deliberate thought was impeded by a requirement to respond quickly, biased responses were exaggerated (Kruglanski & Freund, 1983; Freund, Kruglanski & Shpitzajzen, 1985).

Some research has demonstrated conflicting results, however. Not all accuracy goals may eliminate bias. Monetary incentives and admonition to be accurate have failed to eliminate biases in some investigations – specifically the reliance on the availability heuristic and hindsight bias, as well as the under-reliance on statistical rules (Fischhoff, 1977; Kahneman & Tversky, 1973). It has also been demonstrated that asking people to reflect carefully on the reasons for their preferences can lead them to focus on the “wrong” criteria, thereby reducing the quality of their judgment (Wilson & Schooler, 1991). Similarly, Gigerenzer and colleagues also propose that “fast and frugal” heuristics exist to make us very effective decision makers. One example of such a heuristic is “take the best,” which describes a decision principle in which one “takes the best and ignores the rest” (Gigerenzer et al., 1999). Consider a task in which a person is asked to report which of two cities, Berlin or Wurtzburg, has a greater population. The mere recognition of an object is a very good predictor in this case. The primary rule of the “take the best” heuristic is to choose the “best” (in this case, the recognized) cue. If the name of “Berlin” is recognized and “Wurtzburg,” is not then one will have completed (successful) use of “take the best” – and this process is typically achieved quickly and with little deliberative effort. It has been demonstrated by Gigerenzer and colleagues (1999) that use of this heuristic results in a “less is more effect” in which those who rely on recognition often outperform those who hold more detailed knowledge that may lead
them astray from use of the most diagnostic cues. In other words, use of the “take the best” heuristic leads to very good, quick decisions, primarily through reliance on recognition. Overall, it seems that more intuitive forms of reasoning can sometimes lead to better outcomes than more deliberative modes of thought.

To many, this result may seem counterintuitive. It may seem plausible that increased deliberation should correspond with better judgment and decisions. Kunda (2001) notes that this belief may result in part because many have equated the use of heuristics in judgment (e.g. the representativeness heuristic, the availability heuristic) with quick processing. Chaiken’s important dual-process model of persuasion distinguished between “systematic” processing and “heuristic” processing (Chaiken, Liberman and Eagly, 1989), and Kunda notes that “[t]his terminology may have inadvertently encouraged the assumption that heuristic processing, which is viewed as relatively superficial and mindless, entails heavy reliance on heuristics such as representativeness and availability” (2001, p. 107). Part of this misunderstanding also undoubtedly comes from the fact that there exist what appear to be two differing positions on heuristic use. Although Tversky and Kahneman (1974) maintained from the beginning of their research program that heuristics could often lead to very effective decisions, the bulk of their research on heuristics has focused on the forms of biases that often correspond with heuristic use (e.g. representativeness, availability, etc.). However, a view of the usefulness of “fast and frugal” heuristics has been presented in the work of Gigerenzer and colleagues (1999) (e.g. take the best).
Even if the different perspectives on heuristic use are removed, there is yet more evidence that heuristic use is not perfectly correlated with quick, intuitive processing. For instance, Bodenhausen (1990) found that alert individuals (with ample cognitive resources available to them) were less likely than tired individuals to commit the conjunction fallacy in the famous “Linda problem”. This conjunction fallacy is typically described as resulting from reliance on the representativeness heuristic. However, Pelham and Neter (1995) found that participants who were induced to engage in careful processing, by being told that their performance was diagnostic of intelligence, were more prone to respond erroneously to Kahneman and Tversky’s “hospital problem” than were those participants who used more cursory processing. Both of these results, the conjunction fallacy and the misguided intuitions about the hospital problem, are typically assumed to result from use of the representative heuristic. So again, we see that careful reasoning can sometimes reduce the use of heuristics, sometimes increase heuristic use, and may sometimes have no effect. There is no simple association between the two modes of processing and the use of heuristics.

Another complex issue arising from examination of System 1 and System 2 processing lies within understanding the degree to which they emerge out of either conscious or unconscious processes. System 1 is typically described as a highly efficient, “automatic” system that is effortless and makes minimal demands on cognitive resources. As a result, many have proposed that unconscious priming effects support the notion of the unconscious and automatic operation of System 1 processes (Gilbert & Malone, 1995; Bargh, 1989; Epstein, 1991; Epstein et al., 1996). System 2, on the other hand, is
described as “controlled,” cognitively taxing, and highly analytic (Stanovich, 1999). These descriptions would lead one to believe that automatic processes would correspond with System 1 forms of information processing, and that controlled processes would correspond with System 2 processing. However, it is not clear that this will always be the case. To date, there has not been a demonstration of whether automatic processes may lead to System 2 forms of processing – but just as there is no perfect correspondence between heuristic use and System 1 processing, it may also be that automatic processes will not only lead to System 1 processes, but that System 2 processes may also be activated automatically.

2.2 Automatic Versus Controlled Processes in Decision Behavior

Much research in psychology until the 1970s assumed that people were consciously aware of the cognitive processes that lie beneath their judgments and behavior, and were capable of controlling these processes (Kunda, 2001). Many explanations of decision behavior have been rooted in concepts from cognitive psychology (Bargh, 2002). Before people make a judgment or a decision, it was proposed that they would consciously engage in more or less elaborate levels of information processing (i.e., System 1 or System 2 processing modes). This information processing was expected to influence attitudes, and these attitudes were in turn anticipated to impact judgments and decisions (Chaiken, 1980; Petty & Cacioppo, 1986). Factors proposed to move individuals from a default System 1, low-information processing position to a System 2, higher information processing mode include
involvement (Fazio, 1990) and personal relevance (Petty & Cacioppo, 1979). The key assumption of these descriptions seems to be that people typically consciously process information before making a decision (Dijksterhuis, Smith, Van Baaren & Wigboldus, 2005).

By the late 1980’s however, it became clear that this assumption did not paint a complete picture of the decision process, as research emerged to demonstrate that a wide range of mental processes are carried out with little awareness or intention (see Uleman & Bargh, 1989 and Wegner & Bargh, 1998 for reviews). It is now understood that people have automatic reactions to many situations, objects, and people that influences our judgments and behavior, even if we are not consciously aware of it. Empirical investigation of unconscious and automatic processes in the 1970s led theorists to draw a distinction between automatic versus controlled processes (Shiffrin & Schneider, 1977). Automatic processes are still conceived as processes that occur outside awareness, that are carried out without deliberate intention, and that are uncontrollable in that once they begin, they cannot be stopped. These automatic processes are assumed to be highly efficient, in that they require few cognitive resources in their use, and can occur in parallel with other mental processes. Many aspects of our perception and judgment have been shown to be automatic in this manner, requiring no effort or intention and being closed off to conscious awareness and control. Controlled processes, on the other hand, are generally characterized by the opposite set of features. They are used with intention and awareness, can be controlled and monitored, and require considerable effort - so much so that they can be disrupted when cognitive resources are limited (Kunda, 2001).
It was originally believed that automatic and controlled processes were completely independent and distinct (Kunda, 2001). Any judgment or decision process was thought to be either fully automatic or fully controlled. However, it became evident later this is the case for few, if any, higher-order cognitive processes (Bargh, 1989, 1994; Zbrodoff & Logan, 1986). Rather, it seems that many complex decision processes are automatic in some regard and controlled in other regards. For example, the mere exposure effect may lead an individual to have greater liking for one product over another (automatic process), but the person then may engage in a higher-order decision process leading to the decision to resist the impulse to buy the item (controlled process).

The notion that many of our judgments, feelings, and behaviors are carried out automatically and are influenced by factors that we are unaware of and unable to control was once considered implausible. Now a common consensus exists, suggesting that automatic processes occur frequently – more so than we may yet realize. The research tradition of examining automatic and controlled processes has evolved into two distinct areas of automaticity research – one investigating the impact of priming effects, and another in which automatic processes that occur naturally are examined. Both priming and automaticity research share an underlying concern with the ways in which internal mental states have a passive and hidden impact upon the effects of the environment upon our decision processes and outcomes (Bargh & Chartrand, 2000).

The study of automaticity techniques have often been used as a means to enable an experimenter to measure the particular mental procedures or representations that are assumed in his or her theory believed to correspond to the individual differences in the
phenomenon (Bargh & Chartrand, 2000). For example, Dodge (1993) argued that violent boys differ from other boys in the ways that they automatically perceive the aggressive intentions of others. The distinction between priming and automaticity research is that, in automaticity investigations, there is an emphasis on more permanent or “hard-wired” sources of activation. Priming research is more focused on the temporary activation of a person’s mental representations by some environmental stimulus, and the effect of this activation on psychological phenomena.

Priming studies are designed to examine how environmental cues may lead the average individual to think, feel, and behave differently than they might otherwise. Priming methods can be used either to research the passive, unintended influences of an environmental context or to experimentally simulate automaticity effects. Lashley (1951) first used the term “priming” to refer to the temporary internal activation of response tendencies, in proposing that serial response sequences must flow quickly and effortlessly due to some mediating state that “primed” the response. The first clear demonstration of the effect of passive priming influences, however, was provided by Storms (1958). Storms found that participants who were asked to memorize a list of words prior to a free-association task were more likely than usual to use words presented in the memory task as associates, compared to standard free associate norms. Segal and Confer (1960) later expanded on this study, determining that merely exposing people to the list of words, without asking them to memorize the words, still made them more likely to use those words in the subsequent free-association task.
After this demonstration, priming began to be used as an experimental technique, particularly to demonstrate how information became stored in memory without people’s explicit ability to recall it (Grand & Segal, 1966; Koriat & Feuerstein, 1976). Another ground-breaking development in priming research took place with the research of Higgins, Rholes and Jones (1976), which showed that personality trait concepts (e.g., “independent”) – not just single words – could be primed by recent use. Higgins and colleagues exposed participants to synonyms of personality traits supposedly as part of a memory experiment. Next, in what participants believed to be a second, unrelated experiment, they read about a target person named Donald who behaved in ways ambiguously related to the primed traits, such as “preferring to study by himself.” Those participants who had read words such as “adventurous” and “independent” formed more positive impressions of Donald than did participants who had been previously exposed to words such as “reckless” and “aloof”.

This result provided two important contributions to the priming literature. The first of these was the realization that personality trait concepts, not just words, could be primed. The participants’ responses did not involve use of the prime words themselves; instead their overall impressions were impacted. In other words, it was not just that memory locations corresponding to the stimulus words were activated. The abstract trait concepts were also impacted, in turn influencing final impressions of Donald. Therefore, the other important contribution of this study was in the revelation that individuals’ recent exposure to information could impact – in a passive and unintended way – his or her perceptual interpretation of another person’s behavior.
Since this early research, many forms of priming methods have been developed. Two general forms of priming techniques that Bargh and Chartrand (2000) have outlined are conceptual priming and mindset priming. Conceptual priming involves the activation of mental representations in one context so that they exert a passive, unintended and unconscious influence in subsequent, unrelated contexts. Examples of methods such as these include trait concept priming studies, such as in the original Higgins, Rholes and Jones (1976) study. Ideally in conceptual priming work, the participants’ task in processing the primed information is kept as separate as possible from the task that is used to assess the priming effect. This method allows demonstration that the priming effect is due to the concepts primed, independent of any processing goal.

Another form of priming manipulation, mindset priming, involves having a participant actively engage (or read about a person engaged) in a goal-directed type of behavior in one context, to show that this mindset is more likely to operate later in another context (Gollwitzer, 1990). Therefore, what is primed in this format is a procedure or purposive way of thinking about information or a situation. For example, Wilson and Capitman (1982) had some male participants read a “boy meets girl” story in an unrelated first task. It was later found that those asked to read this story later smiled more and behaved more positively towards a female confederate in a second task. Because mindset priming involves both active and intentional use of a procedure, and does not just involve the passive activation of a concept, mindset priming is considered to be a different variety of priming than conceptual priming (Bargh & Chartrand, 2000). Mindset priming may be characterized more accurately as a carryover of an intentional
mental procedure to a new context. An act of conscious will is required on the part of the participant in mindset priming, unlike conceptual priming. As a result, there is a greater role of intent and awareness in mindset priming – and for this reason the current research will use conceptual priming methods.

Many methods have proven to be effective in producing conceptual priming effects (Bargh & Chartrand, 2000). There are different degrees to which a person may be made aware or unaware of the priming stimuli that are used. Supraliminal priming or “conscious” priming techniques involve exposing a participant to priming stimuli as part of a conscious task. Although the individual is aware of the priming stimuli in this method, they are not aware of the underlying pattern of stimuli that serves to prime the construct of interest. Commonly used supraliminal priming techniques include use of a “scrambled sentence task,” in which participants must form coherent grammatical sentences out of a string of words – and in so doing are exposed to some words that are related to the concept that the investigator wishes to prime. Another method commonly used involves a “word completion task,” in which individuals are asked to determine a missing letter that will complete a word. In writing out the completed words, participants are exposed to the words used in priming the concept of interest. Participants who are primed in this method should be debriefed in order to ensure that they are not cognizant of the relation between the priming manipulation, which is typically presented as an “unrelated” first task in the experiment, and the subsequent experimental task used to assess influence of the prime. Bargh and Chartrand provide helpful guidelines for use of a “funneled debriefing” technique to uncover any suspicions participants may have about
the relationships between the tasks (2000, p. 259). Funneled debriefing may help an experimenter rule out any demand effects due to suspicion about the relationship between the priming and experimental tasks. Another manner of ruling out alternative explanations for supraliminal priming effects is to follow-up with a subliminal priming study. Supraliminal priming techniques, however, are typically found to have stronger priming effects than those that are obtained with subliminal priming methods, described next.

Subliminal priming methods may be carried out in a few different formats, which share the characteristics of very brief presentation of the prime, its immediate masking by another stimulus, and appropriate awareness checks. Bargh and Chartrand (2000) present a detailed set of instructions regarding the process of presenting primed material, either in the participants’ foveal or parafoveal visual field. A social science computer software package, DirectRT, also provides guidelines for subliminal priming methods that follow these recommendations. A typical format for subliminal priming involves having participants stare at a point (such as a number or an asterisk) on a computer monitor in their foveal visual field (the middle of the screen), prime words are briefly displayed parafoveally, or outside the visual field, for between 60-100 milliseconds. In order to ensure that participants keep their gaze in the center of the screen, they are often told that the task involves ability to repeat digits that are presented – and digits are thus presented in the center of the screen to serve as a fixation point while prime words are presented in the parafoveal region. Information presented in the parafoveal region has been demonstrated to not reach conscious awareness, at least in terms of meaning or identity of
the words. Only movement or changes in this region (i.e. a flash on the screen) is identifiable. A mask of the primed word then follows the prime, in order to rule out any visual iconic memory storage.

Bargh and Chartrand (2000) propose that priming methods, both supraliminal and subliminal, produce a variety of effects – motivational, behavioral, and perceptual – and that just because the dependent variable of interest is, for example, a judgment, this does not mean that the only effect of the priming manipulation was upon social perception. In effect, priming manipulations can be expected to have more outcomes than are measured by the experimenter.

A fairly recent development in priming research is the expansion of the range of psychological phenomena that have been primed. For a good number of years, priming research focused solely on effects in impression formation and perception (see reviews in Bargh, 1994; Higgins, 1996). Although some research did employ a dependent variable that was not a judgment, (e.g., the participant’s behavior towards a target person or toward an attitude object; Fazio, Chen, McDonel & Sherman, 1982) – it was a priming effect on an evaluation or a judgment that mediated the behavioral effect. However, more recently there has been evidence that the same priming manipulations used in the past to produce perceptual effects, such as the scrambled sentence test, may produce behavioral or motivational effects as well. In other words, it is possible to prime a behavioral tendency or goal through use of the same manipulation (supraliminal or subliminal) originally employed to produce perceptual effects. For example, Bargh, Chen and Burrows (1996) used a scrambled sentence task to activate the concept of
rudeness or politeness, and then waited to see if the participant would interrupt a subsequent conversation. Those primed with rude stimuli were far more likely to interrupt their experimenter than were those primed with politeness.

Motivations and goals have also been primed. Bargh and Gollwitzer (1994) reported several experiments in which achievement and affiliation motives were primed via a “word search” task. Those primed with achievement worked harder and found more words in a subsequent word search task compared to participants primed with affiliation, who were more concerned with interacting with a confederate than working on a task. Chartrand and Bargh (1996) also demonstrated that primed information processing goals operated in the same manner as intentionally, consciously activated goals. People who were primed with goals of forming an impression were found to display higher free recall of a target’s behaviors as well as greater thematic organization of these behaviors in memory than those who were primed with memorization goals. Other recent priming studies have supported the idea that specific goals and motives may be primed – for example, Erb, Biyo and Hilton (2002) demonstrated the ability to effectively prime risk-seeking and risk-averse motives across a range of scenarios. Bargh and colleagues (2001) found that social goals to achieve or to cooperate may also operate without awareness. It seems that merely priming a goal may provide enough impetus for individuals to engage in goal-directed behavior.

Although there has recently been an extension in the range of priming effects that have been measured, the degree to which priming may be used to activate System 1 and System 2 forms of information processing has yet to be investigated. Because many
dual-process models have assumed a correspondence between automatic / primed cognitive processes (with System 1) and controlled cognitive processes (with System 2), arousal of both System 1 and System 2 processes through priming would be an important contribution to understanding of these information processing and cognitive processes. For example, Simonson (2005) recently summarized the research on automaticity, in which he included System 1 processing as an example of automatic processing (e.g. priming effects), stating “Kahneman… distinguished between the operations of System 1 that tend to be automatic, effortless, associative, implicit, and often emotionally charged, and operations of System 2 that are slower, consciously and deliberately monitored, and potentially rule governed.” (p. 211). Similarly, if one examines the theoretical descriptions given of System 1 and System 2 processing presented earlier in Table 2.1, it is apparent that System 1 and 2 are typically described as being automatic and controlled processes, respectively.

It is true that the decision behavior within System 1 and System 2 processing may lead one to be more susceptible to the presentation of automatic/priming or controlled/cognitive information sources, respectively. Similarly, System 1 processing may often take place as an automatic “default” while System 2 processing may likely take place through a conscious choice to attend to more information in order to make a decision (Petty & Cacioppo, 1986). However, perhaps the meta-decision process, or the process of deciding how to decide, that leads one to a System 1 or System 2 decision process in the first place may either emerge from either a controlled or automatic source.
The influence of unconscious processes at different stages of decision making is not well understood. Chartrand states that “perhaps there are different types of awareness, varying with respect to the stage of the decision making process…” (2005, p.203), and that “it is important for researchers in this area to specify in each instance exactly what part of the process lies outside awareness…” (p.209). Chartrand (2005) has proposed a model of automatic processes in which “unawareness” in the decision process may take place at three different stages (see Figure 2.1). In the first stage, there are features in the environment (A) that can trigger an automatic process – and a person may be either unaware or aware of these features (e.g., a person may not consciously notice a particular word on an advertisement, but that word may still trigger an automatic process). People are typically unaware of the automatic process itself (B) in priming-related experiments (e.g., a person is typically unaware of the automatic process itself that is instigated by the word on the advertisement). Finally, a person may be either aware or unaware of the decision outcome (C) resulting from this process (e.g., a person may either be aware of their decision to purchase the advertised item, or may not consciously realize a resulting positive attitude toward the advertised item).

![Figure 2.1: Model of Automatic Processes](image-url)

Figure 2.1: Model of Automatic Processes
While Chartrand’s model (2005) provides a helpful delineation of the *stages of an automatic process*, it does not outline the *stages of the decision process* in which an automatic process may take place. In model of the decision making process proposed here, it may be the case that automatic and controlled processes can play roles at different stages. In a meta-decision stage (A), automatic and controlled processes may influence how a person will approach a decision task (e.g., with a System 1 or System 2 approach). In the information processing stage (B), a person may either consciously or unconsciously process information in order to make a decision, and may examine more or less information in order to make that decision as well. In the decision stage (C), one may similarly be influenced by both automatic and controlled processes – it may even be that an automatic process at this stage may lead one to skip over the first two stages of decision making entirely, and instead make an “intuitive” and immediate choice.

**Figure 2.2: Model of Decision Processes**

Most priming research to date has examined the impact of priming upon information attended to within the information search process of decision making (e.g., how personality traits are interpreted), or upon specific forms of task goals within a decision (e.g., whether a person has an accuracy goal for an upcoming judgment). In the
meantime, there has been little investigation of the impact of priming upon the process of
deciding how to decide, or the meta-decision process. There is strong evidence that
environmental cues may lead to nonconscious processes during information processing in
decision making (e.g., Higgins, Rholes & Jones, 1976), or to pursuit of particular social
goals during information processing in decision making (e.g. Chartrand & Bargh, 1996).
However, there is not much known about how priming might influence the meta-decision
of how to approach a decision (e.g., with either a System 1 or System 2 typed decision
process).

Although part of the motivation underlying this proposal is to examine how
individual differences may influence the degree to which a person is susceptible to
specific priming processes, there is little other research in this area of investigation.
Some evidence, however seems to imply that specific temperaments may impact
automatic reactions and responses to primes. For example, Bargh and colleagues (1995)
found that men who scored in the top 25% of a measure of “attractiveness of sexual
aggression” measure had faster responses to sex-related material after exposure to
subliminal power primes – demonstrating that men who found sexual aggression
attractive were more likely to demonstrate a power-sex link in their automatic responses.
Fazio and colleagues (1995) demonstrated that photographs of African Americans led to
automatic activation of negative affect in some White Americans, but that other less-
prejudiced White Americans and African Americans showed no such automatic negative
reaction. In fact, some less-prejudiced White and African Americans showed an
automatic positive reaction instead. Clearly, some primed concepts may influence some
individuals, and not others, due to general individual difference tendencies. It has even been suggested that each individual’s idiosyncratic pattern of automatic associations to specific situational cues may lie at the very heart of our personality (Mischel and Shoda, 1995). Different individuals, therefore, may have different reactions to the same environmental situation (e.g. priming), depending on their overall cognitive and affective structure – such as their general tendencies and preferences in decision-related behaviors. One manner of investigating these general tendencies is through the use of self-report individual difference measures.

2.3 Individual Differences in Decision Making Behavior

It is obvious that individuals differ from one another on a myriad of different dimensions. How and why this is the case, and the circumstances in which these differences matter, are questions for which the answers are less clear. The cross-disciplinary study of individual differences is based on attempting to find answers for these elusive questions.

In the study of judgment and decision making, there has historically been a void in the area of individual difference research. However, the individual difference research that does exist within the field demonstrates that individual differences can have an important impact in the process and outcomes of decision making. The individual difference research tradition that seems most frequently represented in the judgment and decision making literature addresses differences in specific temperamental styles, particularly in terms of response tendencies and preferences (e.g., risk taking styles,
One important form of specific temperamental differences that have been measured reflects preferences for cognitive / information-processing styles. One example of such a measure is the need for cognitive closure – a measure of a person’s desire to reach a definitive answer to a question rather than remaining in a state of ambiguity (Webster & Kruglanski, 1994; Houghton & Grewal, 2000). The authors of this scale found that individuals with a high need for closure exhibited an “exaggerated” correspondence bias (by attributing attitudes to an author even when told that the author did not choose to write an essay expounding these attitudes). Other investigators have found that people with a strong attitude about a consumer product and a high need for closure engaged in a less thorough search for information about the product than those with weaker attitudes and need for closure (Houghton & Grewal, 2000). Need for closure may clearly have implications for other information-search investigations.
The most well known measure of the propensity to engage in cognitively effortful activities, such as information search, is the measure of Need for Cognition (NC, Petty & Cacioppo, 1982). Need for cognition represents the tendency for individuals to engage in cognitive efforts and to experience pleasure from these efforts. Cohen, Stotland and Wolfe (1955) originally described the need for cognition as a need to structure relevant situations in meaningful, integrated ways and as a need to understand the experiential world. An original scale of 34 items (Petty & Cacioppo, 1982) and a shorter version of 18 items (Cacioppo, Petty & Chuan, 1984) have been used to measure this tendency. The NC measure has been associated with more effortful processing and search of information leading to a decision (Levin, Hunecke, & Jasper, 2000). Participants with higher NC processed information in a more focused manner with greater depth and breadth than did people with low NC, and the quality of their selections tended to be higher. Even in cases in which a less thorough search has been promoted, NC is positively correlated with more thorough information search. Perhaps not surprisingly, high NC participants have been found to be less vulnerable to framing effect biases. Participants low in NC were found to be more susceptible to framing effects in a monetary as well as a medical decision making task (Smith & Levin, 1996). Altogether, this body of research implies that NC can be extended from a measure of cognitive elaboration to one of decision strategy.

One of the only individual difference measures to attempt to tap differences in decision making tendencies, and a measure that draws from the measure of Need for Cognition, is the Rational-Experiential inventory developed by Epstein and colleagues
based on this conceptualization, Epstein and colleagues (1996) used 19 items from the Need for Cognition scale, to measure individuals’ tendencies to use the “rational system”, and 12 items from a measure they developed, called the Faith in Intuition scale, to reflect the “experiential system”. Epstein and colleagues later developed a psychometrically-improved version of this scale, which still measured rational and
experiential “thinking styles” by drawing from notions of Need for Cognition and Faith and Intuition (Pacini & Epstein, 1999), now labeled respectively as the “rational” and “experiential” subscales. These two scales constitute the two measures of the Rational-Experiential Inventory.

The rational and experiential subscales have been related to decision making tendencies. The experiential scale has been positively related to heuristic responding (Epstein et al., 1996, Pacini & Epstein, 1999), and to risk-taking tendencies (Lauriola & Levin, 2001). The rational scale has been related to the ability to control non-optimal response tendencies. Although most participants displayed non-optimal response tendencies in a gambling task, those higher in rationality displayed better performance under a higher incentive level as compared to those lower in rational subscale score (Pacini & Epstein, 1999). In research with the Rational-Experiential Inventory, these two thinking style measures visibly relate to processes in decision making. However, there exists relatively little investigation of other judgment / decision making outcomes that may be predicted with the use of this scale. For example, it is unclear exactly which forms of heuristic processing are predicted by the rational and experiential scales, and which heuristics are so general as to eclipse individual differences.

The other notable research on individual difference tendencies related to decision making derives from the work of Stanovich and West (1998). Stanovich and West explored the extent to which measures of thinking dispositions and cognitive abilities predict non-normative decision making tendencies – including the famed Wason card-selection task, beliefs in syllogistic reasoning, argument evaluation, hindsight bias, base-
rate use, covariation detection, hypothesis testing, outcome bias, if-only thinking, knowledge calibration, and the false-consensus paradigm. Stanovich and West’s primary conjecture is that the nature of individual differences such as thinking dispositions and cognitive abilities holds implications for why human behavior is sometimes non-normative. Understanding individual differences may help explain exactly why non-normative decision making takes place, and may help provide some guidance for prescriptive decision making models. For example, there is evidence that the greater the correspondence is between task properties and individual thinking style tendencies, the more accurate the judgments of experts may be (Hammond, Hamm, Grassia & Pearson, 1987). In this line of research, Stanovich and West elaborate on distinctions made by Baron (1988) regarding thinking dispositions and cognitive capacities. Capacities refer to the types of cognitive processes studied by information-processing researchers, specifically in seeking the underlying cognitive basis on the performance of IQ tests. Cognitive capacities cannot be improved in the short term by instruction, but can be influenced by long-term practice. In contrast, thinking dispositions are better viewed as cognitive styles, indicated by factors such as likelihood to weigh new evidence against a currently-held belief, disposition to spend time on a problem before giving up, or the propensity to attend to the opinions of others before forming ones own opinions. To the degree that thinking dispositions explain variance on a skill independent of cognitive capacity, theorists such as Baron propose that the skill should be more teachable in quality.
Stanovich and West explore the implications of individual differences in “rational thought” for explaining the gap between descriptive and normative decision making. Their measures of thinking dispositions and cognitive ability bridge from the current category of “specific temperamental differences,” to the next category of individual difference measures to be presented - “intellectual domain performance.” Their measure of thinking dispositions is decidedly temperament-based, as this tendency is scored by a number of measures that reflect “epistemic rationality.” These measures include subscale items from the Actively Open Minded Scale, which measures factors such as epistemological absolutism, willingness to switch perspectives, willingness to decontextualize, and tendency to consider alternative opinions and evidence. Other measures included in the thinking disposition scale include scale measures of intellectual development, dogmatism, and (interestingly enough) paranormal beliefs. The scale components are formed into a composite that indicates a thinking style in which high scores reflect open-mindedness, flexibility, and skepticism. Low scores point toward cognitive rigidity and lack of skepticism.

The measure of cognitive capacity lies within the domain of research on intellectual performance. In order to measure cognitive ability, Stanovich and West asked participants to report SAT test results, and also measured performance on two “analytic intelligence” tests, namely the Raven Advanced Progressive Matrices, and the Nelson-Denny Reading Comprehension Test. These three measures were standardized and summed in order to produce a composite cognitive ability score.
Together, the cognitive ability and thinking styles composites were significantly related to performance on four rational thinking tasks. In investigation of performance on a syllogism task, a statistical reasoning task, a Wason card-selection task, and on the ability to evaluate the quality of an argument, both thinking styles and cognitive ability were significant unique predictors. This was interpreted as evidence that departures from normative reasoning on each task was related to systematic limitations in processing and not to systematic performance errors. As one had greater cognitive capacity, and more of a tendency to adopt an open-minded thinking style, one’s performance on these distinct tasks was benefited. Similarly, in a replication of the previous findings, with the addition of three new tasks - a covariation judgment task, hypothesis testing task, and heuristic processing strategies task - cognitive ability and thinking styles were again found to be significantly correlated with all seven of these rational thinking tasks. Some tasks investigated by Stanovich and West did not demonstrate a relationship to cognitive ability and thinking styles (e.g. noncausal base rate problems), attributed to the notion that these tasks were not easily explained by cognitive differences. Neither the overconfidence or hindsight bias correlated with thinking dispositions, but both overconfidence and hindsight bias were negatively correlated with cognitive ability. Interestingly, these biases were described as being related to cognitive ability rather than to processing style. Overall, Stanovich and West concluded that patterns of individual differences may have implications for explanations of discrepancies between descriptive and normative models in decision making. Both measures of information-processing temperament and cognitive ability can contribute to understanding decision making and judgment.
Rather than measuring global intuitive and analytic thinking styles, Nygren and White (2002) have investigated the degree to which individuals rely upon intuitive, analytical, and regret-based styles, specifically in their judgment and decision making, through the use of a Decision Making Styles Inventory (DMI), which appears in Appendix B. The DMI is a forty-five item self-report measure, consisting of fifteen items on an "analytical" subscale (ANA), fifteen items on an "intuitive" subscale (INT), and fifteen items comprising a "regret-avoidance" based subscale (REG). For example, an item on the analytical subscale of the DMI reads, "My best decisions are those for which I have weighed all of the relevant information." An example item from the intuitive subscale of the DMI reads, "When making decisions, my first instinct usually turns out to be best." A regret-based item reads, "After making a decision I sometimes worry about the regret I'll feel if it the outcome turns out to be a bad one."

This forty-five-item scale has been demonstrated as a highly reliable, valid and unique measure (i.e., has good internal consistency, test-retest reliability, construct validity, and differs in relation to existing individual difference scales). The DMI was constructed from an initial set of 100 face-valid item statements describing use of a wide variety of decision strategies (Nygren and White, 2002). A series of maximum likelihood factor analyses were conducted over a three-year period - the final two from samples of 833 and 801 students, to produce the current set of forty-five scale items, with the three scales consistently emerging from the analyses. In a sample of 845 participants, all three scales were found to be internally consistent, with coefficient alphas equal to .863 (ANA), .862 (INT), and .861 (REG). Test-retest reliabilities in a recent sample of ninety
participants taking the DMI four to eight weeks apart were .816 (ANA), .814 (INT), and .872 (REG). In general, it appears that scores on the subscales are normally distributed, and that individuals are likely to rate themselves slightly higher on the analytical subscale compared to the intuitive and regret subscales. For example, in the experiments presented in this dissertation, analytical scores \( n = 497, M = 67.58, SD = 9.93 \) were higher than participants’ self-ratings on the intuitive scale \( M = 60.58, SD = 10.25 \).

Furthermore, the DMI appears to measure fairly distinct constructs in each of the subscales. From a recent study of 801 participants, no significant correlation was found to exist between the ANA and INT sub scales \( r = .07, p>.05 \) a positive correlation exists between ANA and REG subscales \( r = .281, p<.01 \), and a non-significant negative correlation emerged between REG and INT \( r = -.19, p>.05 \). As there is evidence that these three subscales are fairly orthogonal, this implies that one may be able to rely upon a combination of analytical, intuitive and regret-based strategies in their decision making. It may even be that there is an adaptive benefit to the ability to rely flexibly upon these different decision strategies – an area that holds promise for future investigation. The usefulness of the DMI primarily lies within its potential for providing insight about how the use of different forms of decision styles may impact task approach and performance.

Most individuals are likely to hold an implicit belief that the features that make us unique lie at the core of who we are – and this belief is likely to have kept the study of individual differences under consideration. What can be gained from studying individual differences within the judgment / decision making domain? There are a great number of possible applications of individual difference investigations in the study of judgment and
decision making. One may examine how people’s stable tendencies may influence decision making, rather than focusing solely on the impact of situational factors upon choice. Individual difference measures may also be used in order to examine possible mediator or moderator variables for a decision behavior of interest. In the case of this dissertation, one of the goals within this project is to examine how individual differences and environmental cues (e.g. priming) may coincide to produce effects in judgment and decision processes and outcomes.
CHAPTER 3

RESEARCH RATIONALE

This series of studies are designed to provide two primary contributions to the decision making literature. First, a method of priming System 1 and System 2 information processing will be used to examine whether automatic processes at the meta-decision level can engage both “intuitive” and “analytical” decision making behaviors and outcomes, rather than solely intuitive processes as many have previously assumed (e.g., Simonson, 2005). Secondly, this research tests a model of decision behavior in which both temperamental and environmental (specifically priming) effects combine to produce different levels of information processing, as well as differential decision outcomes.

Across four studies designed to measure decision processes, regression analyses were used to examine the effect of System 1 and System 2 priming and individual difference influences upon both decision behavior, as well as upon decision outcomes. An underlying conceptual model of these effects, seen in Figure 3.1, leads to some concrete hypotheses across all four experiments. This conceptual model is tested on its ability to predict the impact of both environmental and individual difference
temperaments on decision behaviors. Across the studies, it is assumed that individuals possess some underlying tendency to use both System 1 and System 2 forms of processing, as measured by the DMI scale. This individual difference temperament is expected to impact the effects of primes in the environment that may activate use of either System 1 or System 2 forms of information processing. Those who receive primes that are compatible with their individual difference temperament are expected to display information processing behavior consistent with their temperament and environmental cue (prime) – either resulting in more or less thorough information processing. Those who receive primes inconsistent with their temperament are expected to display a moderate degree of information processing. Also, although previous research has suggested that there is not a perfect correspondence between depth of information processing and appropriateness of decision outcomes, two of the studies include a measure of decision outcome quality, for cases in which a relationship between processing depth and decision outcomes has been previously established. The dotted lines / boxes in Figure 3.1 represent the direction through which this analysis will take place – with no explicit hypotheses listed here due to the potentially idiosyncratic nature of this relationship. Each individual study will utilize a distinct set of information processing measures – however, the relationship between the underlying constructs are assumed to reflect the same basic processes across studies.
3.1 General Hypotheses

While the primary focus of this dissertation is to examine whether automatic processes at the meta-decision level may give rise to both System 1 and System 2 decision strategies, there are a number of related hypotheses which are also tested in this dissertation. The general framework presented in Figure 3.1 suggests the primary hypotheses which are examined across the four studies.

*Hypothesis 1:* Supraliminal priming of decision strategies will produce a main effect upon decision behavior. When primed with analytical words, people’s information search will become more thorough relative to a control group that is not primed. When conceptually primed intuitively, information search will become less thorough relative to the control group.
Hypothesis 2: Individual difference in decision strategy use will produce a main
effect upon decision behavior. A self-reported general reliance on an analytical
strategy will be related to more thorough information processing. Those that
report a greater reliance on intuitive strategies will engage in less thorough
information processing.

Hypothesis 3: When priming manipulations and individual differences
correspond, the predicted outcomes will be amplified such that those who have an
analytical predisposition and are analytically primed will have the most thorough
information processing. Those who have an intuitive predisposition and who are
intuitively primed will have the least thorough information processing.

Hypothesis 4: Priming manipulations will influence decision outcomes, primarily
through an influence upon decision behavior. When there is a significant
influence of priming upon decision outcomes, this influence will take place
through the mediation of decision behavior. In other words, priming will
influence decision behavior (e.g. thoroughness of information search) which will
in turn influence individuals’ decision outcomes (see the individual study
descriptions for more specific details about the decision outcome predictions).

Hypothesis 5: Individual differences will influence decision outcomes, primarily
through an influence upon decision behavior. When there is a significant
influence of individual differences upon decision outcomes, this influence will
take place through the mediation of decision behavior (see the individual study
descriptions for more specific details about the decision outcome predictions).

3.2 Statistical Methodology

Analysis of the theoretical model of this dissertation is conducted with the use of
regression and mediational analyses. Multiple linear regression is used to account for the
variance in a dependent variable, based on linear combinations of continuous,
dichotomous, or “dummy” (nominal or ordinal) independent variables. Multiple
regression can be used to establish that a set of independent variables explains a
proportion of the variance in a dependent variable at a significant level (through a
significance test of $R^2$), and can establish the relative predictive importance of the
independent variables (by comparing beta weights, $\beta$). One can test the significance of
difference of two $R^2$ values to determine if adding an independent variable to the model helps significantly. Using hierarchical regression, one can see how much variance in the dependent variable can be explained by a set of new independent variables, over and above that explained by an earlier set. Typically, theory determines the ordering of the variables entered into the regression model, with the most theoretically important variables initially entered, and interaction terms entered later in the model development. In the case of this dissertation, priming manipulation dummy variables are entered in the first step, followed by individual difference factors, and finally interactions between the two. The estimates obtained from the regression model (beta weights and constant) can be used to construct a prediction equation, which takes the form:

$$Y = c + b_1x_1 + b_2x_2 + \ldots + b_nx_n.$$  

The $b$'s are the regression coefficients, representing the amount the dependent variable $Y$ changes when the independent variable changes 1 unit. The $c$ is the constant, where the regression line intercepts the y axis, representing the value of $Y$ when all the independent variables are 0. The standardized version of the $b$ coefficients are beta weights ($\beta$), and the ratio of the beta coefficients is the ratio of the relative predictive power of the independent variables. Associated with multiple regression is $R^2$, multiple correlation, which is the percent of variance in the dependent variable explained collectively by all of the independent variables.

Multiple regression shares all the statistical assumptions of correlation. These assumptions include linearity of relationships, the same level of relationship throughout the range of the independent variable ("homoscedasticity"), interval or near-interval data,
and data whose range is not truncated. In addition, it is important that the model being
tested is correctly specified. The exclusion of important causal variables or the inclusion
of extraneous variables can significantly change the beta weights and hence the
interpretation of the importance of the independent variables. Multiple regression with
dummy variables yields the same inferences as multiple analysis of variance
(MANOVA), to which it is statistically equivalent.

Regression analyses used in this dissertation allow examination of the direct
influence of priming manipulations, individual differences, and their interactions upon
information processing within individuals’ decision behavior. Similarly, regression
analyses were conducted in order to determine whether the confluence of priming
conditions and individual differences will influence the outcomes of people’s decision
making. However, mediational analyses provide more concrete detail about “how”
these potential effects may have occurred through examination of a causal sequence.
Rather than merely examining direct effects of one variable upon another, deeper
understanding of the decision process is gained when process-based analyses, such as
mediational analyses, are employed. For example, if it is determined that priming
conditions influence decision outcomes, this effect may take place through an influence
upon decision behavior. The basic mediation model presents a causal sequence in which
the independent variable (X) influences the mediator (M), which in turn influences the
dependent variable (Y), therefore providing a causal explanation of how X had its’ effect
upon Y (see Figure 3.2). A mediator variable, then, is one that presents a causal path
between two variables, and accounts for some or most of the relationship between those
two variables. Because of the usefulness of mediation models in describing process-based theories of human behavior, they are being increasingly employed in basic and applied psychology (Preacher & Hayes, 2004).

![An Example Mediational Model](image)

**Figure 3.2: An Example Mediational Model**

### 3.3 Priming Methodology

Because this experiment is rather exploratory in nature, a method of priming was chosen based upon the likelihood that priming effects may occur. According to Bargh and Chartrand (2000), the more “conscious” forms of supraliminal priming tend to have stronger effects than do subliminal priming methodologies. The more strength with which a concept is activated, the greater its’ accessibility – and in turn the greater likelihood that the concept will be subsequently used. One commonly used priming method consists of a word completion task, in which participants are asked to write-out a word that was presented with a missing letter. The word completion task priming method was employed in all four experiments presented here.

As all four studies employed the same method of priming both System 1 and System 2 forms of decision strategies, a list of stimulus words to serve as primes was constructed. In a stimulus-development investigation, a list of 50 adjectives was
pre-tested by 92 participants, who were all asked to rate each word in terms of how much it reflected both an “analytical” and an “intuitive” type of information processing in order to make a judgment or decision. For evaluation of the words for use as priming materials, participants were asked to rate the list of words on a scale of 1 – 4, 1 indicating that the word was “extremely analytical (intuitive)” and 4 indicating that the word was “not at all analytical (intuitive)”. All participants rated each word on both its “analytical” and “intuitive” connotation.

A set of 10 words was chosen for each prime set (System 1/intuitive and System 2/analytical), based on the words that were most strongly associated with one information processing style and less so with the alternate. Each word that was chosen was rated statistically significantly lower in a one-sample t-test ($p < .05$) compared to the midpoint score (2.5) on the corresponding strategy of interest, and significantly higher than the midpoint on the alternate strategy. The list of prime words, along with their ratings by the 92 participants, appears in Table 3.1. Three “filler” words were also chosen for use in the study materials, in order to make the nature and purpose of the priming task less obvious to participants, and to avoid related demand effects. The three filler words tested as being unrelated (i.e., were rated significantly higher than the midpoint) to both System1/intuitive and System2/analytical decision styles. These words were “distinct” ($M=3.45, SD=.50$), “plain” ($M=3.52, SD=.49$), and “modern” ($M=3.49, SD=.51$). Bargh and Chartrand (2000) have suggested that roughly 80% of trait-relevant primes within a word list may be likely to lead to reliable priming effects, while hopefully reducing awareness of the nature of the priming manipulation. Therefore, participants in each of
the four experiments were randomly presented with the ten priming words associated with their experimental priming condition, as well as the three filler words consistent across all conditions.

<table>
<thead>
<tr>
<th>System 1: “Intuitive” Words</th>
<th>Mean “analytical” score (SD)</th>
<th>Mean “intuitive” score (SD)</th>
<th>System 2: “Analytical” Words</th>
<th>Mean “analytical” score (SD)</th>
<th>Mean “intuitive” score (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>intuitive</td>
<td>3.23 (.55)</td>
<td>1.35 (.40)</td>
<td>analytical</td>
<td>1.42 (.43)</td>
<td>3.25 (.54)</td>
</tr>
<tr>
<td>spontaneous</td>
<td>3.37 (.93)</td>
<td>1.59 (.91)</td>
<td>investigative</td>
<td>1.54 (.79)</td>
<td>2.90 (.99)</td>
</tr>
<tr>
<td>impulsive</td>
<td>3.23 (1.00)</td>
<td>1.75 (1.02)</td>
<td>reasoned</td>
<td>1.62 (.85)</td>
<td>3.03 (.92)</td>
</tr>
<tr>
<td>instinctive</td>
<td>3.15 (.99)</td>
<td>1.76 (.99)</td>
<td>logical</td>
<td>1.69 (.95)</td>
<td>2.78 (1.04)</td>
</tr>
<tr>
<td>quick</td>
<td>3.26 (.91)</td>
<td>1.88 (1.05)</td>
<td>rational</td>
<td>1.73 (.88)</td>
<td>3.09 (.87)</td>
</tr>
<tr>
<td>reactive</td>
<td>2.78 (.98)</td>
<td>1.95 (1.04)</td>
<td>methodical</td>
<td>1.75 (.92)</td>
<td>3.07 (.95)</td>
</tr>
<tr>
<td>natural</td>
<td>3.01 (.95)</td>
<td>2.02 (1.07)</td>
<td>critical</td>
<td>1.79 (.93)</td>
<td>2.83 (.98)</td>
</tr>
<tr>
<td>effortless</td>
<td>3.32 (.84)</td>
<td>2.11 (1.17)</td>
<td>systematic</td>
<td>1.88 (1.05)</td>
<td>2.99 (1.08)</td>
</tr>
<tr>
<td>sensing</td>
<td>2.75 (.97)</td>
<td>2.18 (.94)</td>
<td>careful</td>
<td>1.90 (.93)</td>
<td>3.04 (1.03)</td>
</tr>
<tr>
<td>unstructured</td>
<td>3.37 (.93)</td>
<td>2.26 (1.05)</td>
<td>prepared</td>
<td>2.02 (1.06)</td>
<td>2.96 (1.08)</td>
</tr>
</tbody>
</table>

Table 3.1: System 1/Intuitive and System 2/Analytical Prime Words

One-third of participants in each study were randomly assigned to a control condition for the priming manipulation task. Of the pre-tested words, 10 were selected for use in the control group word completion task, along with the same three “filler” words used in the two experimental conditions. These words similarly tested as being unrelated to either System 1 or System 2 concepts (i.e., were rated significantly higher than the midpoint). The control words chosen for use appear in Table 3.2.
The priming method used in all four of the investigations was a supraliminal word completion task, in which participants were asked to look at an incomplete word that was missing one letter, to fill in the correct missing letter, and to completely type out the completed word on a computer screen. Participants were led to believe that this task was a measure of cognitive ability to solve word puzzles. The materials used in this task appear in Appendix A.

A trade-off that exists when one uses more “conscious” forms of supraliminal priming is the risk of participants becoming aware of the purpose of the priming task, which may lead to demand effects. Bargh and Chartrand have suggested a method of “funneled debriefing” for use in supraliminal priming tasks, which allows one to identify participants who become cognizant of the relationship between the priming manipulation and the subsequent experimental task. The funneled debriefing method presents
questions to the participants that probe for suspicions or realizations they may have about the intended effect of the prime upon their behavior on the experimental tasks. In Figure 3.3, the open-ended funneled debriefing questions that were used in this study are presented.

1. What do you think the purpose of this experiment was?
2. What do you think this experiment was trying to study?
3. Did you think that any of the tasks were related in any way? If so, how were they related?
4. Did anything you did on one task affect what you did on any other task? If so, how exactly did it affect you?
5. When you were completing the word completion task, did you notice anything unusual about the words?
6. Did you notice any particular pattern or theme to the words that were included in the word completion task?

**Figure 3.3: Funneled Debriefing Questions Presented to Participants**

Bargh and Chartrand suggest that participants displaying genuine awareness of the relation between the prime and the task should be excluded from data analysis (e.g., indicate that they were aware of a theme in the priming materials, are correctly aware of the relationship between the tasks, etc.). If a high proportion of participants in the study display such awareness – Bargh and Chartrand suggest a guideline of upwards of 5% – then it is likely that other participants were similarly aware of the priming manipulation, which should be amended as a result. Across all experiments in this study, no participant displayed clear awareness of the connection between the priming manipulation and the
experimental task with which they were presented. Few participants reported an awareness of any theme within the words, and when they did, they often noticed irrelevant themes within the words (e.g., “the words were all personality traits”). However, 16 of the 513 total participants across all of the four experiments correctly reported an awareness of a decision-relevant theme in the words that were presented and reported that they believed this task was somehow related to the other experimental tasks (3% of participants), which is below a level which would give cause for concern. Data collected from these participants was omitted from further analysis.
CHAPTER 4

EXPERIMENT 1

4.1 Experiment 1 Rationale

For the first investigation of the effects of priming and temperament on decision behavior, a clear measure of decision behavior was required. One well-known measure of decision behavior is an “information board” task, in which individuals are given the opportunity to search through information in order to make a decision. This type of study design, then, allows for a clear measure of the thoroughness with which a person searches through information in order to make a decision. The first study, the simplest of the four study designs, was designed to determine whether priming either System 1 or System 2 types of decision processes can influence information search when one is making a decision. Similarly, the influence of individual differences in intuitive and analytical temperament, as measured by the DMI scale, was also examined in terms of decision behavior. The interaction between individual differences in decision strategy temperament as measured by the DMI, and priming conditions was also investigated. The purpose of this initial study was simply to determine whether priming effects might influence behavior in an information search task.
4.2 Experiment 1 Method

This experiment was designed to measure information search behavior displayed in a multi-option decision making task. Using a computer program, participants were presented with a word completion task which served as the priming method, were given an information board choice task in which one had to select a course in which to enroll, and were also asked to complete some individual difference measures related to decision making style, including the DMI scale. In order to offset possible suspicion about the nature of the experiment, some unrelated filler decision tasks were presented in between the administration of the experimental tasks and the individual difference measures.

4.2.1 Experiment 1 Participants

The participants in this study consisted of students who were enrolled in an introductory psychology course. Participants received course credit for their study participation. In total, 113 students participated in this experiment, 56 males and 57 females, with an average age of 21 years.

4.2.2 Experiment 1 Procedure

In this experiment, participants were asked to first complete a baseline information search task that measured thoroughness of information search in decision making. Specifically, participants were asked to examine information about possible courses in which they might enroll (e.g., credit hours, time, etc.). This task was presented using a computer program called Mouselab, a program developed by Payne and
colleagues (1993), which allows for analysis of the thoroughness of information search patterns used to make a decision. For an example of the Mouselab task screen, see Figure 4.1. In each scenario, a grid of information (a six-by-six grid format) presented a set of options (rows) by attributes (columns). Information within this grid was kept hidden until the participant used a mouse pointer to uncover information within the grid. Participants were allowed to search through as little or as much information as they wished before making a decision. The Mouselab program records outcome variables for the amount of time spent in obtaining information, as well as the number of items "uncovered" in order to make a decision. This investigation will not be concerned with the decision outcome as there is no clear argument for “quality” of a decision in this task (i.e., different courses may be better or worse choices for specific individuals) but instead will merely be concerned with whether priming and individual differences will influence thoroughness of information search (measured by time spent searching and number of items examined in the task). Participants were first asked to complete a short practice Mouselab task involving choices between cars, and then were asked to perform the first of two Mouselab choice tasks, which served as a baseline measure of information search for each individual.
Following completion of the first Mouselab task, participants completed the priming manipulation task (see Appendix A for example materials used). The participants were told that this word completion task was designed to measure people’s ability to solve word problems, a measure of problem-solving. In this study, this task was also described as being a “filler” task, ostensibly so that the outcome of the first Mouselab task would not pollute responses on the second. In fact however, this word completion task was used as the priming delivery method for all four experiments. The participants were given a series of 13 words, all missing one letter, and were told that the job in this task is to type out the completed word. In each experimental condition, the 10 pre-tested experimental words were presented corresponding to each experimental condition, along with the 3 “filler” words that were used across all priming conditions. All words were presented randomly to participants. Approximately one-third of
participants were randomly assigned to each experimental priming condition, 38 in the analytical prime condition, 38 in the intuitive prime condition, and 37 in the control condition. Following the priming manipulation, participants were asked to complete a second Mouselab task. After this point, participants engaged in a series of other unrelated short decision studies. After approximately 15 minutes of these actual filler tasks, participants were asked to complete the DMI measure of decision making individual differences (see Appendix B for the DMI scale measure). In Appendix C, the experimental instructions and materials used in this experiment are presented.

The dependent variables of this research were the number of items uncovered and the amount of time spent searching in the second Mouselab task. A regression model was used to determine the impact of priming manipulations and DMI analytical and intuitive subscale scores upon the thoroughness of information search dependent variables. It was hypothesized that individuals with intuitive priming and temperament would display lower levels of information processing, and analytical prime and temperament would lead to higher levels of information processing.

4.3 Experiment 1 Results

The data from the second post-priming Mouselab administration from experiment 1 were analyzed using two hierarchical linear regression models, one in which the variable of time spent in information search was examined for the second Mouselab administration, and another in which the variable of items examined was investigated for
the second Mouselab task. Not surprisingly, these two outcome variables were highly correlated \((r = .81, p < .01)\).

In the first model, the amount of time that individuals engaged in a search for information was regressed upon the predictors of priming condition, DMI analytical and intuitive scores, as well as interactions between DMI scores, and interactions between priming conditions and DMI scores. The regression model demonstrated a significant main effect of both of the priming conditions and DMI measures, as well as a significant interaction between the two DMI scales. All of the beta weights presented were statistically significant predictors, with \(p < .05\). Furthermore, these variables in total accounted for 20% of the variance in the time variable.

\[
\hat{Y} = -164.803 + 7.95(anprime) - 7.70(inprime) + .53(dmia) - .28(dmii) - .041(dmia*dmii)
\]

\(R^2 = .20\)

95%CI values for regression \(\beta\) weights:
- \(anprime (.20, 15.70)\), \(inprime (-16.17, -.30)\), \(dmia (.87, 5.33)\), \(dmii (-.62, -.05)\), \(dmia*dmii (-.08, -.01)\)

As Figure 4.2 demonstrates, there was no significant difference between analytical \((M = 47.18, SD = 22.28)\), intuitive \((M = 50.67, SD = 22.08)\) and control group \((M = 50.19, SD = 22.46)\) scores in the time spent searching during the initial Mouselab task \((p > .05)\). However, the general tendency of participants, as evidenced by the control group, was to spend less time in searching on the second task administration \((M = 32.89, SD = 19.26)\). A post-hoc paired samples t-test demonstrated that this mean decrement of 17.38 seconds in time spent searching was statistically significant \((t = -5.44, p<.01, 95\%CI: -23.85, -10.90)\). Similarly, those who received an intuitive prime also
significantly declined in their information search time, but by a larger degree of 24.29 seconds ($t = -8.48, p < .01, 95\%CI: -30.10, -18.48$). However, those who received an analytical prime did not display a significant decrease in their information search time (mean difference = $-5.69, t = -1.68, p > .05, 95\%CI: -12.52, 1.15$). In other words, while those who were not primed with a decision strategy declined in the amount of time that they spent searching, those who were primed intuitively declined even more so. However, those who were primed analytically did not display any significant decline for time they spent in information search.

![Figure 4.2: Time Spent Searching in Mouselab Tasks by Prime Condition](image)

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As indicated in the regression equation, and as one can see in Figure 4.3, DMI score also had a significant influence upon amount of time that individuals spent in information search. For the purposes of illustration, DMI scores on both the analytical and intuitive subscales were divided into the upper and lower ½ of scores from the median score on each scale. While those who scored higher on the analytical subscale tended towards spending more time in information search, those who scored higher on the intuitive DMI subscale tended to spend less time in looking through information.

![Figure 4.3: Time Spent Searching in Mouselab Tasks by High and Low DMI Scale Scores](image)

Figure 4.3: Time Spent Searching in Mouselab Tasks by High and Low DMI Scale Scores
Interestingly, an interaction effect was also found for intuitive and analytical subscale scores in this analysis. As people were more likely to report having higher analytical and intuitive DMI subscale scores, their information search seemed to decline slightly, but not so much as associated with intuitive strategy alone. This outcome is perhaps not very surprising, as we might expect that those who seem to possess both intuitive and analytical decision strategies may be likely to fall somewhere between the decision behavior associated with analytic tendency and intuitive tendency. In other words, in the degree to which people report possessing both analytical and intuitive decision styles, they may be more likely to have decision behavior that falls between these two temperaments.

Similar results were obtained in the regression model for number of items uncovered in the search for information. The number of items that individuals examined in a search for information was regressed upon the predictors of priming condition, DMI analytical and intuitive scores, as well as interactions between DMI scores, and interactions between priming conditions and DMI scores. The regression model demonstrated a significant main effect of both priming conditions and DMI measures. However, this model did not demonstrate any interaction between DMI scores, or between DMI scores and priming conditions. The variables in this model accounted for approximately 16% of the variance in the time variable.

\[ \hat{Y} = 29.64 + 12.08(anprime) - 10.20(inprime) + 0.57(dmia) - 0.24(dmii) \]

\[ R^2 = 0.16 \]

95%CI values for \( \beta \) weights:
- \( anprime (1.58, 22.59) \)
- \( inprime (-20.75, -0.31) \)
- \( dmia (0.03, 1.10) \)
- \( dmii (-0.80, -0.10) \)
As one can see in Figure 4.4, there was no significant difference between analytical ($M = 63.13$, $SD = 36.12$), intuitive ($M = 67.63$, $SD = 28.45$) and control group ($M = 62.65$, $SD = 30.37$) scores in the number of items examined during the initial Mouselab task ($p > .05$). Again however, the general tendency of participants was to look at less information on the second task administration, as the control group demonstrated ($M = 45.41$, $SD = 22.04$). A post-hoc paired samples t-test demonstrated that this mean decrement of 17.16 items searched was statistically significant ($t = -3.98$, $p < .01$, 95%CI: -25.90, -8.42). Similarly, those who received an intuitive prime also significantly declined in their information search, but by 32.82 items on average ($t = -8.16$, $p < .01$, 95%CI: -40.96, -24.67). However, those who received an analytical prime again did not display a significant decrease in their information search (mean difference = -4.53, $t = -.69$, $p > .05$, 95%CI: -17.86, 8.80).
DMI score again had a significant influence upon amount of information searched, as indicated in the regression equation and Figure 4.5. For the purposes of illustration, DMI scores on both the analytical and intuitive subscales were divided into the upper and lower $\frac{1}{2}$ of scores from the median score on each scale. While those who scored higher on the analytical subscale tended to look at more items in information search, those who scored higher on the intuitive DMI subscale tended to look through less information. In this analysis, no interaction effect was found for intuitive and analytical DMI subscale scores however.
4.4 Experiment 1 Discussion

The results of this initial experiment provide some support for the general hypotheses outlined in this dissertation. The first hypothesis, which predicted that priming of decision strategies would produce a main effect upon decision behavior, was clearly supported. When primed with analytical words, people’s information search, indicated by both the number of items people examined and the amount of time spent searching, was more thorough compared to the control group and the intuitive prime group. When people were primed intuitively, their amount of time searching and number of items searched was less thorough relative to the control and analytical groups.
Similarly, the second hypothesis was supported. Individual differences in decision making style preference, as measured by the DMI, were related to information processing. Analytical style preference was significantly and positively related to time searching and items searched, and intuitive style preference was negatively related to time and item variables. Therefore, the decision style preference that one self-reported related to decision behavior outcomes in this task.

While the first two hypotheses tested in this study were supported, the third hypothesis of interest in this experiment was not supported. No interaction between priming conditions and individual differences emerged. This lack of interaction may be because the influence of individual differences in decision styles had a relatively smaller effect on decision behavior as compared to the priming manipulation. While priming manipulation had a fairly strong influence upon decision behavior, DMI scale scores held a relatively smaller influence upon decision behavior. The studies that follow will still examine whether this possible interaction effect may occur. While no interaction emerged for priming and decision styles, an interaction did emerge for the two decision temperament measures. As a person’s tendency to utilize both analytical and intuitive strategies increased, their tendency to spend time searching for information declined slightly in terms of actual time, but statistically significantly. This effect was not obtained for the number of items that individuals searched, however. In one sense, this interaction effect may indicate that, in certain contexts, having a tendency to rely on both analytical and intuitive strategies may lead to behavior that falls between what one might expect from either decision strategy. However, it is also evident that the possible
interaction was not consistent across both decision behavior outcomes. The degree to which one might expect an interaction between these decision strategies to impact decision behavior generally is unclear.

This particular study did not include any concrete measure of objective accuracy of decision outcomes, and therefore the final two hypotheses of this dissertation are not relevant to this analysis. Many decisions in life are of this nature, in which there is no obvious “correct” choice for an individual to make. However, decision outcomes are also of interest in this set of investigations. An analysis that includes objective decision outcomes will allow for a more complete picture of the decision process – one which accounts for aspects of the decision environment, the decision process, and ultimately decision outcomes. Therefore, the next study builds upon this initial one by including a measure of objective decision outcomes.
CHAPTER 5

EXPERIMENT 2

5.1 Experiment 2 Rationale

In this second experiment, another task was used which would allow for an analysis of thoroughness of decision behavior, as did the first experiment. The participants in this experiment were asked to take part in a jury-selection simulation. The methodology used in this experiment was adapted from experiments by Yates and Estin (1996), and subsequently used by Sieck and Arkes (2005). Participants in this study were asked to play the role of jury selection experts, tasked with looking at information collected from individuals who were prospective jurors, and making a prediction about whether each individual was in favor of, or opposed to, physician assisted suicide. This study design allows for another concrete measure of information search, as the amount of information that each participant chooses to use in order to make a judgment is measured. As the data that are presented to participants come from actual individuals’ responses to the 1998 General Social Survey conducted by the National Opinion Research Center, there is also a “gold standard” for performance on this task, which may allow for a more detailed analysis of the decision process that people may engage in. Therefore, this
particular task nicely meets the objectives that are required in study materials for this dissertation project – that they allow for some degree of self-directed and measurable information search, and in this case, that there is also a decision outcome that may be measured.

5.2 Experiment 2 Method

This experiment was designed to measure information search behavior displayed in a binary decision making task. Using a computer program, participants were presented with the same word completion task which served as the priming method as in the previous experiment, a jury selection task in which one had to predict the beliefs of prospective jurors. Participants were also given some filler decision making tasks, and were finally asked to complete the DMI individual difference measure.

5.2.1 Experiment 2 Participants

The participants in this study consisted of students who were enrolled in an introductory psychology course. Participants received course credit for their participation in the study. In total, 131 students participated in this experiment, 67 males and 64 females, with an average age of 20 years.

5.2.2 Experiment 2 Procedure

In this experiment, participants were asked to first complete a baseline jury selection information search task, which measured thoroughness of information search in
decision making. In this task, participants were asked to play the role of jury selection experts. As such, they had to make some predictions about the beliefs that were held about a group of prospective jurors – in this case about whether each prospective juror was opposed to physician assisted suicide or not. In order to make these predictions, participants were given the opportunity to examine answers to demographic and personal belief questions that were given by each juror. Each participant was given information about the age and gender of each prospective juror. Participants could choose to examine responses to 15 questions about marital status, political party, household income, number of children, religious affiliation, religious service attendance, current health, and beliefs about sex before marriage, divorce, death penalty, gun permit laws, legalized abortion, prayer in public schools, confidence in the legal system, and belief about the courts’ dealing with criminals. The information that could be examined was presented on a computer screen, and for each juror the participants could choose to examine as much information as they wished. By simply checking a box, the juror’s response to the demographic and personal belief questions was revealed. The participants were asked to make predictions for 15 prospective jurors in the initial task. An example of the jury selection task screen is presented in Figure 5.1, and Appendix D contains detailed information about the administration of this experiment.
Figure 5.1: The Juror Selection Task

After the initial jury selection task, participants were asked to complete the same priming manipulation task – the word completion task – which was used in experiment 1. One-third of the participants were randomly assigned to each of the experimental conditions, 44 to the analytical, 43 to the intuitive, and 44 to the control condition. After the priming manipulation task, participants were again asked to make predictions for 15 new prospective jurors in the jury selection task.

The dependent variables of interest in this experiment were the total number of items that individuals chose to examine in order to make predictions about the views held
by prospective jurors, and the accuracy of the predictions given by the participants in the jury prediction task. Again, the predictors in this experiment were the priming manipulations, the DMI scale scores, and their interactions.

5.3 Experiment 2 Results

The data from the second, post-priming jury selection task were analyzed using two hierarchical linear regression models, one in which the variable of items examined in information search was analyzed, and another in which the number of correct predictions was investigated. In the first model, the number of items that individuals looked at in order to predict jurors’ beliefs was regressed upon the predictors of priming condition, DMI analytical and intuitive scores, as well as interactions between priming conditions and DMI scores, and interactions between DMI scores. The regression model demonstrated a significant main effect \( p < .05 \) of only analytical priming condition, and no significant effect of intuitive priming, or either DMI subscale. The analytical priming variable alone accounted for 8% of the variance in the items variable.

\[
\hat{Y} = 94.45 + 18.61(anprime) \\
R^2 = .08 \\
95\%CI values for \beta weight: \\
anprime (2.65, 34.58)
\]

As Figure 5.2 demonstrates, there was no significant difference between analytical \( (M = 113.06, SD = 45.30) \), intuitive \( (M = 119.05, SD = 49.29) \) and control group \( (M = 115.66, SD = 57.17) \) scores in the items examined during the initial jury task \( (p > .05) \). However, the general tendency of participants was again to engage in less
information search at the second task administration, as seen in the control group. Due to the decreasing novelty of the task, one would expect that there would be a decrease in information search at the second administration. The analytical condition again did not significantly differ from the first jury prediction task to the second jury prediction administration ($t = -.98, p > .05, 95\%CI: -14.15, 10.13$), while the intuitive ($t = 3.65, p < .05, 95\%CI: 12.90, 44.73$) and control groups ($t = 2.89, p < .05, 95\%CI: 6.43, 35.97$) were statistically lower on the second administration.

![Figure 5.2: Number of Items Searched in Jury Tasks by Prime Condition](image)

**Figure 5.2: Number of Items Searched in Jury Tasks by Prime Condition**
A regression was also conducted to examine the possible impact of priming and DMI scores on the number of correct predictions that were made by participants. The regression model demonstrated a significant main effect of only analytical priming condition ($p < .05$), and no significant effect of intuitive priming, either DMI subscale, or their interactions. Therefore, in this task it seems that priming one to be more analytical led to a decrease in their performance ability on the prediction task compared to the other two groups, as seen in Figure 5.3.

$\hat{Y} = 9.46 - .92(\text{anprime})$

$R^2 = .07$

95%CI values for $\beta$ weight:

anprime (-1.50, -.33)

![Figure 5.3: Number of Correct Predictions in Jury Tasks by Prime Condition](image)
As one can see in Figure 5.3, there was no significant difference between analytical ($M = 9.75, SD = 2.13$), intuitive ($M = 9.86, SD = 1.75$) and control group ($M = 9.84, SD = 1.42$) scores in the number of correct predictions during the initial jury task ($p > .05$). The general tendency of participants was to perform slightly less well on the second task administration, as the control group demonstrated ($M = 9.23, SD = 1.96$); however, this difference was not statistically significant ($t = 1.53, p > .05$, 95%CI: -.19, 1.43). Similarly, the intuitively primed group did not perform statistically worse ($t = .49, p > .05$, 95%CI: -.51, .83). However, the analytically primed group performed significantly worse at the second task administration ($t = 3.39, p < .05$, 95%CI: .49, 1.92).

Therefore, these results suggest that while the control group and intuitively primed group did not perform less well, being primed analytically led participants to perform more poorly, both compared to the control and intuitively primed groups. Perhaps even more striking is the fact that the analytical prime condition seemed to damage the participants’ performance compared to their own initial performance on the task. This result seems to indicate that for some tasks, exposure to thoughts of an analytical strategy may actually hurt performance. This outcome is consistent with some research which demonstrates that attending to too much information may sometimes lead us astray in our judgments (Wilson & Schooler, 1991; Gigerenzer et al., 1999).

Because both number of items examined and accuracy in predictions were related to the analytical decision prime, this result lends itself to a possible mediational interpretation. It may be that being primed analytically leads to more information
processing, which in turn leads to decreased accuracy on this particular task. Therefore, a mediational analysis was conducted.

Mediation is considered to be present when (1) the IV significantly affects the mediator, (2) the IV significantly affects the DV in the absence of the mediator, (3) the mediator has a significant unique effect on the DV, and (4) the effect of the IV on the DV shrinks upon the addition of the mediator to the model. These criteria can be used to informally judge whether or not mediation is occurring, but there are also statistically based methods by which mediation may be formally assessed, including the Sobel test (Baron & Kenny, 1986; Preacher & Hayes, 2004; Sobel, 1982).

The first step in the mediational analysis (see Figure 5.4) is to determine whether analytical priming significantly affects the potential mediator. A regression analysis indicates that it does ($\beta = 20.70, p < .01, 95\%CI 6.89, 34.51$). The possible mediator, number of items examined, also has a significant influence upon prediction performance ($\beta = -.01, p < .05, 95\%CI -.02, .00$). Earlier, the analytical priming condition was shown to be related to prediction performance as well. As these conditions have been met, a Sobel test was conducted in order to determine whether a mediational path exists between analytical prime, items examined, and prediction performance. In this model, $a$, $b$ and $c$ represent path coefficients, and the variables in parentheses are the standard errors that correspond to those path coefficients.
The regression model path coefficients were submitted to a Sobel test in order to determine whether the indirect effect of the IV on the DV via the mediator is significantly different from zero. Details about the Sobel test can be found in Baron and Kenny (1986) and Sobel (1982). The z-score formula for the Sobel test is:

$$z = \frac{a \cdot b}{\sqrt{b^2 \cdot s_a^2 + a^2 \cdot s_b^2}}.$$  

After submitting values for the path coefficients, the Sobel test indicated that while the beta weight for the influence of analytical priming did decrease when the number of items searched variable was entered into the equation (from $\beta = -0.92$ to $\beta = -0.81$), there was not clear evidence of statistically significant mediation ($z = -0.95$, $p > .05$). It appears that the influence of analytical priming condition upon the number of correct predictions was not clearly due to an indirect effect through the number of items examined. However, due to the fact that there was a decrease in the influence of analytical priming when items searched were considered, there may be some evidence that mediation effects may still be obtained in a replication of this study, or in another...
new investigation involving a different measure of decision behavior. It is still likely that the effect of analytical prime upon decision outcomes took place through an influence upon decision behavior.

5.4 Experiment 2 Discussion

The results of this second experiment provide some additional support the influence of priming at the meta-decision level upon System 1 and System 2 information processing. The first hypothesis, which predicted that priming of decision strategies would produce a main effect upon decision behavior, was less clearly supported than in the first experiment. When primed with analytical words, people’s information search, indicated by the number of items people examined in the task, was more exhaustive compared to the control group and the intuitive prime group. However, there appeared to be little influence of intuitive prime in this experiment. It may be that priming analytically is a more effectively induced automatic process than is intuitive priming – a rather ironic outcome. It is still unclear whether the lack of influence of intuitive prime in this experiment was due to the nature of the task itself, or if it is the case that analytical priming is more powerful than is intuitive priming.

The second hypothesis of this dissertation (and by extension, the mediation-related fifth hypothesis) was not supported in this experiment. While the individual difference trends were in the direction of what one would predict (i.e., analytical temperament slightly related to more information search, intuitive temperament related to lower information search), individual differences measured by the DMI were not
statistically related to information processing or prediction accuracy in this experiment. Interpretation of this lack of outcome is complicated. It may be that decision temperament is not as relevant to this task as it is to the task in the previous experiment. Or, it may be that the DMI measure alone was unable to capture the influence of individual differences in decision style upon decision behavior in this task. At this point, we are left with some inconclusive results when it comes to the possible influence of temperament upon decision making. The investigations that follow will continue to explore the temperament factor of the model under scrutiny in this dissertation.

The third hypothesis that is of interest in this experiment was again not supported. No interaction between priming conditions and individual differences emerged in this experiment. It seems that the analytical priming effect alone was influential upon decision behavior and outcomes, and that individual differences did not accentuate the effect of analytical processing upon decision making.

Similarly, hypothesis 4 was not clearly supported. While the influence of analytical priming upon decision outcomes declined when the influence of information search was accounted for in the model, there was no statistically significant mediational effect found. Therefore, while this study still demonstrates that priming may influence decision making behavior and outcomes, the mechanism through which this may occur is still not quite clear. It is likely that the effect of priming upon decision accuracy was due to other process-related factors that were not measured in this experiment (e.g., time, attention, etc.) and that may be examined in a multiple-mediation analysis in future research. Perhaps amount of information alone could not adequately explain why
priming had an influence upon decision outcomes – but maybe with the inclusion of other process variables, the effect would be more apparent. Because there is still theoretical reason to believe that priming will influence decision outcomes through an impact on thoroughness of information processing, another study involving an objective measure of decision outcomes was therefore conducted.
CHAPTER 6

EXPERIMENT 3

6.1 Experiment 3 Rationale

The two systems of decision making can be expected to play important roles across very diverse decision environments, so another distinctive decision making task was employed in study three. Because a measure of decision processing is crucial to investigation of the conceptual model under consideration in this research, this investigation will also include a measure of decision processing, as well as an objective measure of decision accuracy. Study 2 results demonstrated that analytical decision priming influenced both decision behavior and decision outcomes, while intuitive priming and decision styles were less influential. The current experiment will provide further evidence about the relative roles of both priming and decision styles. The results of Study 2 also suggested that although there was no statistically significant mediation effect found, there may yet be some evidence of a mediational path from analytical priming influences to decision outcomes through an influence upon thoroughness in information processing. Therefore, this investigation will again examine this possible mediational path in the influence of analytical priming.
In an effort to employ another interesting measure of decision making processes, study three employed a method first used by Tetlock and Kim (1987) in order to assess how thoroughness in information processing influenced predictive ability. In their research, Tetlock and Kim motivated participants to be accurate (which was assumed to increase information processing motivation) – and found that accuracy-motivated individuals were more likely to write cognitively complex personality descriptions of respondents whose responses to 16 personality test items they had read. They also found that these accuracy motivated participants were shown to rely on a greater number of attributes to describe each person, were more likely to note contradictions within a person’s character, and were more likely to form an integrated view of the person by making elaborate connections between distinct attributes of their personality. Interestingly, this increased attention to detail resulted in more accurate predictions about how the respondents would answer a second set of personality scale questions, believed to be due to the increased complexity of their impressions.

6.2 **Experiment 3 Method**

This experiment was designed to measure information search behavior displayed in a personality prediction task. Using a computer program, participants were presented with the same word completion task which served as the priming method as in the previous experiments. Then, the participants completed a personality prediction task in which one had to read through three individuals’ responses to 15 items from a personality scale, to write a brief personality sketch of the three participants, and then were asked to
predict the same three individuals’ responses to an additional set of personality scale items. Finally, participants were asked to complete some filler decision tasks, followed by some individual difference measures related to decision making style, including the DMI.

6.2.1 Experiment 3 Participants

The participants in this study consisted of students at Ohio State University who were paid $10 for their participation in the experiment. In total, 101 students participated in this experiment. The participants included 48 males and 53 females, with an average age of 23 years.

6.2.2 Experiment 3 Procedure

The participants in this study were first asked to complete the same priming task used in the previous two experiments, with participants randomly assigned to the analytical condition \( (n = 34) \), intuitive condition \( (n = 34) \), or control condition \( (n = 33) \). Following this, participants were asked to read the responses of three actual individuals to 16 items from Jackson’s Personality Inventory scale (1994). Response times for the seconds spent examining these responses were recorded. Participants were then asked to write a brief description of each of the three respondents. Subsequently, participants were given a new list of 16 additional items from the same personality scale, and were asked to predict the responses of the same three individuals to the new items. Because the personality measure materials were indeed based on the responses of three actual
individuals to items from Jackson’s Personality Inventory, in this study there is an objective performance measure. For details on the materials used in this experiment, see Appendix E.

The dependent variables measured in this design are the amount of time spent reading over the initial personality inventory responses, and the “integrative complexity” of participants’ free responses in writing a personality description. Tetlock and Kim (1987) provide explicit details for coding methods to be used in rating the integrative complexity of participants’ responses. The conceptual ideas that underlie integrative complexity are “differentiation” and “integration of information”. Differentiation reflects a function of the number of alternative interpretations or perspectives that a person draws in understanding a problem. A person who is undifferentiated in their responses would focus on describing one facet of a person’s personality, whereas a differentiated response would point out numerous aspects of a person’s personality. Integration of information refers to the number of causal or conceptual connections a person makes between responses. A high-integration response would specify how attributes of a person’s personality would interact to produce specific behavioral outcomes. A low-integration response would merely list the attributes without regard to how they may interact. Two independent coders who were naïve to the conditions of this experiment were trained to code each participant’s response on a scale reflecting differentiation and integration of information, according to the scheme provided by Tetlock and Kim (1987); details are provided in Appendix E. Interrater agreement on the integrative complexity ratings given
by the coders was above 96% and disagreements were resolved via discussion. The coding of integrative complexity was therefore believed to be a reliable measure of thoroughness of information processing in this task. Finally, the decision outcome of prediction accuracy was measured, by examining the accuracy of people’s predictions for the second set of need for closure responses given by the three target individuals.

Again, it is anticipated that individuals who possess an intuitive temperament and are primed intuitively will process information less thoroughly (i.e., lower reading times and less differentiated and integrated statements) – leading to a lower accuracy in making predictions on the subsequent judgment task. Those who are more analytical in temperament and are analytically primed are expected to process information more thoroughly (i.e., longer reading times and more differentiated and integrated statements generated) – leading to better accuracy in predictions.

6.3 Experiment 3 Results

The data from this experiment were analyzed using three hierarchical linear regression models, one in which the variable of time spent reading the personality information was analyzed, one in which the complexity ratings of the personality sketches was analyzed, and another in which the number of correct predictions was investigated. In the first model, the amount of time that individuals spent reading the personality inventory responses was examined, using the predictors of priming condition, DMI analytical and intuitive scores, as well as interactions between DMI scores, and interactions between priming conditions and DMI scores. The regression model
demonstrated no significant main effects or interactions of priming condition, DMI scales, or their interaction upon the amount of time that people spent reading the personality response information. It appears that none of the decision mode factors under investigation in this project had an influence upon the amount of time that people spent reading through personality test responses of the target individuals in this task.

The second regression model examined the influence of priming conditions and DMI upon the complexity ratings of the personality sketch responses that were given by participants. The results of the regression analysis for these complexity ratings indicated a significant effect \( p < .05 \) of both priming conditions upon complexity of personality sketches. In this task it seems that priming one to be more either more analytical \( (M = 5.16, SD = 1.27) \) or more intuitive \( (M = 4.52, SD = 1.39) \) led to a significant increase in personality sketch complexity compared to the control group \( (M = 3.39, SD = 1.52) \). A post hoc analysis of variance demonstrated that while both priming conditions were significantly higher in integrative complexity ratings than the control group, the two priming conditions were not significantly different from one another. Therefore, in this experiment, both analytical and intuitive priming led to responses that were more complex.

\[
\hat{Y} = 3.39 + 1.75(anprime) + 1.13(inprime) \\
R^2 = .21 
\]

95%CI values for \( \beta \) weights:

- \( anprime \) (1.08, 2.43)
- \( inprime \) (.45, 1.80)
The third regression model that was tested examined the outcome variable of number of correct predictions for the target people’s responses on the second half of the personality inventory. This regression result indicated that analytical priming condition was related to a performance increase on this task. Intuitive priming and DMI scores were not related to any such impact upon performance outcomes. Therefore, for this particular task, being primed with an analytical mindset may result in a greater ability to both give complex responses and to perform better on a complex personality response prediction task.

\[ \hat{Y} = 29.36 + 1.73(anprime) \]

\[ R^2 = .06 \]

95%CI values for \( \beta \) weights:

*anprime* (.04, 3.41)

Because analytical priming condition was related to both personality sketch complexity and task performance, a mediational model was tested in order to determine whether the influence of analytical prime upon task performance took place indirectly through the complexity of personality ratings that were given by the participants. Following the previously described methodology, the results of the regression analyses were submitted to a mediational analysis.

The first step in this mediational analysis (see Figure 6.1) was to determine whether analytical priming significantly affects the potential mediator, complexity of personality sketches. A regression analysis indicates that it does (\( \beta = 1.22, p < .01, 95\%CI .58, 1.80 \)). The possible mediator, also has a significant influence upon prediction performance (\( \beta = .68, p < .05, 95\%CI .14, .81 \)). Earlier, the analytical priming condition
was shown to be related to complexity of personality sketches as well. As these conditions have been met, a Sobel test was conducted in order to determine whether a mediational path exists between analytical prime, complexity of responses, and prediction performance. In this model, \( a, b \) and \( c \) represent path coefficients, and the variables in parentheses are the standard errors that correspond to those path coefficients.

![Diagram of mediational model](Figure 6.1: Mediational Model Tested)

The results of the Sobel test indicated that there was evidence of significant mediation (\( z = 2.38, p < .05 \)). It appears that the influence of analytical priming condition upon the number of correct predictions was due to an indirect effect through the complexity of personality sketches that were produced, as demonstrated in Figure 6.2. The initial coefficient for the influence of analytical prime on correct predictions (\( \beta = 1.84 \)) declined when the mediator was included in the model (\( \beta = 1.13 \)).
6.4 Experiment 3 Discussion

In this additional examination of the impact of decision system factors upon decision behavior, the results provide some additional support for the hypotheses in this dissertation. The first hypothesis, which predicted that priming of decision strategies would produce a main effect upon decision behavior, was supported. When primed with analytical words, people’s complexity in personality sketches was benefited. Interestingly, intuitive priming conditions also led to an increase in personality sketch complexity compared to the control group. In this case, it may be that simply being primed to think about any decision strategy, compared to not being primed to think about a decision strategy, led to a more detailed approach to the personality sketch task. The second hypothesis of this dissertation was not supported in this experiment. Individual differences measured by the DMI were not significantly related to personality sketch complexity in this experiment.

There was no effect of either priming condition or DMI subscale scores on the amount of time that people were engaged in reading the personality survey responses.
This result demonstrates that for this task at least, time spent reading information was not necessarily a good measure of thoroughness of information processing. In fact, time spent reading and complexity of personality descriptions were not significantly correlated with one another ($r = .03, p > .05$). Due to the lack of influence of individual difference measures, it is not surprising that hypothesis 3 and hypothesis 5 were not supported in this experiment. No interaction between priming conditions and individual differences emerged in predicting decision behavior.

However, hypothesis 4 was supported in the analytical priming condition. When primed analytically, personality prediction task performance increased. A follow-up mediational analysis revealed that this effect of analytical priming upon decision accuracy took place through the mediation of complexity of information processing. As a result, this study not only demonstrates that priming may influence decision making behavior and outcomes, but it also provides some evidence about the mechanism through which this effect may take place. Being more “analytical” in this study led to an apparent performance benefit, through an influence upon complexity ratings that were given.

Interestingly, analytical priming was related to fewer correct predictions on the jury selection task in experiment 2. The conflict between these two results nicely mimics the conflict present in much of the research in judgment and decision making. While many theorists believe that more analytical processing leads to more “rational” decisions (e.g. Stanovich, 1999; Tversky & Kahneman, 1974) others believe the opposite may be true (e.g. Gigerenzer et al., 1999).
7.1 Experiment 4 Rationale

While the previous two experiments examined tasks for which there was an objective correct answer, in this final study a slightly different form of decision outcome was studied. Rather than looking at correct responses, this experiment allowed for investigation of how decision modes might impact information processing, which might in turn influence judgments that participants may make about a message they are asked to evaluate. The fourth investigation in this dissertation employed a method of examining thoroughness of information processing that was demonstrated by Harkins and Petty (1981). Participants were asked to read a persuasive message and to make a judgment on an issue relevant to their interests, namely whether students should be required to take a senior comprehensive exam prior to graduation. This exam was described as a measure of competency in both general skills that any college graduate should possess, and the specific skills required by their major. Participants were asked to read a persuasive position on this issue used previously by Harkins and Petty, which expressed favorable
messages about the use of comprehensive exams (see Appendix F for stimulus materials). Previous research using these materials demonstrated that participants who were distracted while receiving the message (who we can expect had inhibited information processing) were less likely to generate favorable thoughts about the use of comprehensive exams (Harkins & Petty, 1981). Because students are expected to have an immediate negative reaction to the proposal of senior comprehensive exams, unless they attend to convincing information presented in support of the exams we would expect negative thoughts to be reported. In fact, students who had uninhibited information processing of the convincing message were more likely to generate positive thoughts about the use of comprehensive exams, even though one might typically expect students to react negatively to a senior comprehensive exam proposal.

Two additional experimental conditions also existed within the current study. In one version of the comprehensive exam materials, participants were informed that the exam policy would possibly be instituted within the next 2 years (a highly relevant message). In another version of the materials, participants were informed that the policy would possibly be instituted in 10 years time (a less relevant message for current students). In previous investigations using this counterattitudinal topic, those in a high involvement condition (high relevance) were more persuaded by strong arguments than were subjects in the low involvement condition (Petty & Cacioppo, 1979). Consequently, Petty and Cacioppo argued that high involvement served to enhance “unbiased” processing of arguments. That is, high involvement motivated subjects to respond more positively to strong arguments, even when they were counterattitudinal in
nature. In the current research then, the relative effects of priming conditions, message relevance, and individual differences are investigated. It was hypothesized that those who were in the high message relevance condition, primed analytically, and with analytical decision style tendencies would process information about the comprehensive exams most thoroughly, would generate the most positive thoughts about comprehensive exams, and would report the most positive evaluation of comprehensive exams. In contrast, those who were primed intuitively, in the low relevance condition, and with intuitive tendencies would be most likely to fall back on the expected negative reaction that most students would initially hold about the idea of comprehensive senior exams. In other words, as previous research has suggested (Petty & Cacioppo, 1979) those who are not motivated to process a compelling argument in favor of senior comprehensive exams carefully will be likely to maintain an initial negative impression students will typically hold about the exam issue.

7.2 Experiment 4 Method

This experiment was designed to measure information processing behavior displayed in a judgment task. Participants were presented with the same word completion task which served as the priming method in the previous experiments. Following this, they were asked to complete a message evaluation task in which one had to evaluate a message about senior comprehensive exams, to work on some filler decision tasks, and were finally asked to complete some individual difference measures related to decision making style, including the DMI.
7.2.1 Experiment 4 Participants

The participants in this study consisted of students at Ohio State University who were paid $10 for their participation in the experiment, or who received course credit for their participation. In total, 152 students participated in this experiment, 72 males and 80 females, with an average age of 22 years.

7.2.2 Experiment 4 Procedure

The participants in this study were first asked to engage in the same priming task used previously, in which roughly one-third of participants were exposed to analytical primes \( (n = 54) \), one-third to intuitive primes \( (n = 48) \), and one-third to neutral primes \( (n = 50) \). Immediately following this, participants were asked to read a convincing positive message held by another student on the issue of senior comprehensive exams, which has been successfully used in previous research. Participants were informed that they would provide their attitudes and opinions on a campus issue. All participants then received information about a proposal to implement senior comprehensive exams at the Ohio State University. In essence, participants were told that a policy of senior comprehensive exams would require seniors to take and pass an exam in their major area before they could graduate. After receiving the information about the exam, participants were told they would read the position of another student on this proposal. They were then given a very strong message in favor of instituting the exams (see Appendix F). In addition, roughly half of the participants were randomly assigned to read a message that indicated the comprehensive exam policy would be implemented in 2 years (the highly-relevant
condition) \((n = 79)\), and the other half of participants were told that the policy was being considered for implementation in 10 years time (the less-relevant condition) \((n = 73)\).

Response times were measured for the amount of time individuals spent reading the convincing statement. Following this, participants were asked to write as many statements as they chose about their own position on comprehensive senior exams. Participants were then asked to go over their statements, and code them in terms of whether each statement corresponded with either a positive, negative or neutral view of comprehensive exams. Finally, participants were asked to give a response on a scale of 1-10, of their choice of vote on whether student comprehensive exams should be given.

The dependent variables that were entered into the model are the amount of time spent reading the stimulus materials, the total number of arguments generated, as well as the percent of argument-relevant (positive) thoughts generated in their response – in order to assess attention to the issue-relevant information presented. Final evaluation about the exam policy was also examined through scale ratings of the policy. Participants were asked to rate the policy on 10-point scales of bad – good, negative – positive, unfavorable – favorable, and harmful – beneficial. Finally, participants were asked to report, on a 10-point scale, whether they were against or in favor of the policy.

7.3 Experiment 4 Results

The data from this experiment were analyzed using five separate hierarchical linear regression models. In the first, the variable of time spent reading the information about the comprehensive exams was analyzed. In the second analysis, the total number
of thought ratings was analyzed, and in another, the percent of positive thought ratings was analyzed. In the final analyses, both the summed negative – positive evaluation scores, as well as the final judgment in favor or against the policy were investigated. Across all of these dependent variables, the influence of priming conditions, message relevance, DMI subscales, and their interactions were all investigated.

In the first model, the amount of time that individuals spent reading the argument in favor of the comprehensive exam was examined, using the predictors of priming condition, message relevance condition, DMI analytical and intuitive scores, as well as interactions. The regression model demonstrated no significant main effects or interactions of priming condition, message relevance, or DMI scales upon the amount of time that people spent reading the message. As in the previous analysis, it may be that time spent reading may not be a clear measure of information processing – or it may simply be that these factors do not hold a strong influence on reading time.

The second regression model examined the influence of priming conditions, message relevance conditions, and DMI upon the total number of thoughts that individuals generated in response to the persuasive pro-comprehensive exam message. Again, the regression model demonstrated no significant main effects or interactions of priming condition, message relevance or DMI scales upon the number of total thoughts that participants reported in this task. Those in intuitive ($M = 3.44, SD = 1.79$), analytical ($M = 3.72, SD = 2.00$), and control conditions ($M = 3.56, SD = 2.09$), as well as high relevance ($M = 3.81, SD = 2.15$) and low relevance conditions ($M = 3.32, SD = 1.70$) did
not differ in total thought generation. Apparently, the predictor variables did not significantly influence the number of total thoughts that individuals self-reported on this task.

Similarly, the regression analysis for percent of positive thoughts that were generated on the task did not reveal any significant main effects or interactions. Participants in analytical ($M = 60.94$, $SD = 38.26$), intuitive ($M = 57.81$, $SD = 33.46$), and control priming conditions ($M = 56.80$, $SD = 37.08$), as well as high relevance ($M = 61.77$, $SD = 37.36$) and low relevance conditions ($M = 55.14$, $SD = 34.87$) did not differ statistically in the percent of positive thoughts that were elicited. In terms of thought generation as a measure of thoroughness of information processing, the results of this analysis are inconclusive.

Although there has been little impact of the predictors of this experiment thus far, the results of the regression analysis for the evaluation ratings for the comprehensive exam policy indicated a statistically significant effect ($p < .05$) of both priming conditions upon positive valence of ratings (higher number indicates more positive response). The summed composite score of ratings on the 10-point scales of bad – good, negative – positive, unfavorable – favorable, and harmful – beneficial were analyzed, with the regression model indicating that both conditions led to more favorable ratings compared to the control group. Therefore, being primed for either decision strategy led to more positive feelings about the comprehensive exam, regardless of the specific primed strategy to which one was exposed.
The final regression model examined the outcome variable of the final evaluation rating given on a 10-point scale, as to whether participants were against or in favor of the policy (higher score = more favorable). This regression result indicated that analytical priming condition and intuitive priming conditions were again related to higher favorableness scores for the comprehensive exam policy. Again, it seems that both priming conditions led to a more positive evaluation of the policy compared to the control group.

\[ \hat{Y} = 5.92 + 1.00(anprime) + .93(inprime) \]

\[ R^2 = .05 \]

95%CI values for β weights:

anprime (.19, 1.81)
inprime (.10, 1.77)

7.4 Experiment 4 Discussion

The results of this final experiment provide support only for the hypotheses related to the priming manipulation investigated in this dissertation. The first and second hypotheses, which predicted that priming of decision strategies and individual differences respectively would produce a main effect upon decision behavior, were not supported. Due to the lack of effect in hypothesis 1 and 2, there is also no support for hypothesis 3 as a result, in which the confluence of decision temperament and priming conditions were
proposed. It appears that System 1 and System 2 process influences in this experiment were not influential upon either the amount of time people spent reading the persuasive message, the number of total thoughts that were generated, or the percent of positive thoughts generated. It is unclear whether this result is due to the lack of influence of these independent variables for this task, or whether these dependent measures are perhaps inaccurate or incomplete measures of decision behavior. For example, it may be that generation of thoughts is not so much a measure of thoroughness of decision behavior, but perhaps may be another type of effect of thoroughness of information processing.

While the first three hypotheses were not supported, there is some support for hypothesis 4. When primed with either analytical or intuitive words, people’s favorableness ratings, in both the composite positivity score, and in the final evaluation score, were both increased. It seems that being primed to think about decision making rather than not holds some implication for people’s judgment outcomes in this task. While there was no mediational analysis that could be conducted for this result, it may still be the case that this effect may take place through some measure of decision behavior. As individual differences were not of significant impact in this study, hypothesis 5 was again not supported. This trend towards lack of influence of DMI scores may not completely suggest that individual differences are not important. It may be that this measure of decision temperament alone may not be robust enough of a measure to account for a good deal of variance in complex decision tasks.
CHAPTER 8

DISCUSSION AND CONCLUSIONS

8.1 Summary

The present research examined the roles that priming of decision strategies, and individual differences in decision strategies may play in instigating System 1 and System 2 forms of decision behavior. In particular, this project has provided evidence that an analytical, high-effort, deliberative process, and an intuitive, efficient, cursory process can be activated through priming methods. Therefore, these four experiments provided preliminary evidence related to the question of whether analytical and intuitive decision strategies correspond with controlled and automatic cognitive processes, respectively. It appears that there is not a perfect correspondence between automatic cognitive processes and System 1 / System 2 typed decision behavior. At the meta-decision level, automatic processes may occur which can lead to either more or less deliberation during the information processing stage of decision making. However, there was only some evidence to suggest that individual differences in decision making strategy either directly influence System 1 and System 2 processing, or that they interact with priming effects to produce differences in information search strategies and decision outcomes. This result may initially be interpreted as suggesting that individual differences are not as strong in
predicting behavior as are environmental factors. However, this interpretation must be approached with caution – as it may also be that a single measure of decision temperament alone may not be a powerful enough measure of temperamental differences with lower sample sizes.

Another contribution of this research lies in the investigation of the method by which people “decide how to decide”. While Chartrand (2005) has suggested that researchers should present a clearer analysis of the stages of automatic processing, researchers should similarly pay closer attention to the stages of decision making in which both automatic and controlled processes may hold sway on our decision making. Rather than solely being concerned with the outcome of people’s decisions, this research focused upon providing a more complete understanding of how people arrive at the method through which they will approach a decision problem (e.g. a System 1 or System 2 approach). Essentially, by adopting a more meta-decisional focus to understanding decision making, research will more clearly demonstrate the complex and dynamic processes involved in choice and decision making. Some factors that clearly may play important roles in the meta-decision process, as evidenced in this dissertation project, include priming effects and other environmental cues, and may also include individual difference factors.

In this research, an attempt was also made to clearly demonstrate how environmental (priming) and temperamental (individual difference) factors may influence decision behavior, which might in turn influence behavioral outcomes. Through the use of mediational analyses such as those employed in this project, one may develop
experiments that can give a more concrete analysis of the path that individuals take towards their ultimate judgment or decision. Again, rather than simply investigating decision outcomes, mediational analyses provide an ability to clearly study how an independent variable may have an influence upon a judgment or choice of interest. While there was only one experiment in this project for which a mediation effect was obtained, this result in itself lends some information about the process that may underlie priming effects. As a whole, the results of this series of experiments hopefully furthered our knowledge about the nature of priming effects, the understanding of how people “decide how to decide”, and the manner in which these priming effects might influence decision outcomes through an impact upon decision making behavior.

8.2 Primary Findings and Implications

In the Rationale section of this dissertation, a series of hypotheses and a conceptual framework were outlined for this project. Some of the hypotheses outlined in this dissertation received more support than did others. For example, hypothesis 1 stated:

_Hypothesis 1:_ Supraliminal priming of decision strategies will produce a main effect upon decision behavior. When primed with analytical words, people’s information search will become more thorough relative to control. When conceptually primed intuitively, information search will become less thorough relative to control.

In some of the experiments, there is clear support for this hypothesis, while other results are less conclusive. For example, in the study 1 Mouselab task, priming of decision strategies clearly had a main effect upon decision behavior. When primed with analytical words, people’s information search, indicated by both the number of items people
examined and the amount of time spent searching, was more thorough compared to the control group and the intuitive prime group. When people were primed intuitively, their amount of time searching and number of items searched was less thorough relative to the control and analytical groups.

In the second experiment, the jury selection task, the effect of priming was less clearly supported than in the first experiment. When primed with analytical words, people’s information search, indicated by the number of items people examined in the task, was more thorough compared to the control group and the intuitive prime group. However, there appeared to be little influence of intuitive prime in this experiment. It is unclear whether the lack of influence of intuitive prime in this experiment was due to the nature of the task itself, or if it is the case that analytical priming is sometimes more effective than intuitive priming. In experiment 3 however, when primed with either analytical words or intuitive words, people’s complexity in personality sketches was benefited. In this case, it may be that simply being primed to think about any decision strategy, compared to not being primed to think about a decision strategy, led to a more detailed approach to the personality sketch task. Finally, in the fourth experiment, there was no perceived effect of priming upon thoroughness in decision behavior.

There are a few different possible explanations for the differing results across these investigations. First, it may be that the nature of these tasks themselves may impact the degree to which priming effects may hold an influence. It may be that analytical and intuitive priming may have different effects across varying decision contexts. For example, the initial Mouselab study is likely to be the simplest of the decision behavior
measures, for which participants are unlikely to become personally invested due to the lack of clear “correct” answer, and due to the completely hypothetical nature of the task. Similarly, the Mouselab task also provides the most clear measures of thoroughness of information processing (uncovering pieces of simple information). As the experiments progressed in complexity, the behavioral measures of decision making also are likely to have become more complex, and perhaps may be less clear measures of decision behavior (e.g., reading time, responses generated). Also, it may be that some of the measures of information processing may not be information processing measures per se, but may actually be additional outcome variables that are associated with information processing (e.g., complexity of personality sketches, generation of thought listings).

Across these studies, another interesting outcome is that there seemed to be a greater overall impact of analytical priming as compared to intuitive priming. It might be the case that presentation of analytical primes is a more powerful automatic process than an intuitive prime. This argument seems counterintuitive at first glance. However, it is typically proposed that System 1 is a “default” position, and that System 2 processing emerges with the proper time and motivation (Stanovich, 1999; Petty & Cacioppo, 1979). Perhaps time and motivation, controlled processes, are not the only factors that can lead one to a System 2 form of processing. Indeed, the primary goal of this project was to demonstrate that automatic processes may lead to both intuitive and analytical forms of decision behavior. It seems that it may even be the case that automatic processes are more likely to lead to System 2 forms of decision behavior than System 1 decision behavior. While there is some interesting preliminary evidence provided in this project
regarding the role that priming may play in decision making processes, there is clearly much territory to be covered in order to determine the exact nature of decision strategy priming effects.

While hypothesis 1 received some form of support across most of the experiments, hypothesis 2, which held individual differences as the predictor of interest, received less clear results:

*Hypothesis 2: Individual difference in decision strategy use will produce a main effect upon decision behavior. A self-reported general reliance on an analytical strategy will be related to more thorough information processing. Those that report a greater reliance on intuitive strategies will engage in less thorough information processing.*

In the first study, the strongest support emerged for the possible impact of individual differences upon decision behavior. Individual differences in decision making style preference measured by the DMI were related to information processing. Analytical style preference was significantly and positively related to time searching and items searched, and intuitive style preference was negatively related to time and item variables in the Mouselab task. However, in the second experiment, the second hypothesis was not supported – individual differences measured by the DMI were not statistically related to information processing or prediction accuracy in the jury selection experiment. Similarly, in the third and fourth experiments, studies of personality prediction and comprehensive exam evaluation, respectively, individual differences measured by the DMI were not significantly related to complexity of information processing. Interpretation of this lack of outcome is difficult. It may be that with relatively small sample sizes (\(n \approx 100\)), the analyses of individual differences may not be powerful enough
to detect relationships that exist between DMI scores and decision behavior. It may be that decision temperament is more relevant to some tasks (e.g., Mouselab) than other tasks. Perhaps it was again the simple and clear measure of the Mouselab task which led to greater ease in predicting decision behavior. Or, it may be that the DMI measure alone was unable to capture the influence of individual differences in decision style upon decision behavior across the tasks. Perhaps in future research a group of individual difference measures that seem related to the same System 1 / System 2 constructs may be employed, and may increase predictive ability. At this point however, we are left with some inconclusive results when it comes to the possible influence of temperament upon decision making – an area which begs for further investigation.

The third hypothesis of interest in this set of investigations was related to a possible interaction between priming conditions and individual difference measures:

Hypothesis 3: When priming manipulations and individual differences correspond, the predicted outcomes will be amplified such that those who have an analytical predisposition and are analytically primed will have the most thorough information processing. Those who have an intuitive predisposition and who are intuitively primed will have the least thorough information processing.

Interestingly, there was no support across any of the investigations for this hypothesis. No interaction between priming conditions and individual differences emerged in predicting any outcomes of decision behavior – and effectively individual differences did not accentuate the effect of priming upon decision making. Due to the possible limitations that may have led to null main effects for the influence of DMI scores, perhaps it is not surprising that no interaction effect was found. Overall, it seems that the influence of individual differences in decision styles had a relatively smaller effect on
decision behavior as compared to the priming manipulation. At this stage it is difficult to
determine whether this outcome is due to limitations of the present investigations, or
whether environmental priming effects hold more of an impact on decision behavior
compared to temperamental influences.

In the fourth hypothesis under investigation, possible mediating factors were of
interest. It was proposed that effect of priming manipulations on decision outcomes
would take place through an indirect influence on decision behavior:

*Hypothesis 4:* Priming manipulations will influence decision outcomes, primarily
through an influence upon decision behavior. When there is a significant
influence of priming upon decision outcomes, this influence will take place
through the mediation of decision behavior. In other words, priming will
influence decision behavior (e.g. thoroughness of information search) which will
in turn influence individuals’ decision outcomes (see the individual study
descriptions for more specific details about the decision outcome predictions).

While study 1 did not present decision outcomes for analysis, in study 2 there was an
effect that while in the expected direction of a mediational influence (the influence of
analytical priming upon decision outcomes did decline when the influence of information
search was accounted for), but for which there was no statistically significant mediational
effect found. However, in experiment 3 clear mediational results were obtained. When
primed analytically, personality prediction task performance increased, and the follow-up
mediational analysis revealed that this effect took place through the mediation of
complexity of information processing. As a result, this study not only demonstrated that
priming may influence decision making behavior and outcomes, but it also provided
some evidence about the mechanism through which this effect may take place – namely
information processing complexity. In the final experiment, when primed with either
analytical or intuitive words, people’s favorableness ratings towards senior comprehensive exams were both increased. It seems that being primed to think about decision making rather than not holds some implication for people’s judgment outcomes in this task. While there was no mediational analysis that could be conducted for this result due to a lack of support for the first two hypotheses, it may still be the case that the effect upon decision outcomes may take place through some measure of decision behavior. Overall, these results do not give conclusive evidence in support of the path of influence from priming effects to decision behavior, and then consequently to decision outcomes. The lack of consistency in these results may be due to a few factors. It is likely that the effect of priming upon decision accuracy can result from other process-related factors not measured in this experiments (e.g., time, attention, etc.) and that may be examined in a multiple-mediation analysis in future research. Perhaps one or two decision behavior measures alone can not adequately explain why priming may have an influence upon decision behavior, and in turn decision outcomes. Because there is still theoretical reason to believe that priming will influence decision outcomes through an impact on thoroughness of information processing, future research on this topic is warranted.

Finally, hypothesis 5 was concerned with the possible path between individual difference effects, decision behavior effects, and ultimately decision behavior:

_Hypothesis 5:_ Individual differences will influence decision outcomes, primarily through an influence upon decision behavior. When there is a significant influence of individual differences upon decision outcomes, this influence will take place through the mediation of decision behavior (see the individual study descriptions for more specific details about the decision outcome predictions).
This hypothesis was unsupported in the experiments in this dissertation. Due to the lack of effect of decision style temperament upon decision behavior and outcomes, there were no possible mediational analyses that could be examined. However, this mediation model of investigating the decision process would present a very effective and informative approach to understanding the decision process, if more clear results are obtained for the influence of individual differences in decision making.

On the whole, while the theoretical model that was proposed in this dissertation was not generally supported, there were paths within this model that did receive some empirical support. Primarily, it seems that priming influences upon both decision behavior and decision outcomes were the most clearly supported aspect of the conceptual model under investigation. However, while the impact of priming sometimes took place in the predicted direction, sometimes the effects of both types of priming presented results that were similar in direction (e.g., both leading to more thorough information processing). Similarly, sometimes priming analytical strategies led to improved decision outcomes, and in other cases decision outcomes were damaged due to analytical priming. Factors may exist that can predict when different forms of behavioral outcomes will result from analytical and intuitive priming effects. There is clearly a great need for future investigation of the decision process that is set into motion by priming of decision strategies. In essence, the exact nature of the path from priming, to decision behavior and ultimately to decision outcomes is still unclear, and perhaps is currently best represented by the exploratory conceptual model in Figure 8.1 (which reflects the decision process model presented earlier in Figure 2.2):
8.3 Directions for Future Research

This series of investigations point to several areas of possible future investigation within the judgment and decision making literature. While it now seems that decision strategy priming effects can in fact influence decision processes and outcomes, the exact nature of these priming effects is still unclear. The manner in which analytical and intuitive primes influenced information search and decision outcomes was not cohesive across these investigations. Therefore, future work may be designed to clarify the outcomes of decision strategy priming that we might expect to see across distinct decision tasks.

Similarly, while some evidence suggests that individual differences can influence decision behavior, there was some inconclusive evidence across the four investigations presented here. In future research, multiple measures of decision strategy preference may lend greater power to analysis of individual differences in decision making. Experiments with larger sample sizes may allow for more variability in reported levels of decision
style tendencies, which may increase the predictive ability of the DMI individual difference measure. Furthermore, the possible interactions of priming and individual differences should still be topics of interest in the future.

The model of examining how priming effects may impact decision outcomes indirectly through decision behavior is one that may be employed in future investigations of the decision process as well. Instead of a focus on simply predicting how factors may influence decision outcomes, models that allow for a more dynamic investigation of how these effects take place are potentially very informative. It is not only that mediational models can be useful in understanding priming effects – mediational models can provide a great deal of evidence across many possible factors expected to impact decision outcomes.

The experiments presented in this dissertation project were of a very diverse nature. Each of them had varying degrees of complexity, distinct measures of decision behavior, and different forms of decision outcomes. As a result, it may not be shocking to find that the outcomes of each study paint a slightly different picture of how priming of decision strategies and individual differences may impact the decision making process. While it is important to examine how automatic and individual difference processes may impact decision behavior across a variety of contexts, examination across different experimental paradigms can complicate conclusions that may be drawn. As a result, future investigations that will emerge from this set of experiments will focus on one of the decision tasks, so that the nature of priming and individual difference influences may be better controlled and understood in this early stage of investigation.
The task presented in experiment 2, the juror selection task, may hold the most promise for continued investigation. This task may be modified in a few different manners in order to provide some interesting measures of decision behavior. First, apart from the behavioral measure of the number of response items investigated by participants (i.e., the responses to demographic and personal belief questions given by jurors) used in this experiment, additional measures of decision behavior may be collected. For example, modification of the program will allow for a measure of the amount of time that people spend on the task itself, as well as a measure of the specific items that individuals attend to when they anticipate having to make a prediction. Another interesting feature of this experiment lies in the fact that a regression model may be obtained for the juror response items in order to determine which items are the best predictors of a juror’s belief in whether physician assisted suicide is wrong. As a result, it will be possible to examine whether the participants attend to the most diagnostic information when engaged in information search. Investigation of the diagnosticity of the information that participants may search through will yield a cleaner measure of whether participants’ performance on the jury selection task is benefited or is damaged by priming manipulations. Similarly, manipulating the diagnosticity of the information presented is possible with this experimental paradigm, allowing for demonstrations of how assuming a System 1 or System 2 decision process may alter decision outcomes depending on the fit with the environmental context. For example, in one experimental condition, the responses to the demographic and personal belief questions may be altered such that attending to more information may lead to a performance benefit for participants. In another condition,
attending to one sole predictor may lead to the most accurate judgments for participants. Through such an investigation, the impact of priming manipulations and individual differences upon decision strategy, and in turn on decision outcomes may be more clearly investigated.

Few topics in psychological research are as applicable across disciplines as the study of judgment and decision making. Decision making processes are inherent in virtually all topic areas that one might study. Therefore, apart from implications for the research literature on judgment and decision making, this series of investigations are also relevant for numerous other areas of inquiry. For example, the study of priming decision strategies may be applicable across many domains, including consumer behavior (in which one may wish to examine the impact of analytical and intuitive priming on evaluation of consumer products), human factors (in which one may wish to incite more analytical or more intuitive processing based upon their effectiveness for a given task environment), and legal decision making (in which subtle decision processing cues in the courtroom environment may impact juror decision making). There are a great number of domains in which the automatic priming of decision strategies may be of interest.

8.5 Conclusion

The present research examined the roles that priming of decision strategies at the meta-decision level and individual differences in decision strategies may hold for decision behavior and decision outcomes. Traditionally in the judgment and decision making literature, it has been assumed that analytical forms of decision making emerge
out of “conscious” forms of information processing, and that intuitive / heuristic forms of
decision making emerge out of “implicit / un-conscious” processes. In particular, this
project has provided evidence that an analytical, high-effort, deliberative process of
information search, and an intuitive, efficient, cursory process of searching for
information can be activated through priming methods in the meta-decision stage of
decision making. However, there was little support for the idea that individual
differences in decision making strategy interact with priming effects to produce
differences in information search strategies and decisions. In total, these investigations
supplied some preliminary contributions to our understanding about the nature of
environmental and temperamental influences upon decision behavior and outcomes.
LIST OF REFERENCES


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APPENDIX A

PRIMING MANIPULATION MATERIALS

Study 2:
In this next task, we will ask you to participate in a study that involves people’s ability to solve word puzzles. We will present you with an incomplete word, and will ask you to complete the word.

We vary the number of letters that are missing in each word between participants in this study. For example, we are interested in how people respond differently to a word that is missing one letter (m_sing) versus a word that is missing three letters (m_s_in__).

You have been randomly assigned to complete word puzzles in which each word is missing one letter. Please type out the entire word as your answer, after deciding which letter(s) will correctly complete the word.

If you have any questions, raise your hand and ask the experimenter. If not, click on "continue" in order to begin the word puzzle task.

Word completion priming task instructions (used in all four experiments)
This word is missing one letter. Please type in the completed word below.

SPONTA_EOUS

Press ENTER when you have typed your answer

Example of word completion priming item (used in all four experiments)
APPENDIX B

DECISION MAKING STYLES INVENTORY

We are interested in how you typically go about making decisions. Think about different situations and contexts where you have made decisions recently. Then for each statement, indicate the degree to which you agree or disagree with that statement. Keep in mind that there are no right or wrong answers to any of these items, because there is no single "best" way to make every decision. It is important that you try to answer all questions. However, if you feel uncomfortable with any item, you may choose to omit it. You will use the following rating scale for each statement.

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly Disagree</th>
<th>2 Moderately Disagree</th>
<th>3 Slightly Disagree</th>
<th>4 Slightly Agree</th>
<th>5 Moderately Agree</th>
<th>6 Strongly Agree</th>
</tr>
</thead>
</table>

1. ___A___ I feel that if I plan my decisions carefully I will make good decisions.
2. ___R*___ I rarely rehash old decisions I’ve made.
3. ___A___ In making decisions I first try to make a mental list of all the factors or attributes that will be important to my decision.
4. ___A___ Before I make a decision, I like to figure out the most efficient way of studying it.
5. ___I___ Simple decision rules usually work best for me.
6. ___A___ I’m very rational when it comes to evaluating risky options.
7. ___I___ I think that relying on one’s “gut feelings” is a sound decision making principle.
8. ___A___ In making decisions I first make a careful initial estimate of the situation.
9. ___R___ I tend to be someone who worries a lot over decisions I’ve made.
10. ___R___ After making a decision, I find that I often go back and re-evaluate the situation.
11. ___A___ I try to pay attention to past information in making new decisions.
12 __R__ Worrying about future decisions that I have to make is something I often do.

13 __I__ When forced to make a quick decision, I find that information that readily comes to mind is usually the most useful in making a choice.

14 __I__ There are many common sense “rules-of-thumb” that I know of that usually lead to good decisions.

15 __I__ My first reaction to a decision situation usually turns out to be the best one.

16 __A__ I always try to be fully prepared before I begin working on making a decision.

17 __R__ Many times when I look back on a choice I’ve made, I wish that I would have put more effort into evaluating the alternatives.

18 __R__ When I find out that I’ve made a bad decision I feel a lot of regret.

19 __A__ In making decisions I try to evaluate the importance of each piece of information in the decision process.

20 __I__ If I can’t decide what to do, I go with my "best guess".

21 __A__ In making decisions I try to examine the importance of the good and bad points of each alternative.

22 __I__ When making decisions, my first instinct usually turns out to be best.

23 __A__ My best decisions are those for which I’ve carefully weighed all of the relevant information.

24 __I__ I let my intuition play a big part in most decisions I make.

25 __A__ I generally rely on careful reasoning in making up my mind.

26 __R__ I generally don’t make very good decisions under time pressure.

27 __I__ I often rely on my first impression when making a decision.

28 __A__ I like to make decisions in an orderly manner.

29 __I__ I rely on my intuition in making many of my personal decisions.

30 __I__ I find that my best decisions usually result from using the “quick and easy” approach rather than the “slow but sure” method.

31 __R__ After making a decision I sometimes worry about the regret I’ll feel if it the outcome turns out to be a bad one.
Unexpected bad outcomes have a greater impact on me than do unexpected good outcomes.

A good rule of thumb is that the more information I have in making a decision, the better that decision will be.

I sometimes get “butterflies” in my stomach when I have to make decisions.

If I were gambling at a casino I would prefer to play simpler games like slot machines where you don’t have to concentrate on playing complex strategies.

I have trouble putting the results of disappointing decisions I’ve made behind me.

Sometimes decisions, even important ones, are not difficult to make because they just “feel” right.

Before I make a decision, I think about whether others will approve or disapprove of it.

I feel that I have a knack for making good, quick decisions.

Most important decisions in life are complex and need to be evaluated in a systematic way.

I sometimes spend too much time hesitating before making decisions.

I can get a good “feeling” for most decision situations very quickly.

I like to take a rational, systematic approach to making decisions.

In spontaneous decision situations I usually find that I have good intuitions.

I think that I could keep myself from worrying later if I had made a bad decision.

A = Analytical Decision Making Style
I = Intuitive Decision Making Style
R = Regret-Based Decision Making Style
* = indicates reverse coding

Thomas Nygren and Rebecca White
The Ohio State University

For more information regarding use of this scale, contact Dr. Thomas Nygren (nygren.1@osu.edu).
APPENDIX C

SAMPLE MATERIALS FROM EXPERIMENT 1

Session Overview

Thanks for attending our study today! Today you will be participating in a study that investigates how people form judgments and make decisions. This study is designed to investigate various aspects of decision making and problem solving. Please read the instructions that accompany each separate section of the study.

If there is any question that you feel uncomfortable answering, you may skip over the question by pressing “Ctrl →” on the keyboard, or ask the experimenter to assist you. Also, keep in mind that your participation is voluntary, and that you may quit participation in this study at any time without penalty. If you have any questions at any time, please raise your hand and the experimenter will assist you.

Press the Spacebar to Continue

Session overview instructions (used in all four experiments)
Study 1: Part A

In this experiment, we wish to examine how people go about making decisions. Specifically, we are interested in how people make choices among a set of options. You will be asked to make some decisions between some college courses that you might take.

Information about several college courses will be presented in a table that holds information about the various alternatives. You may search for as much or as little information as you need in order to make a decision.

Press the Spacebar to Continue

Instruction screen for Mouselab task

For each decision task, we will present you with a matrix of information about the attributes of each alternative from which you can choose. For example, let's pretend that you will be choosing between potential courses that you might want to take. In the matrix, the alternatives (courses) will be listed on the left-hand side of the matrix, and attributes of the courses will be listed across the top of the matrix, as seen below. Each cell of the matrix will contain the description of the specific feature (column) of a particular course (row).

Press the Spacebar to Continue

Instruction screen for Mouselab task
At first, the cells of the matrix will appear to be blank. To read the descriptions of the features in a cell, simply move your mouse over the cell and the description will appear. When you move the mouse to a new cell, the description in the old cell will disappear and the new description will be visible. *You can go back and look at the same information as many times as you would like.*

Out of each set of options (such as cars) that we present to you, we would like you to select the option that you would be *most likely to choose* by clicking the appropriate button at the bottom of the screen. You can search for as much or as little information about the options as you like before making your decision.

*Press the Spacebar to Continue*

Instruction screen for Mouselab task

<table>
<thead>
<tr>
<th>Course 1</th>
<th>Course 2</th>
<th>Course 3</th>
<th>Course 4</th>
<th>Course 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relev. to Major</td>
<td>Time</td>
<td>Credit Hours</td>
<td>Workload</td>
<td>Instructor</td>
</tr>
<tr>
<td>High</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Choose one: Course 1 | Course 2 | Course 3 | Course 4 | Course 5

Example Mouselab task
1. What do you think the purpose of this experiment was?
2. What do you think this experiment was trying to study?
3. Did you think that any of the tasks were related in any way? If so, how were they related?
4. Did anything you did on one task affect what you did on any other task? If so, how exactly did it affect you?
5. When you were completing the word completion task, did you notice anything unusual about the words?
6. Did you notice any particular pattern or theme to the words that were included in the word completion task?

Funneled debriefing questions (used in all four experiments)
APPENDIX D

SAMPLE MATERIALS FROM EXPERIMENT 2

Juror Selection Task

In this experiment, you are to assume the role of a new attorney in a law firm, Brown & Black. Brown & Black does a lot of jury trial work. Thus, an important skill every attorney must have or acquire is the ability to anticipate how potential jurors would feel about a given issue. The supervising partner to whom you report, Philip Elkin, has prepared a test of your juror judgment skills. If Mr. Elkin concludes that your skills are just too weak, he will have to let you go.

The kind of case Mr. Elkin wants you to consider is similar to that of Jane Williams, who was hospitalized with a terminal illness. Ms. Williams wanted her hospital to withhold treatment so that she could let nature take its course, i.e., be allowed to die. But the hospital refused. She thus took the hospital to court and retained Brown & Black to represent her. At the jury-selection stage of the case, the attorneys sought to select jurors who were inclined to vote in favor of Ms. Williams’s request. Mr. Elkin wants to gauge how good a job you would have done picking jurors in the Williams case. All the prospective jurors in the given jurisdiction completed a general questionnaire concerning several personal characteristics as well as their opinions about various miscellaneous issues. Those prospective jurors also responded “yes” or “no” to the question of whether a terminally ill patient should be allowed to end his or her own life. Your job is to decide how the jurors responded.

In this task, only use the "click to continue" buttons (below), and DO NOT use the "Continue" link at the bottom right of the page unless you are instructed to do so.
You will see each juror's profile with information about their age and their gender.

You will also have the option of viewing information about their responses to 15 questions they were each asked.

You may choose to find out information about the juror's (1) marital status, (2) political party affiliation, (3) total household income, (4) number of children, (5) religious preference, (6) religious service attendance, (7) current health condition, (8) belief about whether it is wrong or not for a man and a woman to have sex before marriage, (9) belief about whether divorce should be easier or more difficult to obtain than it is now, (10) whether they favor or oppose the death penalty, (11) whether they favor or oppose gun permit laws, (12) whether they favor or oppose a woman's right to have an abortion, (13) whether they favor or oppose the ban of prayer in public schools, (14) degree of confidence in the courts and legal system, and (15) whether they believe the courts deal too harshly or not harshly enough with criminals.
It is completely up to you to decide how best to use this information in your determination of whether the prospective juror favors or is against suicide as an option for people with incurable diseases. You can seek to look at as much information, or as little information in order to make a judgment as you wish. You should use this information in whatever way you think will lead you to achieve your best performance on the task. One hint is that half of the jurors you will evaluate favor physician assisted suicide in cases of terminal illness, and half oppose it.

NOTE: THE JURORS IN THIS TEST ARE REAL PEOPLE. THEY WERE ACTUAL, RANDOMLY SELECTED RESPONDENTS IN A SURVEY OF THE ADULT POPULATION CONDUCTED IN 1998.

Click here to Continue
For each prospective juror, you are asked to do two things. *First, you should choose which information to look at in making your judgment.* You should choose to only look at information that you think will help improve your judgment accuracy. You can look at as much or as little information as you wish.

*Second, you are asked to indicate whether you think the juror responded “yes” or “no” to the suicide question.* You are also asked to report your confidence that the prospective juror actually favors the position you indicated. Please express your confidence in the form of a probability judgment ranging from 50% (that the prospective juror is just as likely to favor as to oppose the suicide option) to 100% (that the prospective juror’s position is absolutely certain to be as you indicated).

We will first give you a short practice example, after which you will be asked to complete a task in which you assess whether each of 30 jurors were in favor of, or against, physician assisted suicide. We have found that it is best for individuals to assess no more than 15 individuals within a short time frame - therefore after the first 15 assessments, you will be given a break during which we will ask you to complete a distractor task involving a word puzzle. After the distractor task, we will ask you to assess 15 more prospective jurors.

Now, we would like for you to complete a practice task before you move on to the actual task.
<table>
<thead>
<tr>
<th>JUROR #1</th>
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<tbody>
<tr>
<td>AGE: 21</td>
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</table>

- **Marital Status**: Single
- **Political Party Affiliation**: Independent
- **Total Household Income**: 
- **Number of Children**: 0
- **Religious Affiliation**: 
- **Religious Service Attendance (how often)**: Several Times a Year
- **How Good Current Health Is**: 
- **Belief about whether sex before marriage is wrong**
  - Not Wrong at All
- **Belief about whether divorce should be easier or more difficult to obtain**
- **Favor or Oppose the Death Penalty**: 
- **Favor or Oppose Condom Use**
- **Favor or Oppose Legalized Abortion**
- **Favor or Oppose the Ban on Prayer in Public Schools**: 
- **Degree of Confidence in the Courts and Legal System**: 
- **Belief about whether courts deal too harshly or not harshly enough with criminals**

**Do you believe that this person favors, or oppose physician assisted suicide for terminally ill patients?**

**Rate your confidence that this prospective juror actually favors the position you indicated, from 50% (uncertain) to 100% (that you are positive in your response).**

- **Favors**: 
- **Opposes**: 
  
  (From 50% - 100%), I am ______ certain.
Person-Perception Task

On your desk, you have been given the responses that *three actual people* have made to 16 items drawn from a personality test called “Jackson’s Personality Research Form”.

In a moment, you will be asked to read the responses that each person gave to these 16 items. Following this, you will be asked to write a brief personality sketch of each person. When you are ready to begin the task, press the spacebar.

*Press the Spacebar to Continue*
Session Overview

Thanks for attending our study today! Today you will be participating in a study that investigates how people form judgments and make decisions. This study is designed to investigate various aspects of decision making and problem solving. Please read the instructions that accompany each separate section of the study.

If there is any question that you feel uncomfortable answering, you may skip over the question by pressing “Ctrl →” on the keyboard, or ask the experimenter to assist you. Also, keep in mind that your participation is voluntary, and that you may quit participation in this study at any time without penalty. If you have any questions at any time, please raise your hand and the experimenter will assist you.

Press the Spacebar to Continue

Today’s Tasks

Today, the primary task that we will ask you to complete involves the person-perception process, that is, how people form impressions of others from various types of information. You will be asked to read and make judgments about the personality traits of three individuals.

We will also ask you to complete some surveys that are designed to measure how you typically go about making decisions and thinking about issues. First, however, we will begin with a short study that measures people’s performance on a verbal task.

Press the Spacebar to Continue
Please read over each of the following statements, and respond either “true” or “false” to reflect whether you think this statement accurately reflects your personality.

**T** I don’t really have fun at large parties.

**F** I seldom set standards which are difficult for me to reach.

**T** I do not let my work get in the way of what I want to do.

**F** I will not be satisfied until I am the best in my field of work.

**T** I am quite independent of the people I know.

**T** I would work just as hard whether or not I had to earn a living.

**F** I go out of my way to meet people.

**F** I have rarely done extra studying in connection with my work.

**T** People consider me to be quite friendly.

**F** I would not be very good at a job which required me to meet people all day long.

**F** I choose hobbies that I can share with other people.

**F** I truly enjoy myself at social functions.

**T** I enjoy difficult work.

**F** I try to work just hard enough to get by.

**T** I seldom put out extra effort to make friends.

**F** People should be more involved with their work.
In the box below, please write a brief personality sketch of TEST TAKER #1, based upon their responses to the Personality Survey. Please write at least 3 sentences describing what you think this person’s personality is like. Please write as legibly as possible! Thanks!

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How do you predict that PERSON #1 would have responded to this question:

As a child, I worked for a long time for some of the things I needed.

- "True"
- "False"
FREE RESPONSE PERSONALITY SKETCH CODING

These responses come from participants who were asked to write a personality sketch of 3 different people. I would like for you to code these responses on one scale that represents two factors – conceptual differentiation and integration.

**Differentiation** – describes the number of alternative interpretations or perspectives that a person considers in analyzing an event or issue. Undifferentiated responses come from simple evaluative rules.

- For instance, a person might take an undifferentiated view of a test-taker by focusing on only one major theme running through the test responses (e.g., “This person loves to take charge, get their way, and win arguments”).

- A more differentiated statement would recognize either contradictory evidence on the test-taker’s personality on a trait dimension (e.g., this person is dominant in some settings but accommodating in others) or the difficulty of capturing the complexity of the personality with a single trait label (e.g., this person needs the company of others, but also needs to feel in control of most social situations).

- Basically, if a person only describes one basic trait dimension, it is a low differentiation response. If they describe 2-3 dimensions, then it is a moderate differentiation response. More than 3 is a highly differentiated response. Notice on the scale that a person can have a moderate to highly differentiated response – so we need to then focus on integration to separate peoples’ responses further.

**Integration** – describes the development of complex connections among differentiated characteristics. The complexity of integration depends on whether the person perceives the differentiated characteristics as existing in isolation (low integration), in simple interactions (moderate integration), or in multiple, contingent patterns (high integration).

- For example, high-integration statements might include explicit statement on how two or more trait dimensions interact to shape behavior (e.g., “This person needs both to dominate and to be in the company of others. When the two needs come into conflict – because dominant behavior may provoke an unpleasant scene, he or she will probably back off unless the issue is very important.”). This person gave a very well thought-out response as to how exactly these personality dimensions may interact with one another, and how behavior would be influenced.

- A moderate level of integration would include less explicit statements about how trait dimensions interact, but would still describe some simple interactions among traits (e.g., “Sometimes this person likes to get their way. However, because of their social nature, they probably give in to others sometimes too.”). This person
gave a less explicit example of how personality dimensions might interact, but they still gave a basic description of how the dimensions might interact with one another.

- A low integration response would be one in which a person only describes differentiated characteristics existing in isolation (e.g., “This person likes to be dominant and in control. However, this person is also very social in nature.”). This person did not describe how these dimensions might interact with one another at all.

**Scores range from 1-7**

First make a judgment about differentiation (low 1-2, moderate 3-5, high 5-7) then judge integration (low 1-3, moderate 5, high 7) from there.

Use transition levels (2, 4, 6) when there is evidence of implicit differentiation (e.g., use of qualifiers like “sometimes”, recognition of uncertainty, information seeking), or implicit integration (e.g., hints or allusions to interactions between different attributes of the test-takers’ personality. Also, if you get other forms of “inbetween” responses, such as a person who lists a lot of items (high differentiated) but does not integrate any of them, then this person will get a score of 4 (high differentiation, but low integration still).

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<table>
<thead>
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<th></th>
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<tbody>
<tr>
<td>1</td>
<td>Low Differentiation &amp; Integration</td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Moderate Differentiation, Low Integration</td>
</tr>
<tr>
<td>4</td>
<td></td>
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<tr>
<td>5</td>
<td>Moderate/High Differentiation, Moderate Integration</td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Moderate/High Differentiation, High Integration</td>
</tr>
</tbody>
</table>
Policy Evaluation

For this task, you will be presented with information about a policy that is under consideration by Ohio State, and which may be implemented in 2 years. We will ask you to read over information about the policy, and to provide us with your views about the policy.

Press the Spacebar to Continue
Policy Evaluation

The administration at Ohio State University is considering implementation of a new policy that would require students to pass a comprehensive exam in their major before they would be allowed to graduate. This exam would be a test of what the student had learned after completing the major, and a certain score would be required for the student to graduate.

This policy could be implemented as soon as 2 years from now, and would apply to any student currently enrolled at the university. Failure to pass these exams would mandate that remedial coursework be completed before a degree could be conferred.

We would like for you to read an essay that was written about this proposal.

Press the Spacebar to Continue
Comprehensive Exam Policy

Implementing senior comprehensive exams at Ohio State would be an extremely beneficial policy for students, even if students may be reluctant about the idea of a comprehensive exam. Ohio State should definitely implement a comprehensive exam policy within 2 years from now.

The National Scholarship Achievement Board recently revealed the results of a five-year study conducted on the effectiveness of comprehensive exams. The results of the study showed that after comprehensive exams were implemented at universities in the study, the grade point average of undergraduates increased by 31%. At comparable schools without the exams, grades increased by only 8% during the same time period. The prospect of a comprehensive exam clearly seems to be effective in challenging students to work harder and faculty to teach more effectively.

Comprehensive Exam Policy

A study conducted by the Educational Testing Service revealed that most of the Ivy League schools and several of the Big 10 Universities use senior comprehensive exams to maintain their academic excellence. Professors at those schools who were interviewed recently said that senior comprehensive exams assured that only high quality and knowledgeable students would be associated with the university. This, of course, increases the prestige of current students, alumni of the school, and the university as a whole.

A national educator’s publication recently predicted that within the next ten years, the top universities would have the exam policy, and the weaker ones would not. The exams should be instituted to increase the academic reputation of Ohio State.
Comprehensive Exam Policy

One aspect of the comprehensive exam policy that many schools offer, and which many students seem to like, is that all regular final examinations for seniors are typically eliminated. This elimination of final exams in all courses for seniors allows them to better integrate and think about the material in their major area just prior to graduation, rather than spending a lot of time "cramming" to pass tests in courses in which they may not be very interested. The comprehensive exam places somewhat greater emphasis on the student’s major, and allows greater concentration on the material that the student feels is most relevant to their goals.

Another interesting feature of comprehensive exam requirement is that it seems to lead to a significant improvement in the quality of teaching in the schools where it has been used. The improvement in teaching effectiveness appears to be due to departments placing more emphasis on high quality teaching, because departments look bad when students do poorly on the exam.

Data from the University of Virginia, where comprehensive exams were recently instituted, indicate that the average starting salary of graduates increased over $8,000 over the two-year period in which the exams were begun. At comparable universities without comprehensive exams, salaries increased only $800 over the same period.

As Saul Siegel, a vice-president of IBM put it in Business Week recently, “We are much quicker to offer the large salaries and executive positions to these kids, because by passing their area exam, they have proven to us that they have expertise in their area, rather than being people who may or may not be reliable.”

Another benefit is that universities with the exams attract larger and more well-known corporations to campus to recruit students for their open positions. The end result is that students at schools with comprehensive exams have a 55% greater chance of landing a good job than students at schools without the exams.
Comprehensive Exam Policy

Graduate schools, law schools and medical schools are also beginning to show clear and significant preferences for students who received their undergraduate degrees from institutions with comprehensive exams. Admissions officers of graduate, medical and law schools have endorsed the comprehensive exam policy, and indicated that students at schools without the exams would be at a significant disadvantage in the near future. The institution of senior exams will be an aid to those who seek admission to graduate and professional schools after graduation.

The prestigious National Accrediting Board of Higher Education has recently rejected Ohio State’s application for membership, citing lack of a senior comprehensive exam as a major reason. Accreditation by the NAB enhances a university’s reputation to graduate schools, employers, and alumni who may provide financial support to the school. Therefore, comprehensive exams should be used to protect the reputation of Ohio State and the future of its students.

Press the Spacebar to Continue