

PREDICTORS OF INTUITIVE DECISION-MAKING IN
GRADUATE PHYSICAL THERAPISTS

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CHAPTER I

INTRODUCTION

The analytic and the intuitive play off each other: The analytic grasps and holds, while the intuitive opens and embraces; the analytic has purpose, while the intuitive plays; the analytic measures and calculates, while the intuitive appreciates; the analytic builds, cuts, and controls, while the intuitive remains open-ended... the analytic is contained and directed by the ego and the will, while the intuitive tends toward self-transcendence and arises spontaneously... the analytic is willful, while the intuitive willing.

– Tobin Hart (2001, p. 72).

Every day, health professionals of varying experience levels make countless decisions about the care of the people who seek their services. Physical therapists, long-time practitioners and recent graduates alike, make clinical decisions about their patients when conducting an examination, determining a diagnosis, and postulating a prognosis. Numerous factors, some very deliberate and concrete and others more subtle and less simple to identify, influence the choices these providers make. Many decisions occur as the result of a conscious logic-oriented step-by-step path and others seemingly appear from nowhere, yet both can lead to amazingly accurate or effective conclusions. This study investigated those influences on decision-making that occur outside the awareness of the practitioner, which are sometimes called hunches, gut feelings, or simply intuition. It explored intuitive decision-making with a group of individuals who have limited practical experience as recently graduated physical therapists. By determining elements of intuition and clinical decision-making as distinct constructs, this study had as its goals

to examine the extent to which measures of intuition relate to one another, to determine if they could be used to develop a prediction model to identify individuals with greater capacity for intuitive clinical decision-making, assess whether intuitiveness was different between genders, and ascertain whether accurate hunches occurred more frequently than by chance.

Decision-making

Decision-making is the process of making choices or determining courses of action based on available information. It has been a primary focus of interest among cognitive psychologists for many decades (Redelmeier, Ferris, Tu, Hux, & Schull, 2001). The general consensus is that humans engage in two strategies of decision-making involving both cognitive and intuitive processes, which they use independently or in conjunction with one another (Burke & Miller, 1999; Damasio, 1994; Isenberg, 1989). The cognitive process represents an analytical-logical-rational approach, which is explicit and systematic in nature. The intuitive process, which is implicit and global, consists of establishing salience among pieces of information and recognizing patterns that produce coherence (Bergson, 1912; Eason & Wilcockson, 1996; Lieberman, 2000; Smith & DeCoster, 2000; Ubel & Lowenstein, 1997). Although intuition is often viewed as being in opposition to logic, reasoning, and rationality, research suggests that these two processes, although distinct, are complementary to one another (Metcalf & Wiebe, 1987; Smith & DeCoster, 2000).

Smith and DeCoster (2000) suggested that humans use a cognitive rule-based system of information processing as well as an intuitive system of association, which can operate independently or collaboratively. The cognitive rule-based system applies logic

in an effortful and conscious way that produces rationale that, due to its linear nature of rule-following, leads to slowly evolving conclusions. The intuitive or associative system employs nonverbal connections among many pieces of information that cause decisions to quickly and effortlessly pop into existence, yet which are typically difficult to explain due to their unconscious nature. When a situation presents itself, the two systems activate simultaneously, sometimes working interactively yet each following a distinct path of information processing, with the associative or intuitive system reaching the conclusion much more rapidly. This co-mingling of intuitive and rational processes suggests that decision-making is both cognitive and intuitive, and would support the conclusion that they are not disparate entities, but mutually complementary ones (Metcalf & Wiebe, 1987; Smith & DeCoster, 2000).

Clinical Decision-making

Decision-making in a health care context such as physical therapy is referred to as clinical decision-making (Braddock, Edwards, Hasenberg, Laidley, & Levinson, 1999; Mattingly & Fleming, 1994). Physical therapy is a health care profession that addresses movement dysfunction and enhancement of functional abilities, optimal wellness and fitness, and overall quality of life and physical therapists are licensed practitioners of physical therapy. Clinical decision-making is an integral element of the process of patient management by physical therapists (American Physical Therapy Association, 2001).

In a review of the literature of clinical decision making, Buckingham and Adams (2000a) proposed a unified model consisting of five steps. The first step is establishment of a pattern vector, which identifies all the pieces of available information related to a clinical situation. Step two is development of a feature vector, which consists of

discerning relevant and irrelevant pieces of information and grouping the meaningful information. The next step involves psychological representation in which the critical information of the data collected from the medical history and patient clues is transformed to the decision-maker's psychological equivalent. From there, classification occurs, in which the information and clues are integrated and possible outcomes are generated. The fifth and final step is the decision, which involves judging the strength of the classifications and choosing the one(s) with the greatest likelihood of being correct, and then choosing a course of action. Physical therapists emulate this decision-making model in day-to-day patient care.

Clinical decision-making in physical therapy consists of conducting an examination and evaluating the available information that leads to determining a diagnosis, postulating a prognosis, and then selecting an intervention and assessing the outcomes of the process (American Physical Therapy Association, 2001). The examination involves taking a patient history (an account of past and current health status), performing a review of the various physical and physiologic systems, and selecting and taking tests and measures relevant to the patient's condition. Evaluation is the process of synthesizing the data gathered from the examination, organizing it into clusters, syndromes, or categories, and interpreting it to determine a diagnosis. The prognosis is the predicted optimal level of improvement in function within a projected time frame. The intervention consists of the various treatments that the physical therapist selects that are appropriate, safe, and effective for the identified condition(s). The outcome is the overall measure of the results of the course of physical therapy management.

Physical therapists perform clinical decision-making throughout the course of a patient's care, with a great deal of it occurring during the first patient visit. For this study, the definition of clinical decision-making is the process of gathering information about a patient, conducting an examination, determining a diagnosis, and theorizing a prognosis (Benner, 1984; Braddock, et al., 1999). Physical therapists and other health care practitioners use both cognitive and intuitive processes to make clinical decisions, with the use of intuition occurring most often during the examination, diagnosis, and prognosis phases of patient care (King & Appleton, 1997; Rew, 1988).

Intuition

Although the literature describes and defines intuition in many and varied ways, certain common characteristics emerge. It has been described as a “sense of rightness and wrongness” (Dewey, 1925, p. 244) or a “feeling of knowing with certitude” (Shirley & Langan-Fox, 1996, p. 564). It is viewed as being “not verbally expressible” (Smolensky, 1988; Vaughan, 1979, p. 27) and often described as “knowing without knowing why” (Claxton, 1998, p. 217). Most frequently, intuition is defined as a “hunch” (Bowers, Regehr, Balthazard, & Parker, 1990, p. 74; Lieberman, 2000, p. 111; Miller & Ireland, 2005, p. 21) or a “gut feeling” (Eason & Wilcockson, 1996, p. 668; Miller & Ireland, 2005, p. 21; Pyles & Stern, 1983, p. 57). Generally speaking, the prevailing literature would define intuition as a hunch or gut feeling that compels us to make a particular decision; however we typically, cannot verbalize how we arrived at that conclusion.

In almost every instance, intuition is described as an unconscious, non-conscious, subconscious, subcortical, or implicit process (Bowers, et al., 1990; Dane & Pratt, 2007; Gladwell, 2005; Polyani, 1964, 1966; Reber, 1989; Westcott, 1968). For clarity, this

study will refer to the processes of intuition as being unconscious and implicit. It is often described as a conclusion that becomes apparent in its entirety, usually without the individuals being able to explain how they arrived at their decision (Gerrity, 1987; Jung, trans.1923; King & Appleton, 1997; Patton, 2003). Some would refer to this realization as “insight” (Mayer, 1996 p. 3; Nisbett & Wilson, 1977), in which the individual suddenly becomes aware of the logical relationships between a problem and its answer (Schooler & Melcher, 1994). Others would suggest that with intuition, there is no logical connection, simply a hunch or judgment of rightness without supporting rationale (Lieberman, 2000). Although no definitive distinction has been made, it would seem that, if intuition and insight are not identical processes, they are at the very least closely connected, with this connection stemming from the unconscious processing of information.

Given its unconscious and implicit nature, intuition is sometimes imbued with mystical qualities, as evidenced by the perceptions of intuition as clairvoyance or a “sixth sense” (Burnard, 1989, p. 52) and the concept of “women’s intuition” (Hayes, Allinson, & Armstrong, 2004; Lieberman, 2000, p. 126; McDermott, Liu, & Dluzen, 1994). Although the existence of these have neither been proven nor disproven, most researchers would suggest that intuition is “neither wild guessing nor supernatural inspiration, but the sort of ability we all use all the time as we go about our everyday tasks” (Dreyfus & Dreyfus, 1986, p. 29). As such, intuition, as well as the concepts of the unconscious and implicit learning have gained acceptance in the literature.

The concepts of unconscious processes and implicit learning have relatively long histories; however, only in the past few decades have they been empirically substantiated

(Berry & Broadbent, 1984; Broadbent, Fitzgerald, & Broadbent, 1986; Greenwald, 1992; Kihlstrom, 1996; Kolers & Roediger, 1984; Reber, Allen, & Regan, 1985; Schacter, 1987). Often these two terms are used interchangeably because they have many of the same characteristics. The most general meaning of unconscious is “unaware of” (Greenwald, 1992, p. 767). It involves actions that are performed without apparent mental effort, outside the awareness of the individual, and often without the ability to remember the process. It has also been described as consisting of habitual, automatic actions (Greenwald, 1992). Reber (1967) first introduced the concept of implicit learning, which he defined as acquisition and processing of information that occurs unconsciously. Howard (2008) described it as the kind of learning “that happens when people are just going about their daily business, when they are focused on living, not on memorizing or on learning per se” (p.1). Although the terms unconscious and implicit are very similar, it would seem that implicit learning is a subset of the unconscious, and is specific to the acquisition and processing of information at a level outside the awareness of the individual (Schacter, 1987).

Currently two potential theories of implicit learning exist (Cleermans, 1997). The “shadow” theory posits that humans have a cognitive unconscious that is just the same as the conscious cognitive system in that it uses rule-based, symbolic, and abstract knowledge, only minus consciousness. The “modularity” theory of implicit learning considers the mind to be primarily a central processor that accesses information from varying databases for processing, and at times this central processing is bypassed by independent encapsulated learning subsystems that instead processes the information and produces output automatically (p. 7). Whether the shadow theory, modularity theory, or

some other representation of implicit learning is most accurate, consensus is that it is an automatic process that occurs unconsciously (Schacter, 1987). Further, intuition is considered to be the “phenomenological and behavioral correlate of knowledge obtained through implicit learning” (Lieberman, 2000, p. 110).

What information drives the implicit process of intuition? Dreyfus and Dreyfus (1986) identified six elements of intuition, elaborated upon within a clinical context by Cioffi (1997) and King and Appleton (1997). These authors propose that intuition consists of the following components:

1. Pattern recognition: The ability to recognize and make sense of the components of a situation as a whole;
2. Common-sense understanding: Identification of subtle trends;
3. Similarity recognition: Comparison of similar and dissimilar characteristics; the ability to recognize subtle likenesses to cues found in past episodes despite many differences in the current situation;
4. Sense of salience: Identifying key pieces of information, determining relevance versus irrelevance;
5. Deliberative rationality: Selective attention to certain aspects or events; the preference for viewing situations from a broader perspective;
6. Skilled know-how: Experiential knowledge, where the tools of a practical situation become an extension of one’s self.

The Dreyfus and Dreyfus (1986) representation is a frequently cited model of intuition in health care and it serves as an appropriate theoretical lens through which to view intuitive decision making. As such, I define intuition in this study as:

A feeling or hunch regarding a situation that arises from unconscious processing of pieces of incomplete information that relies on one's experience and abilities to recognize patterns, subtle trends, similar and dissimilar characteristics, relevant and irrelevant information, and preference for a broad perspective, all of which provide impetus to choose a particular course of action.

With repeated exposures to information related to any of these six elements, the brain subconsciously learns patterns that form probabilistic relationships that are predictive of significant events (Lieberman, 2000; Patton, 2003). When part of a previously-learned event occurs and the brain recognizes the elements that make up this event, it anticipates and predicts subsequent elements resulting in a coherent overall interpretation of the partial data (Bargh, 1989). Certain areas of the brain, primarily the basal ganglia, become proficient at unconscious pattern recognition and pattern completion and inform other areas of the brain of the potential for anticipated rewards, causing the individual to become consciously aware of the possibility and altering behavior accordingly (Lieberman, 2000; Mishkin, Malamut, & Bachevalier, 1984). This suggests how the implicit process of intuition becomes the explicit "hunch" or "gut feeling" that provides movement toward a particular decision and subsequent course of action (Agor, 1989; Isenberg, 1989; Rowan, 1989; Vaughn, 1979, p. 46).

Intuitive Clinical Decision-making

The use of intuition by itself or in combination with cognitive processes to make decisions is well-established in the literature (Burke & Miller, 1999; Damasio, 1994; Eason & Wilcockson, 1996; Isenberg, 1989; Lieberman, 2000; Metcalfe & Wiebe, 1987; Smith & DeCoster, 2000; Ubel & Lowenstein, 1997). Ubel and Lowenstein (1997)

investigated the use of cognitive-rational decision analysis and concluded that logic-based systematicity, although it may reduce error, could not occur without consideration for intuitive factors such as values and emotions. Further, Wilson and Schooler (1991) determined that cognitive decision-making does not lead to better decisions, and that most people are often happier with intuitive decisions than those based on deliberate, rationale-based determinations. In the clinical setting, health care practitioners use intuition when information is incomplete and the course of action is ambiguous or uncertain. Intuitive clinical decision-making involves the deliberate application of knowledge or understanding that is gained immediately as a whole and that is independently distinct from the usual, linear, and cognitive reasoning process (Rew, 2000). It is a process that consists of rapid establishment of associations between information collected from the patient and pattern recognition that becomes so automatic as to be unconscious (Buckingham & Adams, 2000b).

Health care practitioners make intuitive clinical decisions in situations with high levels of uncertainty, where there is no previous precedent, when facts are limited or not pointing toward a particular course of action, and when there is limited time and pressure to arrive at a decision (Langan-Fox & Shirley, 2003; McCutcheon & Pincombe, 2001). Hogarth (2005) suggested that intuitive decision making occurs more with complex problems. Bowers, Farvolden, and Mermigis (1995) proposed that there are two conceptually distinct phases in the process of intuitive decision-making. The first is an unconscious phase that involves a graded process of activating responses that are stimulated by, and increasingly appropriate to, the available pattern of clues. The second phase involves a conscious recognition, often quite sudden, that a particular response

constitutes a potential solution to the problem: The dawning of the hunch or gut feeling that suggests a particular decision or course of action. This model emphasizes how the mind of the problem solver is informed by the various elements of the problem. In physical therapy practice, the therapist unconsciously processes clues from the patient history and presenting signs and symptoms, using existing knowledge to compare the available information to various pathologies, then consciously arrives at a diagnosis. Often times the diagnosis presents itself as a rapid, complete insight that the practitioner cannot fully explain (Rew, 1988). With respect to patient care, this study considers intuitive decision-making to be the unconscious processing of patterns and clues, recognition of subtle trends, similar and dissimilar characteristics, and relevant and irrelevant information that produces a hunch or feeling of certitude about the nature of a patient's problem (Bowers, et al., 1995; Buckingham & Adams, 2000a, 2000b).

Some would argue that intuitive decision-making has no role in caring for patients, and they urge that health care practitioners focus their attention away from intuitive to more cognitive ways of examining patients and determining courses of action (Lamond & Thompson, 2000). This emphasis on facts and science, also known as evidence-based practice, would support the argument for the cognitive approach to decision-making (Sackett, Straus, Richardson, Rosenberg, & Haynes, 2000). Those who argue that intuition is an instinctual part of our thinking and is a clinically relevant process would support the notion that health care is also an art (Hansten & Washburn, 2000). Identical to the prevailing cognitive psychology literature that supports the position that humans use both cognitive and intuitive decision-making processes, Eason and Wilcockson (1996) suggest that intuition and rational decision-making is a "false

dichotomy” and that “health care practitioners should use both processes to the benefit of their patients” (p. 667). Sackett, Rosenberg, Gray, Haynes, and Richardson (1996) proposed that health care practitioners can establish a balance between the intuitive and cognitive by integrating clinical intuition with the best available evidence, in essence blending the art and science of medicine.

Early research initially concluded that intuitive clinical decision-making develops as a person gains higher levels of experience (Benner, 1982, 1984) and it is useful to practitioners when they have a pre-existing knowledge base to skillfully interpret a clinical situation (Orme & Maggs, 1993). However, subsequent studies suggested that intuition does not lie only in the domain of experts (Benner & Tanner, 1987; Benner, Tanner, & Chesla, 1996). McCormack (1993) determined that less experienced practitioners such as students use intuition and King and Appleton (1997) reported that gut feelings were present in students and new graduates. Intuitive insights are occasionally discussed in health care education programs, however concern is growing that health care education programs emphasize sensory perception at the expense of intuition (King & Appleton). Benner and Tanner stated that dependency on checklists instead of active inquiry may prevent new health care practitioners from moving from competent to expert performance (King & Appleton).

Measures of Intuition and Intuitive Decision-making

Three direct measures of intuition that are frequently cited in the literature link directly with the Dreyfus and Dreyfus (1986) theoretical lens used in this study. The *Accumulated Clues Task* (ACT) (Bowers, Regeher, Balthazard, & Parker, 1990) is a measure of pattern recognition or the ability to recognize and make sense of the various

components of a situation and common-sense understanding, or the identification of subtle trends. The ACT measures pattern recognition and trends by presenting a series of clue words to a specific solution word, provided additively in a series of 15 clues. The *Dyads and Triads Task* (DOT) consists of two sets of three words, one of which produces a solution word. The DOT measures both similarity recognition and sense of salience, the former is the ability to recognize subtle likenesses and is the comparison of similar and dissimilar characteristics and the latter is the ability to determine relevant from irrelevant information. Deliberative rationality, or the preference for using intuition, is measured using the Sensing-Intuition subscale of the *Myers-Briggs Personality Type Indicator* (MBPTI) (Myers & McCaulley, 1986). These three measures of intuition, the ACT, the DOT, and the MBPTI, are among the most frequently-cited in the literature (Bowers, et al., 1995; Bowers, et al., 1990; Murray, 1990). Finally, age is a commonly-used measure of experience, which links with the last aspect of the theoretical lens, skilled know-how (Staudinger, 1999; Trueman & Hartley, 1996).

Numerous measures of decision-making exist, with each measure being unique to its respective health care discipline. Within the context of physical therapy, the largest measure of clinical decision-making among recent graduates is the *Examination/Foundations for Evaluation, Differential Diagnosis, & Prognosis section of the National Physical Therapy Examination*. For utility, this measure will be referred to as the *National Physical Therapy Examination* (NPTE). This is a national licensure examination that is representative of contemporary entry-level physical therapy practice (Knapp, Russell, Byrum, & Waters, 2007). The NPTE requires decision-making related to information presented in patient-based scenarios. These scenarios consist of patient

data in the form of patterns of clues provided in a patient history, signs and symptoms, and findings from particular measurements and observations as well as occasionally irrelevant information. To determine the correct answer to a scenario, the graduate must be able to recognize patterns and trends associated with specific diagnoses, differentiate relevant from irrelevant information as well as weigh the importance of that information, all the while viewing the scenario in its totality. The questions on the NPTE typically involve some degree of uncertainty, the facts are limited, and given that it is a timed examination, there is pressure to promptly arrive at a decision; all of which are the hallmarks of intuitive decision-making in the clinical setting (Langan-Fox & Shirley, 2003).

Statement of the Problem

Although the literature supports the position that clinicians such as physical therapists use intuitive decision-making, we do not know how the measures of intuition that reflect the six elements identified in the Dreyfus and Dreyfus (1986) model and gender relate to one another. We do not know if correlations exist among the *Accumulated Clues Task* (which measures pattern recognition and common sense understanding), the *Dyads of Triads* (an assessment of similarity recognition and sense of salience), the *Sensing-Intuition Subscale* of the *Myers Briggs Personality Type Indicator* (a measure of deliberative rationality), skilled know-how or experience (as measured by age) and gender. In a similar vein, we do not know if one or more measure of intuition or gender has a greater correlation with intuitive decision-making, as assessed by the *National Physical Therapy Examination*. Further, we do not know if we can predict if certain newly graduated physical therapists have a greater predisposition to intuitive

decision-making than others. If we view intuition as a legitimate way of attending to available information that has a valid role in the decision-making process, can we predict the success of newly graduated physical therapists who have a greater predisposition to intuitive clinical decision-making based on measures of intuition defined by Dreyfus and Dreyfus (1986) and using their achievement scores on the NPTE as a measure of intuitive decision-making? As it relates to possible gender differences, we do not know if female graduate physical therapists are more intuitive than their male counterparts. With regard to this same group of practitioners, it is unknown whether their hunches about correct answers on a test of intuition are more accurate than chance occurrence.

As such, the purpose of this study was to (1) examine the relationships among assessments of intuition that measure pattern recognition and common-sense understanding (the ACT), similarity recognition and sense of salience (the DOT), deliberative rationality (MBPTI), experience as reflected by age, and gender and (2) how well they predict intuitive decision-making in newly-graduated physical therapists. It also aims to (3) explore whether women in this group have greater intuitive decision-making ability than men, and (4) whether hunches that both groups have occur beyond levels of chance when making intuitive decisions.

Theoretical Framework

This study employs the Dreyfus and Dreyfus (1986) theoretical framework of intuition placed within a healthcare context as described by Cioffi (1997) and King and Appleton (1997). The Dreyfus and Dreyfus representation, which views intuition as the ability to recognize patterns, subtle trends, similar and dissimilar characteristics, relevant and irrelevant information, having a preference for a broad perspective, and experience

serves as an appropriate means for viewing intuitive decision making. The elaborations to the model by Cioffi and King and Appleton place it in a clinical context appropriate to recently graduated physical therapists. Bowers, et al. (1995) propose that intuitive decision making consists of a graded process of unconscious activating responses that are stimulated by the available pattern of clues that leads to a conscious recognition, often quite sudden, that a particular response constitutes a potential solution to the problem. This merged model produces the theoretical lens for viewing intuitive decision making in graduate physical therapists. This lens along with terms gleaned from the literature provide the terminology used in the study, as well as a context for framing its research questions.

Summary of Terms

The following terms are central to this study:

- Clinical decision-making: The process of gathering information about a patient, conducting an examination, determining a diagnosis, and theorizing a prognosis.
- Intuition: A feeling or hunch regarding a situation that arises from unconscious processing of pieces of incomplete information that relies on one's experience and abilities to recognize patterns, subtle trends, similar and dissimilar characteristics, relevant and irrelevant information, and preference for a broad perspective, all of which provide impetus to choose a particular course of action.
- Intuitive clinical decision-making: The unconscious processing of clues and various pieces of information toward an insight or hunch about the nature of a patient's problem.

Research Questions

1. What are the relationships between measures of intuition, intuitive decision-making, age, and gender? Specifically are there correlations among the *Dyads of Triads Task* (DOT), the *Accumulated Clues Task* (ACT), the Sensing-Intuition Subscale of the *Myers Briggs Personality Type Indicator* (MBPTI), age, and/or gender?
2. To what extent do measures of intuition and age and gender predict achievement on a measure of intuitive decision-making (the *National Physical Therapy Examination/NPTE*) in newly-graduated physical therapists?
3. Do female graduate physical therapists have higher scores on measures of intuition and intuitive decision-making than males?
4. Do hunches about correct solutions on a measure of intuition (*Dyads of Triads Task*) occur at a level beyond chance?

CHAPTER II

REVIEW OF RELEVANT LITERATURE

Intuition has received attention from philosophers and researchers from ancient to modern times, and its role in decision-making has been studied by researchers for over five decades. Early studies of intuition involved the construction of computer models used in artificial intelligence research as well as the development of heuristic algorithms that were intended to reflect human thought processes. Subsequent advances in technology led to greater understanding of the cognitive and neurological aspects of intuition. Research then began to diversify greatly, with investigations that addressed varying aspects of intuition, including precognition and the concept of women's intuition. Although intuition is not infallible, the breadth of studies conducted in the last 50 years support its legitimate role in decision-making, and a number of researchers have developed reliable and valid measures that have been successfully applied in various types of prediction models. One notable gap in the literature relates to prediction models in clinical settings, particularly in the arena of intuitive clinical decision making in graduate physical therapists.

Intuition from Ancient to Modern Times

In 380 B.C., Plato referred to intuition in his *Dialogues* as “noesis,” or a sense of inner certainty (380 B.C., trans. 1982, p. 511e; Wierzbicki, 2004). The thirteenth century

philosopher St. Bonaventure described it as “contemplative knowing” (1259, trans.1891, p. 313). Descartes (ca. 1628, trans. 1954) considered intuition to consist of innate ideas that are self-evident and self-sufficient, and he proposed that it is one of two ways of arriving at knowledge, with the other path being that of sequential thinking, or deduction. In a similar vein, Kant (1781, trans. 1996) described intuition as a source of a priori synthetic judgments, or our fundamental convictions about nature, space, and time. Most of the premodern philosophers, from Plato through Descartes to Kant, believed that intuition was infallible and it served as a source of inner certainty (Wierzbicki, 2004).

In the Twentieth century, intuition was viewed with somewhat greater reserve while still acknowledging its importance in making meaning of large amounts of typically incomplete information (Bergson, 1903). Jung (1921, trans. 1923; Storr, 1973) described intuition as a perceiving function that unconsciously attends to patterns and connections underlying an experience that provides contextual meaning. In 1943, Briggs and Briggs-Meyers adapted Jung’s theory of psychological types to produce one of the first instruments to measure intuition, along with other aspects related to personality (Briggs-Myers, 1993). Similar to Jung’s concept of intuition, Heidegger (1953, trans.1996), who referred to it as “meditative thinking” considered its purpose to be revelation or “unconcealment of being” (p. 139). Along this line of thinking, Bruner proposed that a critical aspect of learning is grasping the structure of a subject and establishing meaningful relationships with other information (Bruner, 1960, 1971; Takaya, 2008). He described intuition as “more oriented to the whole problem than to particular parts, less verbalized with respect to justification, and based upon a confidence in one’s ability to operate with insufficient data” (1971, p. 82).

Although intuition continued to be discussed in philosophical terms for many more decades, it also garnered the attention of researchers and in the 1960s sparked the development of numerous tools designed to assess aspects of intuition. Many of the early researchers into intuition were cognitive psychologists who were seeking to better understand how humans process information and make decisions. Among these was Wescott (1961), who investigated the measurement of inductive conclusions with limited information. Research on intuition in the 1960s led to significant discussions in the 1970s among cognitive psychologists and technologists who were working to develop computer programs that emulated human information processing, including intuition.

Artificial Intelligence, Heuristics, and Intuition

The 1950s have been referred to as the “dawn of the computer age” (Schaeffer & van den Herik, 2002, p.1) and established the point at which computer programmers began attempting to artificially emulate human cognition with technology. Early computers were used primarily for military purposes, and essentially served as very large calculators for such purposes as producing calculations for missile launches. They soon evolved to include rule-driven applications with games such as chess playing (Shannon, 1950). The term “artificial intelligence” was first used by John McCarthy in 1956 to describe the elaborate programs that emulated very basic human thought processes (McCarthy, Minsky, Rochester, & Shannon, 1955, p.44). Shortly thereafter, Herbert Simon, a cognitive psychologist referred to by many as the “father of artificial intelligence (AI),” began his work to create computer programs that allow machines to think and make choices (Pomerol & Adam, 2004, p. 656). Simon’s work and that of

others laid the foundation for the computer revolution of the late 1970s and 1980s, which produced amazing “machines who think” (Frantz, 2003, p. 272).

Cognitive psychologists such as Simon sought to better understand how technology could emulate the human mind in the processes of thinking and decision-making (Frantz, 2003). Early in the quest to develop AI, McCarthy and Hayes (1969) proposed criteria for what makes an entity “intelligent” (p.4):

- It has an adequate model of the world, including an understanding of its own goals and other mental processes;
- It is clever enough to answer a wide variety of questions on the basis of this model;
- It can get additional information from the external world when required;
- It can perform such tasks in the external world as its goals demand and its physical abilities permit.

Simon’s conviction about the ability to understand intelligent human processes was, “Wonderful, but not incomprehensible” (Simon, 1969, p. 4). He proposed that humans process and store experiences by way of associational and indexing strategies that subsequently allow the information to be accessible when it is needed for making decisions. Further, many processing strategies become so routine that they are internalized as automatic actions. Simon (1997) referred to these unconscious associational and indexing devices of memory as “intuition” (p. 31).

Simon was among the first cognitive psychologists to propose that “intuition is not a process that operates independently of analysis,” rather the two processes are essential complementary components of effective decision-making systems (Simon & Gilmartin, 1973, p. 33). He viewed human thinking as consisting of three basic

operations: scanning for patterns, storing the patterns in memory, and then applying the patterns to make inferences or extrapolations (Frantz, 2003). He proposed that these operations paralleled the information processing performed by computers, and subsequently developed machines that ‘think’ in similar ways. As psychology blended with technology, what emerged were machines that used ‘if-then’ rules with the data collected to make decisions, which subsequently led to the development of software that engaged in heuristic means-end analyses.

Heuristics are subjective probability judgments used to make decisions under uncertain circumstances (Tversky & Kahneman, 1973, 1974). They are “rules of thumb” based on experience (Hutchinson & Gigerenzer, 2005, p. 97) and habit-based shortcuts that people unconsciously use to make decisions (Kahneman & Tversky, 1972; Tversky & Kahneman, 1973, 1974, 1982). Often heuristics are developed by trial and error (Dreyfus, 1965). Cioffi (1997) identified four key aspects of heuristics that influenced decision-making: Representativeness, availability, anchoring and adjustment, and personal experience. Representativeness is the assessment of the extent to which an event is similar to other experienced events. Availability is the ease with which these personal experiences come to mind. Anchoring and adjustment reflect the establishing of a baseline (or anchor point) for decision-making and then performing adjustments based on additional information. Personal experience forms a baseline from which practitioners can make their subjective probability assessments. The accumulation of experience results in the development of patterns, or habits, of making decisions that become more automatic over time. Because of the rule-driven and probability oriented nature of heuristic decision-making, it found a natural application in software programming

associated with AI. Further, given the routine and automatic nature of heuristic decision-making, it was not surprisingly linked with intuition (Friedlander & Stockman, 1983; Schraeder & Fisher, 1987).

Although heuristics and intuition have similar elements and appear to be intertwined in the decision-making process, they are fundamentally different. Proponents of heuristics propose that habits or established rules gained from experience lead to a predetermined course of action. This is counter to the concept of intuition, which at its core would suggest that the course of action is not predetermined, and sometimes what we choose to do is counter to the rules and probabilities that heuristics would warrant (Lieberman, 2000). This disparity between intuition and heuristics, which is suggestive of the interplay between the intuitive system and the cognitive rule-based system of information processing, was also the basis for contention that the creation of intelligent thinking machines was not plausible.

Dreyfus (1965) proposed that efforts to create artificial intelligence would fail because machines are incapable of three fundamental human forms of information processing: Fringe consciousness, essence/accident discrimination, and ambiguity tolerance (see also Dreyfus & Dreyfus, 1986). Whereas heuristics limit the number of alternatives explored, fringe consciousness potentially takes into account all of the information available in the environment. Because these cues are usually too numerous to be explicit, processing typically occurs unconsciously, placing information in “the back of the mind” unless needed (Polyani, 1963, p. 214). Essence/accident discrimination is the ability to grasp an essential structure or gestalt while distinguishing between the essential and the accidental, or the relevant from the irrelevant. Ambiguity tolerance

allows humans to use a global context for problem solving without becoming overwhelmed with exhaustive enumeration over countless possibilities. Each of these three aspects of human thought involves the elements of pattern recognition, similarity recognition, commonsense understanding, skilled know-how, sense of salience, and deliberative rationality: What Dreyfus and Dreyfus (1986) called intuition.

Many skeptics of artificial intelligence believed that “ordinary, non-mystical intuition...is the core of human intelligence” (Dreyfus & Dreyfus, 1986, p. xiv). Unlike machines, humans can easily recognize patterns under increasingly difficult conditions: Whether the pattern is skewed or incomplete, the traits required for recognition are extremely fine or numerous, the link is dependent on internal and external contexts, and where there are no common traits, only a complex association of overlapping similarities (Dreyfus, 1965). This tolerance of the “fuzziness of data” (Kerre, Zenner, & DeCaluwe, 1986, p. 341) has thus far delayed machines achieving intelligence as described by McCarthy and Hayes (1969).

At present, science has developed highly functional software and hardware that ranges from being commonplace to near science-fiction. On a daily basis, most of us use AI-based information extraction programs, referred to as search engines, to locate information on the Internet. At the other end of this spectrum, and still under development in AI laboratories, are humanoid robots that can interact with the environment, and machines that recognize, respond to, and produce facial expressions (Brooks, et al., 1998), which some refer to as “social intuition” (Lieberman, 2000, p. 124). Even at the cutting edge, present-day machines and their programming still fall short of “human-level capabilities” (Yudowsky, 2006, p. 36).

This has prompted the redevelopment of theories of computer and human decision-making and proposal of new directions for AI. Kahneman (2002), one of the original driving forces in heuristics, has revised the theory that he and Tversky developed in the 1970s to reflect the role of intuition in the process. The current theory, developed with other colleagues after Tversky's death, addresses how intuition may serve as the anchor for many heuristic decisions, and yet is shaped and adjusted by rationality, perception, and probability. As heuristic theory evolves to include intuition, so does the pursuit of artificial intelligence. Anderson (2008) proposes that for machines to achieve what humans possess, the path must include "artificial intuition" (p. 1). She posits that the purpose of intelligence is prediction, which arises from the processing of a large number of factors relating to previously described aspects of intuition, including an understanding of the environment at hand, tolerance of ambiguity, ability to work with incomplete information, apparent paradoxes, and multiple points of view. Given advances in data storage and processing technology, Anderson suggests that "Intuition is surprisingly easy to implement in computers," it just "requires a lot of memory" (p. 1). Even as scientists strive to replicate the human mind and its ability to intuit, others are continuing to investigate how it functions physiologically.

The Neurology of Intuition

Just as technology is advancing AI, it is also contributing to a greater understanding of intuition from a biological perspective. Neurophysiologic imaging studies including positron-emission tomography (PET) and functional magnetic resonance imaging (fMRI) provide evidence to support the activation of specific areas of the brain during both cognitive and intuitive decision-making tasks (Lieberman, 2000).

Cognitive, conscious processing involves the hippocampus, and intuitive unconscious processing involves the basal ganglia.

Located in the medial temporal lobes of the forebrain, the hippocampus is responsible for short term memory and plays a major role in cognitive tasks and also has a significant involvement with emotions. Frank, O'Reilly, and Curran (2006) described the role of the hippocampus in making logical inferences associated with cognitive decision-making. Further, when the hippocampus is inactivated by the medication Midazolam, subjects experienced profound explicit memory deficits, however, their ability to make implicit, intuitive inferences, which is the role of the basal ganglia, remained intact.

The basal ganglia has a “unique role in automatic predictive sequencing of cognitive and motor phenomena,” which are key elements of intuition (Lieberman, 2000, p. 120). The basal ganglia is a collection of neural structures located deep within the cerebral hemispheres just in front of the midbrain and it has no less than five circuit-like connections with the rest of the cerebral cortex, suggesting that it is intricately involved in the processing of large amounts of information from almost every area of the brain. The basal ganglia consists of the substantia nigra, the globus pallidus, and the striatum, the latter of which is further differentiated into the caudate and the putamen. The caudate appears to be active in probabilistic-activation tasks and in the judgment aspect of implicit learning, and the putamen is active in automatic motor learning tasks (Elliott & Dolan, 1998; Lieberman, 2000; Poldrack, Prabakaran, Seger, & Gabrieli, 1999). Further, the caudate and putamen make different contributions to the nonverbal aspects of social learning and interaction, referred to by Lieberman (2000) as “social intuition” (p. 124).

Studies of social intuition suggest that the putamen is responsible for the production of nonverbal information, such as facial expressions, and the caudate is responsible for nonverbal decoding, and that both of are automatic, unconscious processes (Morris, Robinson, Raphael, & Hopwood, 1996). These findings are corroborated by neuropsychologic studies of diseases processes affecting the basal ganglia, such as Parkinson's Disease and Huntington's Disease (Ferraro, Balota, & Connor, 1993; Knowlton et al, 1996). People with Parkinson's Disease, which is a neurodegenerative process that in its early stages effects primarily the putamen, have diminished ability to produce facial expressions (Benke, Bosch, & Andree, 1998). People with Huntington's Disease, which involves severe loss of as much as 80 per cent of the caudate nucleus, have impaired ability to respond to nonverbal facial cues (Gray, Young, Barker, Curtis, & Gibson, 1997). Moreover, both groups of patients have significantly diminished capacity to perform probability classification tasks related to intuition (Knowlton et al, 1996).

Just as cognitive and intuitive processes may act independently or collaboratively, the hippocampus and basal ganglia also appear to work by themselves or in unison. Habitual learning provides an illustration of the collaborative nature of these processes and how the brain transitions from explicit to implicit procedures. Prior to an activity being established as a habit, the brain consciously attends to the new information using the prefrontal cortex and hippocampal regions. As repetition of information occurs, it shifts to unconscious attending to the information, which is mediated by the striatum of the basal ganglia (Lieberman, 2000). Further, as exposure to the same patterns of information progresses, "the basal ganglia shifts from responding to behaviorally significant events themselves to instead responding to the predictors of behaviorally

significant events” (Lieberman, 2000, p. 121). The basal ganglia shift from pattern recognition to pattern completion, a vital function in intuitive decision-making.

Precognition and Women’s Intuition

Some would suggest that intuition plays a role in predicting future events. Orme and Maggs (1993) posited that intuition is not a rational process, nor is it necessarily based on pre-existing knowledge. Burnard (1989) described intuition as a ‘sixth sense’ (p. 52). With this said, only a handful of studies exist that examine the precognitive aspect of intuition. Radin and Schlitz (2005) believed that intuition isn’t necessarily experience or knowledge based, and that people can use it to provide accurate information about future events. They performed a study in which people were asked to intuit the emotions of an unseen person located many miles away from them. The results showed that the subjects’ abilities to intuit positive emotions were accurate greater than if they occurred by chance. Damasio (1994) determined that skin conductance changed beyond chance levels in subjects prior to selecting cards from decks that were stacked to yield either positive or negative results, and that in a short period of time, the subjects began to draw exclusively from the positively stacked decks, yet were unable to verbalize why they were doing so. Similarly, Globisch, Hamm, Esteves, and Ohman (1999) reported statistically significant changes in pupil size in people with phobias in anticipation of being shown photographs that contained images they found frightening, which were distributed among non-frightening images. Although these studies are intriguing and may spark future research, at present, they are too few to conclude that intuition has a paranormal aspect that is beyond unconscious processing of information.

Similar to the precognitive aspect of intuition is the supposition that women are more intuitive than men. Some studies do suggest that women are better encoders and decoders of nonverbal communication (Hall, 1984; Pease & Pease, 1978), which has been linked with the concept of social intuition (Lieberman, 2000). Further, women have greater levels of estrogen, a hormone that directly affects the amount of dopamine released into the striatum of the basal ganglia, which could enhance intuitive processing of information (Becker, 1990; McDermott, Liu, & Dluzen, 1994). Most of the studies investigating gender differences and intuition involve management and leadership styles, and the results are variable. A number of studies described male managers as more rational and logical and female managers as more empathetic and intuitive (Brenner & Bromer, 1981; Clares, 1999; Loden, 1985; Walsh & Hardy, 1999). Other studies show that men and women lead in similar ways (Bartol & Martin, 1986; Buttner, 2001; Donnell & Hall, 1980; Nieva & Gutek, 1981, Kanter, 1977). A meta-analysis of 162 articles on the gender differences in management conducted by Eagly and Johnson (1990) suggested no difference in style existed between men and women, however if the types of studies were stratified into laboratory experiments and organizational studies a difference in leadership style between men and women emerged. The authors posited that laboratory experiments typically involved studies where the subjects were strangers, and organizational studies were conducted among individuals who had established relationships with those whom they were managing. With consideration for the type of study performed, the meta-analysis showed that in the organizational studies, females had more of an intuitive, democratic style of leadership and males were more logical, rational, and autocratic. Taggart, Valenzi, Zalka, and Lowe (1997) analyzed studies that had used

objective measures of rational and intuitive styles in male and female leaders. From the five studies examined, two of the studies indicated that women were more intuitive than men, two studies concluded that men were more intuitive than women, and one study found no gender differences. It appears that in studies of gender differences examining aspects of intuition, the results appear to be mixed, however it is possible that context may cause some differences between females and males to emerge.

The Fallible Aspect of Intuition

Intuition can sometimes produce negative outcomes. Although the literature on this aspect of intuition is relatively sparse, some authors reflect that intuitive decision-making can lead to incorrect or inaccurate decisions. Myers (2002) suggested that some conclusions derived from intuitive processes may be misleading, and often are related to misperceptions or inaccurate interpretation of the available information. Further, intuitive decisions may be negatively influenced by emotions (Bastick, 1982; Patton, 2003) and mood (Bohm & Brun, 2008). Regardless of whether we base our decisions on knowledge gained from intuition or cognition, Lamond and Thompson (2000) provided sound advice: “One must consider the nature of that knowledge and how it affects decision-making” (p. 412).

Intuition’s Legitimate Role in Decision-making

Although not infallible, intuition as a “legitimate way of knowing” (Hart, 2001, p. 73) and its use in decision-making has gained acceptance among mainstream scientists. Between 1970 and 1986, the recipients of the Nobel Prizes in physics, chemistry, and medicine were asked in recorded interviews if they believed in scientific intuition and, if so, how they defined it. A study of the transcripts of these interviews revealed that, of the

93 laureates asked, six denied that it existed, another five expressed doubts about using the word, and the remaining 72 declared an explicit belief in scientific intuition (Marton, Fensham, & Chaiklin, 1994). Those 72 offered varying definitions of intuition, however certain themes emerged from the commentaries. The prevailing theme was that intuition is finding or following a path based on hunches or gut feelings. Another common thread was that intuition is a “pattern view” that emphasizes grasping of the whole, of viewing simultaneously a wide range of components and constructing a picture, even though many of the components are missing (p. 467). A final theme was that intuition is an unconscious process that is not necessarily cognitive, but is critical to the process, perhaps best expressed by Rita Levi-Montalcini, the 1986 recipient of the Nobel Prize for medicine: “Intuition... is something subconscious, which, all of a sudden, comes out of a clear blue sky to you and is absolutely a necessity, more than logic, in any sense” (Marton, et al., p. 463).

Like the other members of the scientific community, health care practitioners have also come to accept that intuition has a role in caring for patients. Early qualitative studies of intuition in the medical setting occurred in the 1980s and involved primarily nurses. They revealed that nurses relied on intuition to make decisions, however most were reluctant to say that it was the basis for those decisions (Benner, 1982, 1984; Benner & Tanner, 1987; Pyles & Stern, 1983). Rew (1986, 1988) described three themes of intuition: Cognitive inference, which is rapid unconscious processing of cues, gestalt intuition (gaps of data filled in to complete a pattern), and precognitive function (perceiving a change before it happens). Gerrity (1987) considered it a perception of possibilities, meanings, and relationships that are shaped by insight. Benner (1982, 1984)

concluded that intuitive decision-making develops as a person gains higher levels of experience. Young (1987) identified conditions and attributes that facilitate intuition in health care providers, which include direct patient contact, openness to information, experience, energy, self-confidence, and the ability to reflect on previous decisions. Although some will continue to debate its application in patient care, the majority of studies would substantiate that intuition does have a role in health care (Benner, Tanner, & Chesla, 1996; Cioffi, 1997; Langan-Fox & Shirley, 2003; Rew & Barrow, 1987), that experts and novices use it (McCormack, 1993; Orme & Maggs, 1993), that we can reliably measure it (Balthazard, 1985; Bowers, et al., 1990; Langan-Fox & Shirley, 2003), and we can use these measures to predict success in making accurate decisions (Barr, 1999; Woszczyński, Guthrie, Chen, & Shade, 2004).

Measures of Intuition

Researchers have developed other tools designed to quantify the various aspects of intuition in addition to those linked with this study's theoretical lens (Balthazard, 1985; Bowers, et al., 1990; Langan-Fox & Shirley, 2003). Although many measures of practical intelligence and situational judgment tests that are associated with intuition exist, approximately six other direct measures or assessments of intuitive ability are found in the literature (Hodgkinson, Langan-Fox, & Sadler-Smith, 2008). *Westcott's Test of Intuitive Ability*, consists of a series of fragments of relevant information that measures the ability to make inferences and to take "intuitive leaps" (Westcott, 1961, p. 267) and *Westcott's Intuition Scale* (Westcott, 1968) measures intuitive ability based on the number of clues required to solve a puzzle. The *Agor Intuitive Management (AIM) Survey* is a self-report test of intuitive potential based on Jung's theory of preferences for

processing information (Agor, 1984, 1989). The *Intellect or Openness to Experience* portion of the *Five Factor Model* (Costa & McCrae, 1985; McCrae & Costa, 1989) is a subscale of the personality inventory that correlates with preference for intuition as a means of processing information (Goldberg, 1993; Jackson, Parker, & Dipboye, 1996). The *Faith in Intuition Scale* is a 12-item self assessment of “confidence in one’s feelings and immediate impressions as a basis for decisions and actions” (Epstein, Pacini, Denes-Raj, & Heier, 1996, p. 394). The *Self-Perceived Intuitive Interests Inventory* (SPIII) is a 28-item questionnaire that assesses cognitive and behavioral interests that are linked with intuitive ability (Langan-Fox & Shirley, 2003). The remaining measures of intuition commonly found in the literature, and which link more directly with the theoretical lens used in this study, are the *Accumulated Clues Task* (ACT), the *Waterloo Gestalt Closure Task* (WGES) (Bowers, et al., 1990), the *Dyads and Triads Task* (DOT) which is based on Mednick’s (1962, 1967) *Remote Associates Test* (RAT) (Goldstein & Hogarth, 1997; Isen & Berg, 1991), and the Sensing-Intuition subscale of the *Myers-Briggs Personality Type Indicator* (MBTI) (Myers & McCaulley, 1986). Similar to the ACT, the *Waterloo Gestalt Closure Task* presents partial visual images of common items, requiring individuals to identify the object by way of pattern completion (Bowers, et al., 1990).

Studies of Intuition and Its Role in Clinical Decision-making

Only a few studies exist that employ measures of intuition in association with particular outcomes and in empirical studies of decision-making. A comprehensive review of the literature yielded only one study that investigated the relationships among measures of intuition with one another. Bowers et al. (1995) established that the ACT and the DOT had an average correlation of .46, however they did not investigate

correlations with other measures of intuition, nor with age or gender. As it pertains to prediction of success based on measures of intuition, only a handful of studies exist, none of which investigate intuitive decision-making in a clinical context. Schurr and Ruble (1986) determined that students with a preference for intuition using the MBPTI have greater academic aptitude. Woszczyński, et al. (2004) identified a preference for intuition as one predictor of academic success in student computer programmers and Barr (1999) reached the same conclusion when studying student nurses. Bowers, et al. (1990) explored the degree of intuitive decision-making in college students, using results on the ACT to classify them as having high, medium, or low intuition. The only study of intuition in physical therapists involved an investigation of the personality traits of student health professionals using the MBPTI. It identified the predominance of the sensing preference in physical therapy students, with only 34.5 per cent having a preference for intuition (Hardigan & Cohen, 1998). Although it would appear that the minority of physical therapy students possess a preference for intuition, no studies exist that use different measures of intuition with these professionals other than the MBPTI. Further, no prediction models exist for determining the degree of intuitive decision-making in individuals based on established measures of intuition, decision-making, experience, and gender. Although a number of studies have investigated gender differences and intuition, most of these related to decision-making in management environments, and no studies have been performed with intuitive decision-making in a clinical context nor with physical therapists (see Eagly & Johnson, 1990). Finally, many articles have addressed intuitive hunches (Bowers, et al., 1990; Lieberman, 2000; Miller & Ireland, 2005) some of which relate to the clinical setting, however the majority of

these were among nurses (Hogarth, 2005; Langan-Fox & Shirley, 2003) and none have involved physical therapists. One study demonstrated that intuitive judgments under conditions of uncertainty showed only a small occurrence over chance (Bowers et al., 1990). Given the relative paucity of information on intuitive decision making in physical therapy, this study proposed to examine four questions that were unanswered by the literature: What are the relationships among measures of intuition (specifically the ACT, DOT, and MBPTI), age, and gender? To what extent do these measures predict intuitive decision-making as measured by the NPTE? Do female graduate physical therapists have higher scores on measures of intuition and intuitive clinical decision-making? Do hunches about correct solutions on a measure of intuition (the DOT) occur at a frequency beyond chance?

CHAPTER III

METHOD

The purpose of this study was to examine the extent that measures of intuition and achievement on a measure of clinical decision-making predict intuitive decision-making. It investigated the relationship among certain measures of intuition, intuitive clinical decision-making, age, and gender. Additionally, it explored whether physical therapists who are women have greater scores of intuition and intuitive clinical decision-making than men, and it examined whether accurate hunches occurred beyond chance levels. This chapter describes the sequential steps that were taken to conduct the study through a presentation of the study design, the participants and number of subjects required to provide sufficient statistical power, the procedures for executing the study, instruments used, and data preparation and analysis.

Design

This study was a non-experimental one-group design targeting a purposive sample of 65 physical therapy graduates of the classes of 2007 and 2008 at a midwestern United States university. It involved a one-time data collection of the participants, which was achieved via a secure Internet web site. The information were gathered to produce the five variables used in the prediction model. Four of these variables aligned with the study's theoretical lens: Pattern recognition, identification of subtle trends, similarity

recognition, sense of salience, preference for selective attention to details, and experience. The fifth variable, gender, was included to examine the question of women's intuition and to explore whether being female or male influenced intuitive-decision making.

A research plan containing a description of the study goals, design, and protocol, along with recruitment letter and consent form, was submitted to the Institutional Review Boards (IRB) of two Universities. The first institution contained the academic program from which the potential participants would be recruited, and the second was the educational institution of this study's investigator and under whose auspices the study was conducted. Approval was received by both entities. Appendix A contains the relevant IRB documents pertaining to this study.

Participants

The purposive sample consisted of volunteers from a population of women and men who recently graduated from a Master's degree program in physical therapy. Sixty-five participants between the ages of 22 and 45 were invited to participate in this study. The inclusion criteria were that a participant graduated from the Program in Physical Therapy within the last two years, the person had taken the *National Physical Therapy Examination* (NPTE), and the individual agreed to participate in the study.

Procedure

Participants were invited to be a part of this study via electronic mailing, and if some individuals were not accessible by this avenue of communication, personal communication via telephone calls was used. In both forms of communication to recruit subjects, the investigator emphasized that participation was voluntary. Further, given that

the participants had graduated from the academic institution, the investigator, who was their former instructor, no longer held any type of influence over them, other than interpersonal relationships established while they were in the academic program.

Those individuals who were interested in participating accessed a secure web site developed for the study. The web site used the Blackboard[®] platform, which is an Internet based system used to organize and manage information, typically within an educational context (Blackboard Inc., 2008). To access the site, potential participants logged into the site using the electronic mail username and passwords that they used in the academic program prior to graduation. The Blackboard main page for this study consisted of a welcome message explaining the study, and it contained tabs with links to subsequent pages including the consent form, each of the assessment tools, the demographic survey, and a final 'thank you' page as a means of providing closure to the experience. Consent was acquired using an on-line form on the secure web site and participants acknowledged consent by typing in their names next to the sentence "I agree to participate in this study" and clicking on a button labeled "Accept." Since participants used individualized user names and passwords, the potential for someone other than a study participant to access the site or input data was minimized as much as possible.

The participants completed a brief demographic information form, asking them to record their age, gender, and ethnic background, plus it included a section for comments and questions. Participants then took two measures of intuition: The *Accumulated Clues Task* (ACT) (Balthazard, 1985; Bowers, et al., 1990) and the *Dyads of Triads Task* (DOT) (Bowers, et al., 1990). Both are word tasks that required the participant to intuit a solution word in different ways. The ACT does so by the consecutive layering of 15 clue

words that are progressively more relevant to the solution word, and the DOT achieved this by requiring the reader to discern between similar and dissimilar groupings of words, then intuit a solution word.

Participants were asked to record two pieces of information from tests administered outside of this study: Their preference on the Sensing-Intuition subscale of the *Myers-Briggs Personality Type Indicator* (MBPTI) (Myers & McCaulley, 1986) and their score on the Examination / Foundations for Evaluation, Differential Diagnosis, & Prognosis section of the NPTE. As part of their course work in the academic program, participants in this sample had taken the MBPTI previously. Similarly, the participants had already taken the NPTE, including the Examination / Foundations for Evaluation, Differential Diagnosis, & Prognosis section, and simply input their scores on this section. The one-time process of participation in this study took about 30 minutes. No procedures, situations, or materials that were hazardous to the participants were involved in this study.

Instruments

This study used four tools to measure aspects of intuition and intuitive decision-making. It employed three tasks to assess the elements of intuition as defined by the Dreyfus and Dreyfus (1986) model: Pattern recognition, identification of subtle trends, similarity recognition, determining relevance versus irrelevance, and selective attention to particular information. The only aspect of the theoretical model not assessed by these tools was skilled know-how or experience, which was measured by recording the participant's age. The study used the ACT to measure pattern recognition and identification of subtle trends, the DOT to assess similarity recognition and relevance

versus irrelevance, and the Sensing-Intuition subscale of the MBPTI as a measure of selective attention. The study used the Foundations for Evaluation, Differential Diagnosis, & Prognosis portion of the NPTE as a measure of intuitive decision-making. Each of these tools has undergone psychometric evaluation, including assessments of validity, internal consistency, and other statistical measures, which substantiated their use in this study.

The three measures of intuition assessed five of the six elements of the Dreyfus and Dreyfus (1986) model of intuition: Pattern recognition, common-sense understanding, similarity recognition, sense of salience, and deliberative rationality. As stated previously, the sixth element, skilled know-how or experience, was measured using participant’s age in years. The nature of the ACT and the DOT allowed the measurement of multiple elements of intuition, which are described along with other aspects of the theoretical model in Table 1.

Table 1

Elements of Intuition, Their Definitions, and Associated Measurement Instruments

Element of Intuition	Definition	Measurement Tool
Pattern Recognition	The ability to recognize and make sense of the components of a situation as a whole.	Accumulated Clues Task
Common-sense Understanding	Identification of subtle trends.	Accumulated Clues Task
Similarity Recognition	Comparison of similar and dissimilar characteristics; the ability to recognize subtle likenesses to cues found in past episodes despite many differences in the current situation.	Dyads of Triads Task

Sense of Saliency	Identifying key pieces of information; determining relevance versus irrelevance.	Dyads of Triads Task
Deliberative Rationality	Selective attention to certain aspects or events; the preference for viewing situations from a broader perspective.	Sensing-Intuition Subscale of the Myers-Briggs Personality Type Indicator
Skilled Know-how	Experiential knowledge, where the tools of a practical situation become an extension of one's self.	Age in years

The ACT is a measure of both pattern recognition, which is the ability to recognize and make sense of the components of a situation as a whole, and common-sense understanding, which is the identification of subtle trends. Originally developed by Balthazard (1985) as the *Associate Clues Task*, this measure of intuition evolved into the *Accumulated Clues Task* (Bowers, et al., 1990). The ACT is a verbal task consisting of 12 items of 15 clue words, each of which is an association of a solution word. Subjects read one word at a time, and when they have accumulated enough to determine what they believe is the solution word, they indicate that word as the answer and include the number of clues it took for them to determine it.

Following is an example of an item from the ACT:

1. red
2. nut
3. bowl
4. loom
5. cup
6. basket
7. jelly
8. fresh
9. cocktail
10. candy
11. pie
12. baking
13. salad

14. tree

15. fly

If it took eleven clues to determine that the solution word was ‘fruit,’ participants indicated this in their response. The ACT is based on a theoretical model of intuition proposing that a pattern of clues unconsciously and automatically “activates relevant mnemonic and semantic networks in the brain, thereby guiding thought tacitly to an explicit hypothesis or hunch” (Bowers, et al., 1990, p.94). The ACT is valid and has an internal consistency of 0.70 (Cronbach’s alpha) (Balthazard, 1985; Bowers, et al., 1990; Langan-Fox & Shirley, 2003). The range of scores for the ACT is from 1 to 16, with the lower score reflecting greater intuitive ability. If respondents could not reach a solution word, they automatically scored a 16 for that set of clues. Balthazard (1985) emphasized that the central aspect of the ACT is the sequential presentation of clues, and the fewer the number of clues required to produce a correct solution, the more intuitive the individual is. Bowers, Farvolden, and Mermigis (1995) categorized respondents as having high, medium, or low intuition, determined by the number of clues needed to provide the solution word. An individual with high intuition solved the ACT in 4 – 9 clues, one with medium intuition solved it in 9 – 11 clues, and one with low intuition solved it in 11 – 16 clues.

The DOT (Bowers, et al., 1990) is a measure of both similarity recognition or comparison of similar and dissimilar characteristics and sense of salience, which is the ability to identify key pieces of information and determine relevance versus irrelevance. The DOT consists of 25 sets of triads of words, one of which is a coherent triad i.e. all three words have something in common, and the other is incoherent, i.e. there is no connection between the three words. Subjects are asked to solve the coherent triad by

determining the solution word that links the three words or at least indicate their feeling of which of the two triads is the coherent one (Bowers, et al., 1990). It is possible that the solution word was not apparent to participants, however they may have had a “hunch” about which was the coherent triad. In that case, they identified what they believed was the coherent triad on the task. Bowers et al. (1990), determined that hunches regarding the correctness of a triad, even when the participants did not know the solution word, occurred beyond the frequency of chance. The range of scores on the DOT is 0 to 50. Participants scored two points if they correctly identified the coherent triad and its correct solution word, one point if they chose the coherent triad but do not identify the correct solution word, and zero points if they chose the incoherent triad. The higher the score on the DOT, the greater the intuitive ability. Following is an example of an item from the DOT:

A	B
Playing	Still
Credit	Pages
Report	Music

In this case, list A has a solution: All three words have the word ‘card’ in common. The DOT is regarded as a valid tool for assessing individual differences in intuitive ability, and it too can measure the degree of intuition as low, medium, or high. It has an internal consistency of .76 to .78 (Bowers, et al., 1990). The DOT has an average correlation of .41 with the Vocabulary subtest of the WAIS-R across multiple samples, suggesting that verbal intelligence is distinct from intuitive skill (Bowers, Farvolden, & Mermigis, 1995).

The Sensing-Intuition subscale of the MBPTI (Myers & McCaulley, 1986) is a measure of deliberative rationality, which is the preference to apply selective attention to

certain aspects or events or to view situations from a broader perspective (Hull, 1971; Myers & McCaulley, 1986). The complete MBPTI, based on the theory of psychological types described by Jung (1973), is a tool to measure the degree to which an individual prefers to operate from four dichotomous pairs of preferences, of which sensing and intuition is one aspect. Jung described Sensing as “the psychological function that mediates the perception of a physical stimulus” (Hull, 1971, p. 461) with a preference for viewing information in discrete segments. Intuition is a function that mediates perceptions unconsciously and is predisposed to viewing the totality of information, seeing connections among varying and diverse elements (Jung, 1973).

Murray (1990) reported that over 1800 studies have been conducted on the MBPTI. As a whole, the MBPTI is valid (Schweiger, 1985; Thompson & Borrello, 1986) and reliable (Johnson, 1992). A meta-analytic reliability generalization study of the MBPTI found score reliabilities between .76 and .84 with alpha coefficients ranging from .55 to .97 (Capraro & Capraro, 2002). It has concurrent validity with instruments including the Five Factor model (Costa & McCrae, 1985; Uhl & Day, 1993). Further, the validity of the MBTI’s four subscales has been determined via factor analysis (Johnson, Johnson, Murphy, Weiss, & Zimmerman, 1998; Tischler, 1994; Uhl & Day, 1993). Internal consistency of the Sensing-Intuition subscale for college students is 0.81 (Langan-Fox & Shirley, 2003).

The MBPTI’s subscales ordinally measure a person’s preference along a continuum such that an individual may be ‘more intuitive’ or ‘more sensing’ than another. The bimodal nature of the MBPTI subscales produces reliability issues the closer a measure falls to its midpoint. This said, continuous scores can be assigned to the

subscales and cutoffs can be reliably determined to identify an individual as having a preference for intuition or sensing (Harvey & Thomas, 1996; Thompson & Borrello, 1986). Given the defined nature of the MBPTI sensing-intuition scale and its proven validity and reliability of scores, its use is substantiated to measure intuition as defined by its authors in a quantifiable manner.

The MBPTI Form G, which is a self-scoring form, was used in this study. The instrument produces raw scores for each subscale, including the sensing-intuition subscale. The maximum score for individuals with a sensing preference (i.e., they responded in the affirmative that every question related to a sensing preference was closest to how they feel or act) was 34. The maximum score for individuals with a preference for intuition (i.e., they responded in the affirmative that every question related to an intuitive preference was closest to how they feel or act) was 25. Given that a preference for sensing is farther away from intuition, scores for a sensing preference were designated as negative, and those scores indicating a preference for intuition were designated as positive. This produced a range of continuous scores for the sensing-intuition subscale of the MBTI from -34 to zero to +25. Individuals who score below zero are “Sensing” and those who score above zero are “Intuitive” (Myers & Myers, 1993, p. 3). The lower the continuous score, the greater the individual’s preference for sensing, the higher the continuous score, the greater the individual’s preference for intuition, and a score of zero reflected an individual with neither a preference for sensing nor a preference for intuition.

The Examination/Foundations for Evaluation, Differential Diagnosis, & Prognosis section of the NPTE is the largest portion of the computer-based multiple-

choice licensing examination that measures knowledge and abilities required of entry-level physical therapists. Scores on the examination are based on correct responses to 200 questions that are organized into six sections. The Examination/Foundations for Evaluation, Differential Diagnosis, & Prognosis section is the largest section of the NPTE with 47 questions, constituting 23.5 per cent of the overall examination (Federation of State Boards of Physical Therapy, 2008). The NPTE is a valid representation of entry-level physical therapy practice, reflecting contemporary work activities and knowledge of physical therapists (Knapp, Russell, Byrum, & Waters, 2007). The Examination/Foundations for Evaluation, Differential Diagnosis, & Prognosis section specifically evaluates intuitive clinical decision-making by requiring graduates to interpret information presented in the form of patient-based scenarios. These scenarios consist of information about the patient in the form of patterns of clues provided in a patient history, signs and symptoms, and findings from particular measurements and observations, they also will include irrelevant information. To determine the correct answer, the graduate must be able to recognize patterns and trends associated with specific diagnoses, differentiate relevant from irrelevant information as well as weigh the importance of that information, all the while viewing the scenario in its totality. The questions on the examination typically involve some degree of uncertainty, the facts are limited, and given that it is timed, there is pressure to promptly arrive at a decision; these are the hallmarks of when practitioners make intuitive clinical decisions (Langan-Fox & Shirley, 2003). Scores on the Examination/Foundations for Evaluation, Differential Diagnosis, & Prognosis section can range from 200 to 800, with the minimum passing score for licensure being 600.

Age as a measure of experience relates to the sixth aspect of the study's theoretical model. Although this element also deals with the skilled know-how aspect of experience, given that the subjects are recent graduates, life experience is emphasized in this measure as opposed to work experience. Age as a valid marker for life experience has been reported in a number of studies (Staudinger, 1999; Trueman & Hartley, 1996) as has its role in decision-making ability (Hershey & Wilson, 1997; Finucane, et al., 2002; Scott, Reppucci, & Woolard, 1995). In this study, age is measured in years.

A-priori Power Analysis

Statistical power analysis, or the probability that a study will lead to statistically significant results relies on the relationships among the four variables involved in statistical inference: Sample size (N), significance criterion (alpha), population effect size (ES), and statistical power (Cohen, 1992). Given a particular number of predictors, one can calculate the necessary sample size a priori by choosing the desired level of significance, the acceptable level of power, and the anticipated effects size.

This study has five predictors, it uses an alpha level of 0.10, a power level of 0.80, and an effect size of 0.25. The five predictors are comprised of the scores on the ACT and DOT, the continuous score on the Sensing-Intuition subscale of the MBPTI, the person's age in years, and gender. An alpha level of 0.10 was selected for this study. Although the level of significance can range from .01, .05, .10, to 0.25 and beyond, Hellman and Nye (1998) in a treatise on statistical significance points out that we run the risk of dismissing educationally and socially meaningful results by choosing an alpha level that is too stringent. Further, Cohen (1992) substantiates that alphas such as 0.10 or 0.25 are appropriate in studies that are exploratory and predictive in nature. A power

level of 0.80 or greater is suggested, with any lower value incurring “too great a risk of a Type II error” (Cohen, 1992, p. 156). A value of 0.25 reflects a medium to large effect size (small ES = 0.02, medium = 0.15, large = 0.35). A medium effect size is one that is “visible to the naked eye of the careful observer,” and a large effect size “is the same distance above medium as small is below” (Cohen, 1992, p.156). In the instance of this study, a medium to large effect size is one that most observers knowledgeable of the subject matter would be able to readily identify. Using five predictors, the minimum sample size required to produce a power of 0.80 at the significance level of 0.10 with a medium to large effect size of 0.25 is 47 participants.

Data Preparation and Analysis

Participants’ raw scores on the ACT, the DOT, the continuous score of their preference on the Sensing-Intuition subscale of the MBPTI, their score on the Examination / Foundations for Evaluation, Differential Diagnosis, & Prognosis section of the NPTE, their ages, and genders were captured from the data entered by the participants using the grade book function of the Blackboard® platform. The data were retrieved from Blackboard® and copied into a Microsoft Excel® Spreadsheet. To enhance ease of interpretation, the continuous scores on the Sensing-Intuition subscale of the MBPTI were adjusted to reflect positive numbers by adding a constant of 34 to each score. As such, the original range for the MBPTI of -34 to zero to +25, in which -34 reflected the maximum score for sensing, zero was the neutral point on the scale reflecting a preference for neither sensing nor intuition, and +25 indicated the maximum score for intuition, was converted to a range of positive scores that started at zero. The adjusted range of scores for the Sensing-Intuition subscale of the MBPTI was zero to 34 to 59,

with zero as the maximum score for sensing, the neutral score of zero, and the maximum intuition score of 59. Demographic information produced the participant's age in years and gender. Age was entered into the spreadsheet, and gender was coded and entered, with females coded as one and males as zero. Data analysis was conducted using Statistical Package for the Social Sciences[®] (SPSS) software.

Analysis consisted of an examination of correlations among the three measures of intuition, the measure of intuitive clinical decision-making, gender, and age. Then multiple linear regression was used to develop a structural equation model to predict intuitive clinical decision-making ability in recently graduated physical therapists. Scores on measures of intuition and intuitive clinical decision-making were compared between males and females. Finally, accurate hunches on the DOT were examined to determine whether they occurred beyond chance levels. Correlations among the three measures of intuition, the ACT score, the DOT score, and the continuous score on the Sensing-Intuition subscale of the MBPTI were conducted along with the measure of intuitive decision-making (NPTE score), age, and gender. The structural equation model had as its predictors: The ACT score (measure of pattern recognition and common-sense understanding), the DOT score (measure of similarity recognition and sense of relevance-irrelevance), the continuous score of the Sensing-Intuition subscale of the MBPTI (measure of deliberative rationality), the subject's age (measure of experience), and gender. The criterion was intuitive decision-making, reflected by the score on the Examination/Foundations for Evaluation, Differential Diagnosis, & Prognosis section of the NPTE. Scores of intuition and intuitive decision-making between females and males

were compared, and frequencies of accurate and inaccurate hunches on the DOT were compared to those of a random distribution.

CHAPTER IV

FINDINGS

Participant data were summarized and subsequent statistical analysis was conducted. The four questions posed in this study were examined using various applications of the Statistical Package for the Social Sciences[®] (SPSS). This analysis yielded findings related to the correlations among the study variables, the overall significance of the predictive model, comparisons by gender, and an examination of the frequency of hunches in decisions to determine if they occurred beyond chance levels, presented sequentially below.

Summary of Participants

A total of 47 physical therapy graduates, consisting of 30 females and 17 males who ranged in age from 24 to 34 years (mean age 27.13), consented to participate in this study. This set of respondents represents a 72.3 % response rate from the 65 invitations sent. Participants submitted their scores on the *Myers Briggs Personality Type Inventory* (MBPTI) and *National Physical Therapy Examination* (NPTE), completed the *Accumulated Clues Task* (ACT) and *Dyads of Triads* (DOT) task, and provided demographic information including age and gender. No data or demographic information was missing for any participant. Of the subjects in the study, 23.4 per cent had a preference for intuition, based on the Sensing-Intuition subscale of the MBPTI.

Table 2 provides descriptive statistics for the scores on the measures and age, stratified by gender.

Table 2

Descriptive Statistics for the Measures of Intuition, Intuitive Clinical Decision-making, and Age, Stratified by Gender

Male (N = 16)

Female (N = 31)

	Gender	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower Bound	Upper Bound		
ACT	Male	11.434375	1.6242248	.4060562	10.568887	12.299863	8.4200	14.2500
	Female	11.423871	1.5424044	.2770240	10.858112	11.989629	8.9200	14.7500
DOT	Male	23.75	5.106	1.276	21.03	26.47	14	32
	Female	26.81	6.107	1.097	24.57	29.05	16	39
MBPTI	Male	36.75	15.868	3.967	28.29	45.21	14	56
	Female	21.35	7.748	1.392	18.51	24.20	10	44
NPTE	Male	640.12	61.042	15.260	607.60	672.65	556	708
	Female	640.35	35.116	6.307	627.47	653.24	586	687
Age	Male	27.56	1.896	.474	26.55	28.57	25	30
	Female	26.90	2.797	.502	25.88	27.93	24	36

Outcomes of Data Analyses

To respond to the four questions posed in this study, correlations among the variables were examined first (addressing question one), then the predictive model for intuitive decision making was tested (question two), then differences by gender were examined (question three), and finally a chi square analysis of hunches on the DOT as

compared to random occurrence was performed (question four). Some of the results of these analyses led to additional statistical exploration. Overall findings of data analysis were: The ACT and NPTE were significantly correlated, as were the DOT and the Sensing-Intuition subscale of the MBTI with gender; the overall model was not significant for predicting intuitive clinical decision-making; female graduate physical therapists scored as more intuitive only on the DOT; males scored as more intuitive on the MBPTI, and no difference between the two was found on the ACT and NPTE. The frequency of correct hunches on the DOT was no different than what would occur by chance. Following are the findings related to the analyses made regarding each question posed by this study.

Relationships of Variables

Question one asked, “What are the relationships between measures of intuition, intuitive decision-making, age, and gender? Specifically, are there correlations among the *Dyads of Triads* (DOT), the *Accumulated Clues Task* (ACT), the Sensing-Intuition Subscale of the *Myers Briggs Personality Type Indicator* (MBPTI), the scores on the *National Physical Therapy Examination* (NPTE), age, and gender?” A one-tailed analysis of correlations of the scores on the ACT, DOT, MBPTI, Age, and Gender was performed. A one-tailed analysis was selected to provide greater statistical power, supported by the directional hypothesis that measures of intuition on one scale along with the measure of experience should all be in the same direction. This resulted in three significant correlations. The ACT and NPTE were significantly correlated at $\alpha = .05$ and Pearson’s r of .282. Cohen (1992) defined effects size of multiple and multiple partial correlations as small (.02), moderate (.15), and large (.35). Using these definitions, the ACT is nearing

moderate strength in prediction of intuitive decision-making as measured by the NPTE. Further, the DOT and gender were significantly correlated at $\alpha = .05$, with $r = .248$, indicating a positive relationship between scores of intuition related to similarity recognition and being female, and the MBPTI and gender were significantly negatively correlated at $\alpha = .01$, with $r = -.556$, reflecting a relationship between intuition scores of deliberative rationality (preference for a broader perspective) and being male. Table 3 provides the correlations among the five predictor variables and the criterion variable used in this study.

Table 3

Pierson's Product-moment Correlations of Study Variables

All Subjects (N = 47)

	ACT	DOT	MBPTI	NPTE	Age	Gender
ACT	1.0	-.074	-.050	.282*	-.205	-.003
DOT		1.0	-.008	-.059	.180	.248*
MBPTI			1.0	.102	.109	-.556**
NPTE				1.0	-.004	.002
Age					1.0	-.125
Gender						1.0

* Correlation is significant at the 0.05 level (one-tailed)

** Correlation is significant at the 0.01 level (one-tailed)

Prediction Model Testing

Data were analyzed via SPSS to address the second question posed in this study, “To what extent do measures of intuition, age, and gender predict achievement on a measure of intuitive decision-making (the National Physical Therapy Examination/NPTE) in newly-graduated physical therapists?” Results indicated that the overall model was not significant, with $F = .996$ and $p = .432$. The ACT, DOT, MBPTI, age, and gender do not reliably predict intuitive decision-making as measured by the NPTE in graduate physical therapists. The R^2 for the model was .108, reflecting that only 10 per cent of the variance in the NPTE can be predicted by the five variables. Further, the adjusted R^2 is .000, indicating that none of the variance of the NPTE is accounted for by the predictors. Analysis of the coefficients for each variable confirms that, at $\alpha = .10$, the ACT is a useful predictor of intuitive clinical decision-making as measured by the NPTE, with $p = .054$.

Comparisons by Gender

The third in the series of analyses addressed the question, “Do female graduate physical therapists have higher scores on measures of intuition and intuitive decision-making than males?” The study revealed significant correlations between gender and the MBPTI and the DOT; therefore, subsequent analysis by gender of scores on the three measures of intuition (ACT, DOT, and MBPTI) and the measure of intuitive decision-making (NPTE) revealed varying results. Analysis of the ACT showed no significant difference between females and males, the DOT revealed a significant difference with females scoring as more intuitive than males, and the MBPTI showed a significant difference with males scoring higher on the intuitive portion of the scale than females. As

it relates to intuitive clinical decision-making, scores on the NPTE by gender revealed no significant difference, with nearly identical mean scores for both groups.

Analysis of variance of the ACT by gender showed no significant difference between males and females ($p = .983$), and in fact, both groups had nearly identical mean scores, with females having a mean of 11.42 and males 11.43. Analysis of variance of the DOT by gender showed a significant difference between females and males at $\alpha = .10$, with $p = .093$, with females scoring as more intuitive than males with means of 26.81 and 23.75 respectively. Analysis of variance of the MBPTI by gender showed a significant difference between females and males ($p = .000$), with males scoring higher on the intuitive portion of the scale than females. The mean score for males on the MBPTI was 36.75 and the mean score for females was 21.35. Analysis of NPTE by gender revealed no significant difference between females and males ($p = .987$), and once again, mean scores for both were nearly identical, with females at 640.35 and males at 640.12.

Given the significance of the ACT as a predictor of intuitive clinical decision-making nearing moderate effects size (Cohen, 1992), further analysis by gender with participants stratified into MBPTI types was considered for both the ACT and the NPTE. Classification of males and females into either the Sensing or Intuition group was determined by their MBPTI scores. Because reliability of classification using the MBPTI decreases the closer a score is to the neutral point of the bimodal subscale (Harvey & Thomas, 1996), those subjects with MBPTI scores that were half a standard deviation above or below the neutral point of 34 were excluded from this analysis. As such, the scores of four subjects were not considered. Groupings for the remaining 43 subjects were as follows: 25 sensing females, 7 sensing males, 2 intuitive females, and 9 intuitive

males. Given that the group of intuitive females contained only two participants, the resulting two-way analysis of variance should not be considered. Analysis of the remaining groups of gender and MBPTI type (sensing females, sensing males, and intuitive males) by the ACT revealed no significant difference between the groups, with the values for gender at $p = .892$, type at $p = .844$, and the interaction of gender * type at $p = .944$. The same type of analysis of variance for the NPTE was also not significant, with values for gender at $p = .794$, type at $p = .843$, and the interaction of gender * type at $p = .608$.

Frequency of Hunches Used in Decisions Compared to Chance Occurrence

The final question addressed by this study was, “Do hunches about correct solutions on a measure of intuition (DOT) occur at a level beyond chance?” As mentioned previously in the description of the instruments, when subjects were unable to determine a solution word for the DOT but they had a hunch as to which of the two triads had a solution, they indicated that “hunch” in the assessment. To analyze this question, all correct solutions to the DOT were eliminated, leaving only the unsolved dyads with the hunch as to the triad with a solution word. Frequencies for Correct and Incorrect hunches were recorded. Analysis was conducted using a chi square goodness of fit test of the frequency of correct and incorrect hunches on the DOT compared to a random distribution. With the expected theoretical distribution set to equal, the results indicated that there was no difference between the two groups and a random distribution. When the observed test statistic was compared to a critical value with $\alpha = .05$ and $\alpha = .10$, with 15 degrees of freedom for correct hunches and 9 degrees of freedom for incorrect, the findings were not significant. Further, levels of significance were .263 for correct

hunches and .417 for incorrect hunches. Thus, the frequency of correct hunches and/or incorrect hunches on the DOT was no different than what would occur by chance.

CHAPTER V

SUMMARY, CONCLUSION, IMPLICATIONS, AND RECOMMENDATIONS

This study addressed four questions related to intuitive decision-making in graduate physical therapists. It revealed significant correlations among some of the variables: the *Accumulated Clues Task* (ACT) with the *National Physical Therapy Examination* (NPTE) as well as both the *Dyads of Triads Task* (DOT) and the Sensing-Intuition subscale of the *Myers Briggs Personality Type Indicator* (MBPTI) with gender. It determined that a model based on a theory proposed by Dreyfus and Dreyfus (1986) that used three measures of intuition and age along with gender was not significant at predicting intuitive decision-making in graduate physical therapists. It produced varying results on the measures of intuition when examined between genders, with females scoring as more intuitive on one measure (DOT), males higher on another (MBPTI), and no difference between them on the third measure (ACT) or on the measure of intuitive decision making (NPTE). Finally, it determined that the hunches formulated on correct solutions to the DOT did not occur any more frequently than if by chance. What follows is a discussion of the findings of the study with respect to the statistical power of the study, interpretations of the findings related to pattern recognition as a predictor of intuitive decision-making, usefulness of the study's theoretical lens, relationship between

intuition and gender, frequency of hunches as compared to chance occurrence, and the overall intuitiveness of the subjects. Finally, the implications for practice are addressed, along with study limitations and recommendations for future research.

Statistical Power

The 47 participants involved in this study provided the exact minimum required to produce statistical power of .80 at the significance level of 0.10 with anticipated medium-to-large effects size of 0.25. Although the N is sufficient for this study (see Cohen, 1992), given the lack of a larger number of subjects, it is considered exploratory in nature. Subsequent data collected and analysis from future cohorts will allow for further testing of the questions posed, as well as produce new lines of inquiry.

Pattern Recognition as a Predictor of Intuitive Decision-making

Of the findings illuminated in this study, perhaps the most useful came from the correlation of variables that identified the ACT as a predictor of intuitive decision-making, which is nearing moderate in strength as defined by Cohen (1992). Applying the Dreyfus and Dreyfus (1986) theoretical lens, the ACT is a measure of pattern recognition and subtle trends. This would tend to suggest that pattern recognition and trend identification are influential elements of making clinical decisions using these two aspects of intuition. Given that a clinical diagnosis is a collection of groupings of key signs, symptoms, and findings, this would lend face validity to the ACT as a useful predictor of intuitive decision making and particularly as a useful element in identifying success on the NPTE. This is substantiated by recent studies that concluded that pattern recognition has a central role in the diagnostic process among physicians (Fried, Gather, & Imhoff, 2001; Matthews, Buckley, & Gledhill, 2008; Wolff, 2006). It would be of

interest to see if the ACT is correlated with other measures of pattern recognition/completion, such as the *Waterloo Gestalt Closure Task* (WGES) developed by Bowers, et al. (1990) and if the latter measure also has a significant correlation with the NPTE. Although a correlational study of the ACT and the WGES is not apparent in the literature, Bowers, et al. (1995) did report that correlations between the ACT and the DOT scores of four different samples ranged from .38 to .57. This is in contrast to the $r = -.074$ between the ACT and DOT found in this study.

Usefulness of the Study's Theoretical Lens

The lack of the overall model as a significant predictor of intuitive decision-making warrants further examination of the theoretical lens used in its development. Although pattern recognition and identification of subtle trends do seem to have some degree of predictive value, the remaining elements of similarity recognition, determining relevance or irrelevance, selective attention, and experience did not contribute to accurate prediction in this study. Although the literature would substantiate their validity (Balthazard, 1985; Bowers, et al., 1990; Schweiger, 1985; Thompson & Borello, 1986), it is possible that the tools used to measure these elements of intuition were not as useful at measuring intuition in graduate physical therapists. Further, it is also possible that subjects have not had sufficient time to adequately develop these aspects of intuition. Of note is that age in years was used as the measure of experience. First, the range of ages of the subjects (24 to 34 years) did not produce a great deal of variability, and second, life experience can be quite different from professional experience. Although the literature supports that novice practitioners do possess and use intuition (King & Appleton, 1997; McCormack, 1993), the preponderance of studies suggests that a greater accumulation of

professional experience is a key aspect of intuition's use in clinical practice (Benner, 1982, 1984; Effken, 2001; English, 1993; Orme & Maggs, 1993). This would seem reasonable that the greater the accumulation of information about various problems, diagnoses, and clinical situations, the greater the ability to intuit appropriate decisions and courses of action. Another consideration in regard to this model, which will be discussed in greater detail shortly, is the finding that the subjects in this study did not score as highly intuitive on the ACT, the DOT, nor the MBPTI. To develop a useful predictive model for novice practitioners, other variables beyond those of intuition must be identified. Balogun (1988) determined that grade point average (GPA) and scores on the *Allied Health Professions Admission Test* (AHPAT) were predictors of academic and clinical success, as measured by performance on a comprehensive examination administered at the end of the physical therapy degree program, accounting for 40.6 per cent of the total variance. Harrelson, Gallaspy, Knight, and Leaver-Dunn (1997) also identified GPA and scores on the *American College Test* (ACT) as predictors of success on the *National Athletic Trainers' Association Board of Certification* examination. Given the significant correlation between the *Accumulated Clues Task* score and the NPTE, combining it with other predictors of success, including GPA and scores on the AHPAT and *American College Test* may produce a more useful predictive model. Although intuition plays a role in successful decision-making as reflected by scores on the NPTE, inclusion of additional variables is warranted, along with subsequent testing, to acquire a useful prediction model.

Intuition and Gender

The findings of this study regarding intuition and gender are a reflection of the literature on the subject: A great deal of variability exists, and there is no conclusive evidence that women are more intuitive than men, that men are more intuitive than women, or that there is any significant or conclusive difference whatsoever between the two groups. It is possible that context may play a role in which gender, if either, is more intuitive. In this study, females had a significantly higher mean score on the DOT test than males. If it holds true that the DOT is a valid test of the ability to recognize subtle trends and identify key pieces of information, the advantage of women on this test may link with other studies (see Lieberman, 2000) proposing that women are more socially intuitive, a skill that depends to a good extent on ability to identify nuances of facial expression and to distinguish relevance among various pieces of nonverbal information and cues. This said, males scored as more intuitive on the Sensing-Intuition subscale of the MBPTI, which suggests a more global approach to information collection and processing (Hull, 1971). The same finding was demonstrated in a study by Allinson and Hayes (1996), which determined that males were more intuitive than females as reflected by scores on the *Cognitive Styles Index*. These findings are in contrast to a study by Agor (1992) who found that women scored higher on the intuition scale of his *Agor Intuitive Management (AIM) Survey*, which contained items from the Sensing-Intuition subscale of the MBPTI. Although this study's theoretical lens was not useful in developing a prediction model, it may have some utility in viewing intuition among graduate physical therapists within differing contexts: That females may be more adept at recognizing subtle trends and identifying key pieces of information in a situation, that males are more

global in their information collection and processing, and that both genders are adept at pattern recognition and identification of subtle trends. Additional studies with a larger sample size are warranted.

Frequency of Hunches as Compared to Chance

Do correct hunches occur more frequently than chance in the clinical setting? This study found no difference between hunches on the DOT and chance. This is in contrast to the findings of Bowers et al. (1990), who reported that findings from the DOT showed a “modest improvement over chance,” however the authors did not provide specific statistics as to the extent of this improvement (p. 97). It is also possible that hunches related to unknown solutions to the DOT may not be an accurate reflection of the hunches described by many clinicians or Nobel laureates (Marton, Fensham, & Chaiklin, 1994). In qualitative studies of hunches, many subjects describe them as “a sense of rightness” (Dewey, 1925, p. 244) that may simply be an unconscious processing of collected information that has not yet arrived at the level of overt cognitive attention. Using two sets of three words to produce a hunch may not accurately reflect the process that occurs clinically, in which practitioners describe subtle cues from the patient and contextual situations as the stimuli for their “gut feelings” (Eason & Wilcockson, 1996, p. 668). Bowers et al. echo this possibility, suggesting that the DOT causes problem-solving to be “foreshortened” and not reflective of “real-life inquiry” (p.98). It is possible that more information must be available, even if in the realm of fringe consciousness, for the accuracy of hunches to exceed frequencies beyond chance levels. Further investigations that pay particular attention to the context of intuitive hunches and the instruments used to measure them are warranted.

Intuitiveness of the Study Participants

Another conclusion related to the findings in this study is that, if this sample is representative of the larger population, graduate physical therapists do not appear to be highly intuitive as reflected by the various measures of intuition. Of the participants in the study, 23.4 per cent of the subjects had a preference for intuition, based on the Sensing-Intuition subscale of the MBPTI. This is well under the 34.5 per cent reported for student physical therapists by Hardigan and Cohen in 1998. Further, the mean score for males on the Sensing-Intuition subscale of the MBPTI was 36.75, which was only slightly above the neutral point of 34, and the mean score for females was 21.35, indicating a greater preference for sensing. In regard to the ACT, the mean number of clues required to produce a solution was 11.43. In their 1990 study, Bowers, et al. classified college students into one of three intuition categories based on their scores on the ACT. Those classified as “high intuition” reached a solution word on the ACT using between 4 and 8 clues, those with “medium intuition” used between 9 and 11, and those with low intuition required 12 to 16 clues (p. 88). Using this classification, the subjects in this study would be categorized as having medium to low intuition. As it relates to the DOT scores, which have a range from zero (less intuitive) to 50 (more intuitive), the subjects in this study had a mean score of 25.77. All three measures of intuition used in this study corroborate one another: The subjects tend to fall near the midpoint or slightly lower on each scale of intuitiveness. This raises an interesting question: Are college students more sensing because education emphasizes sensory perception and checklists (see King & Appleton, 1997), or do educational programs use these strategies because students are more sensing than intuitive in nature?

Implications for Practice

Regardless of the preceding “chicken or the egg” quandary, the conclusions based on the findings of this study suggest a number of educational implications for physical therapy curricula. Given that pattern recognition is a moderate predictor for intuitive decision-making and has been identified as having a central role in the diagnostic process (Fried, Gather, & Imhoff, 2001; Matthews, Buckley, & Gledhill, 2008; Wolff, 2006), many academic programs that decline to teach “cookbook” approaches, may wish to reconsider their teaching strategies. Although by no means can or should theory be dismissed from teaching, it is possible that creating “illness scripts” or “diagnosis cards” that present collections of key findings, signs, symptoms, and clues in the patient history and physical examination for particular problems may be beneficial. Recent educational trends tend to support this approach (Ark, Brooks, & Eva, 2006; Kassim & Lau, 2002), which would appeal to the sensing-oriented student, who prefers collections of facts and information as opposed to broad concepts (Hull, 1971). Such an educational approach would, in a sense, create artificial intuition for the students who have a preference for sensing. Further, given that experience likely plays a key role in intuitive decision-making in the clinic, it would seem quite useful not only to maximize a student’s exposure to the experience of practicing clinicians, but to also encourage the practitioner to “think aloud” their decision-making (Davey, 1983, p. 163; Duffy & Herrmann, 1988; Swan, 2005), and as much as possible to make explicit how they arrived at decisions, particularly those that simply feel right.

Limitations and Recommendations

This study has a number of limitations. Most notable is the small sample size, which, as stated previously, would substantiate its consideration as exploratory in nature. Further, although its theoretical model does have a number of appealing qualities, its use should be revised to foster a better fit within the context of clinical practice among newly graduated physical therapists. Further exploration of additional measures of intuition, particularly those related to hunches, could prove beneficial. Moreover, although this study produced findings that may prove beneficial to physical therapy education and practice, further research into intuitive decision-making is warranted and encouraged. Given the limited experience level of the participants (who had a mean age of 27.23), future studies of the use of intuition in decision-making among experienced practitioners and particularly those identified as master clinicians would be of interest. Additional quantitative studies will likely bear useful findings, but of equal importance is the execution of qualitative studies, particularly as it relates to how experienced clinicians use pattern recognition and trend identification to make clinical decisions, whether context influences intuitive decisions between genders, and to verbalize how hunches influence their patient care.

This exploratory study suggests that pattern recognition is one element of effective intuitive decision-making in graduate physical therapists; however, to create a useful prediction model of this process, other elements have yet to be identified. It suggests that, overall, males and females appear to have about the same level of moderate-to-low intuition, although gender differences may exist depending on the context in which the decision-making is occurring. Accurate hunches don't appear to

occur more often than random chance, however this may be influenced by the amount of information available and the amount of experience of the individual involved. This study produced a number of potential answers and raised many more questions. Future research will hopefully produce a greater understanding of intuitive decision-making, which will have a positive influence on both recently-graduated and experienced physical therapists, which ultimately will enhance the care of the people who seek their services.

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APPENDICES

Appendix A: Institutional Review Board Documents



The University of Oklahoma
Health Sciences Center
INSTITUTIONAL REVIEW BOARD

IRB Number: 14125
Amendment Approval Date: October 09, 2008

October 10, 2008

Ken Randall
Academic Center, University of Oklahoma - Tulsa
4502 E 41st Street, SAC 2J30
Tulsa, OK 74135

RE: IRB No. 14125: Intuition and Decision-making in Graduate Physical Therapists

Dear Mr. Randall:

On behalf of the Institutional Review Board (IRB), I have reviewed your protocol modification form. It is my judgement that this modification allows for the rights and welfare of the research subjects to be respected. Further, it has been determined that the study will continue to be conducted in a manner consistent with the requirements of 45 CFR 46 or 21CFR 50.56 as amended; and that the potential benefits to subjects and others warrant the risks subjects may choose to incur.

This letter documents approval to conduct the research as described in:

Amend Form Dated: September 23, 2008
Consent form - Subject Version : 2 Dated: September 22, 2008

Amendment Summary:

Changes to consent for increased clarification of: why study is being completed, Myers-Briggs Personality Type Indicator, participant confidentiality, and contact information.

This letter covers only the approval of the above referenced modification. All other conditions, including the original expiration date, from the approval granted June 30, 2008 are still effective.

Any proposed change in approved research including the protocol, consent document, or other recruitment materials cannot be initiated without IRB approval except when necessary to eliminate immediate hazards to participants. Changes in approved research initiated without IRB approval to eliminate immediate hazards to the participant must be promptly reported to the IRB. Completion of approved research must be reported to the IRB.

If consent form revisions are a part of this modification, you will be provided with a new stamped copy of your consent form. Please use this stamped copy for all future consent documentation. Please discontinue use of all outdated versions of this consent form.

If you have any questions about these procedures or need additional assistance, please do not hesitate to call the IRB office at (405) 271-2045 or send an email to irb@ouhsc.edu.

Sincerely yours,

Martina Jelley, M.D., M.S.P.H.
Chair, Institutional Review Board

Post Office Box 26901 • 1000 S.L. Young Blvd., Room 176
Oklahoma City, Oklahoma 73126-0901 • (405) 271-2045 • FAX: (405) 271-1677

Ltr_Amend_Final_Appv_Exp



Oklahoma State University Institutional Review Board

Date: Thursday, October 16, 2008
IRB Application No ED08134
Proposal Title: Intuition and Decision-making in Graduate Physical Therapists

Reviewed and Exempt
Processed as:

Status Recommended by Reviewer(s): Approved Protocol Expires: 10/15/2009

Principal
Investigator(s):

Ken Randall	Diane Montgomery
2112 South Florence Place	424 Willard
Tulsa, OK 74114	Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 219 Cordell North (phone: 405-744-5700, beth.mcternan@okstate.edu).

Sincerely,



Shelia Kennison, Chair
Institutional Review Board

Consent Form

**University of Oklahoma Health Sciences Center (OUHSC)
Intuition and Decision-making in Graduate Physical Therapists**

Investigator: Ken Randall, PT, MHR

Investigator's Affiliations:

Assistant Professor, University of Oklahoma
College of Allied Health
Department of Rehabilitation Sciences
4502 East 41st Street, Room 2J30
Tulsa, OK 74135

Doctoral student, Oklahoma State University
College of Education
School of Applied Health and Educational Psychology
434 Willard
Stillwater, OK 74078

This is a research study. Research studies involve only individuals who choose to participate. Please take your time to make your decision. Discuss this with your family and friends.

Why Have I Been Asked To Participate In This Study?

You are being asked to take part in this study because you are a graduate physical therapist and I am interested in understanding to what extent you use intuition in your decision-making.

Why Is This Study Being Done?

The purpose of this study is to examine the extent that measures of intuition and achievement on a measure of clinical decision-making predicts intuitive decision-making in recently-graduated physical therapists.

What procedures are involved in this study?

If you choose to participate in this study, you will:

- Take two assessments that consist of word problems:
 - The Accumulated Clues Task, which consists of 12 lists of 15 words that provide clues to a solution word. You will be asked to identify the solution word, and how many of the clues you required to do so.
 - The Dyads of Triads Task, which consists of 25 sets of three words, one of which is associated with a solution word and the other which does not.

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IRB# E008124

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solution. You will be asked to identify which of the sets you believe has a solution, and provide the solution word.

- Input the your score on the Sensing – Intuition subscale of the Myers-Briggs Personality Type Indicator. If you do not know your score, you will be given the option of consenting to allow the investigator to retrieve this score from your student records.
- Input the score you achieved on the Examination / Foundations for Evaluation, Differential Diagnosis, & Prognosis section of the National Physical Therapy Examination (NPTE).
- Complete a brief demographic form that provides information to the Investigator to manipulate various aspects of the data collected. This information includes your age, gender, and ethnicity, plus a space to provide any comments or questions that you have in regard to intuition and decision making.

How Many People Will Take Part In The Study?

About 65 graduate physical therapists will take part in this study.

What Is Involved In The Study?

If you choose to participate, you will be involved in a one-time episode of data collection, which occurs on-line. Participating in this study will take about 30 minutes of your time. You will take two short assessments (the Accumulated Clues Task and the Dyads of Triads Task) both of which consist of word problems, you will record the score of the Sensing – Intuition subscale of the Myers-Briggs Personality Type Indicator, which you took while a student at OU, you will record the scaled score that you received on the Examination / Foundations for Evaluation, Differential Diagnosis, & Prognosis section of the National Physical Therapy Examination (NPTE), and you will complete a brief demographic information and comments sheet.

How Long Will I Be In The Study?

You will be in the study for the length of time that it takes you to complete the online assessments, input the score from your licensure examination, and complete the demographic sheet. This should take no longer than 30 minutes.

You can stop participating in this study at any time. However, if you decide to stop participating in the study, we encourage you to communicate with the researcher regarding your reasons for ending your participation. (You may use the comments section of the demographic form to do so.) You may end your participation by clicking on the button “Exit this web site” which is available on each page of the web site.

What Are The Risks of The Study?

There are no known risks associated with this study that are greater than those ordinarily encountered in daily life.

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Are There Benefits to Taking Part in The Study?

The benefits of being a member of this study are primarily those positive feelings of participating in an effort that will produce greater insight regarding the role of intuition in decision-making among graduate physical therapists. This may influence how information is taught to future classes of student physical therapists.

What Other Options Are There?

You have the option of choosing not to participate in this study.

What About Confidentiality?

The records of this study will be kept private, and individual names of participants will be removed and unique identifiers used in their place. Written results will discuss group findings and will not include information that will identify you. Research records will be stored securely and only researchers and individuals responsible for research oversight will have access to the records. It is possible that the consent process and data collection will be observed by research oversight staff responsible for safeguarding the rights and wellbeing of people who participate in research. I cannot guarantee absolute confidentiality. Your personal information may be disclosed if required by law.

I will store the data in two places: the "hard copies" of data will be in a locked file cabinet in my locked office and "electronic copies" will be on my computer, which is password protected and located in my locked office. I will keep this data for a period of two years following the study. After that time, I will shred all portions of the study that contain identifying information about the participants. I will keep the group information in hard copy and electronic formats for approximately five years following completion of the study. I plan to report the data in two possible ways: via publication in scholarly journal and/or orally at local, regional, or national meetings.

The OUHSC Institutional Review Board has the authority to inspect consent records and data files to assure compliance with approved procedures.

What Are the Costs?

The Investigator and Department of Rehabilitation Sciences assumes the cost of developing and maintaining the Internet platform for collecting data from you. The only cost that you may incur associated with this study is that related to your use of the Internet from your home. If you have an agreement with an Internet service provider for service less than unlimited access to the Internet, you may incur the cost of the approximately 30 minutes of time on the Internet that it will take you to participate in this study.

Will I Be Paid For Participating in This Study?

You will receive no compensation for this study, other than those mentioned in the "benefits" section above.

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What Are My Rights As a Participant?

Taking part in this study is voluntary. You may choose not to participate. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. If you agree to participate and then decide against it, you can withdraw for any reason and leave the study at any time. You may discontinue your participation at any time without penalty or loss of benefits, to which you are otherwise entitled.

You have the right to access the information that has been collected about you as a part of this research study. However, you may not have access to this information until the entire research study has completely finished and you consent to this temporary restriction.

Whom Do I Call If I have Questions or Problems?

If you have questions, concerns, or complaints about this study contact the Investigator at:

Ken Randall, PI, MHR
Electronic mail address: Ken-randall@ouhsc.edu
Office telephone number: (918) 660-3276 or
Cellular telephone number: (918) 809-2156

If you cannot reach the Investigator or wish to speak to someone other than the investigator, contact:

The OUHSC Director, Office of Human Research Participant Protection at 405-271-2045.

Dr. Shelia Kennison, IRB Chair, at 405-744-1676, 219 Cordell North, Stillwater, Oklahoma, 74078 or at irb@okstate.edu

Signature:

By entering your name and clicking "accept" on this electronic form, you are agreeing to participate in this research study under the conditions described. You have not given up any of your legal rights or released any individual or entity from liability for negligence. You have been given an opportunity to ask questions. You can print a copy of this consent document.

If you agree to participate in this study, please type your name in the space provided, and click on the button labeled "Accept."

Typed Name of Research Participant Date

[Accept]


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Electronic Signature of Person Obtaining
Informed Consent

Ken Randall, PT, MHR

Typed Name of Person Obtaining Date
Informed Consent

If you choose not to participate in this study, please click on the button labeled "Exit
from this Web Site."

[Exit this web site]

IRB Office Version Date: 04/11/08

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Copy of Electronic Mail Letter of Recruitment

Dear Colleagues,

Once again, congratulations on your recent graduation! I hope that this message finds each of you doing well, and settling into your new careers.

As you may recall, I am in the process of completing my doctoral studies, and as such, am conducting a research study that investigates the role of intuition with a new physical therapist's ability to determine a diagnosis. I would like to invite you to consider participating in my study, titled "Intuition and Decision-making in Graduate Physical Therapists." Your participation would be completely voluntary.

The study will take about 20 to 30 minutes, and is achieved completely via the Internet. During that time, participants will take two short assessments and be asked to record their score on the diagnosis section of the National Physical Therapy Examination, as well as reflect their preference for Sensing or Intuition on the Myers-Briggs Personality Type Indicator. They will also complete a brief demographic survey. Participation in this study will be confidential, and reporting of findings will be based on groupings, not individuals.

If you are interested in participating in this study, please go to the following secure web site: <http://www.ouhsc.edu/blackboard/>

Click on the "login" button, which will take you to another window that asks you to enter your username and password. These are the same username and password that you used to access your e:mail when you were a student in our program. This will take you to a page that lists the Intuition and Decision-making in Graduate Therapists as a course to which you have access. Click on this link and you will be taken to the study site, which will talk you through the consent and data collection process.

If you have any questions prior to visiting the web site, or if you encounter any problems doing so, please do not hesitate to contact me at ken-randall@ouhsc.edu or at (918) 660-3276 or (918) 809-2156.

Thank you so much for your consideration to be a part of my study.

Best Regards,

Ken Randall, PT, MHR

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Appendix B: Accumulated Clues Task (Balthazard, 1985)

Adapted with permission from C. Balthazard (personal communication, May 13, 2008)

This timed task involves the solving of word problems. Each of the following lists contains 15 clue words that build on each other to lead to a particular solution word, that which all the words in the list have in common. The object of this task is to identify the solution word and note how many clues it took you to do so. The clues are spaced in such a way that you will need to scroll down the list. Spend no more than 15 seconds on each word, then move on to the next in the list. You have 15 minutes to complete this task.

As you work through each list of clues, there will be a point when you are confident that you have determined the solution word to the problem. Note how many clues it took you to find the solution word, and type the solution word in the box next to it. (For instance, if you determined the solution word after reading the sixth word on the list, write the solution word in the box next to word number six.) It is important that you honestly reflect the number of clues that it took for you to determine the solution word... the fewer the number of clues is not necessarily better.

Following is a sample list, with the solution word typed next to the eighth clue.

Sample:

1. Times
2. Inch
3. Deal
4. Corner
5. Peg
6. Head
7. Foot
8. Dance *Square*
9. Person
10. Town
11. Math
12. Four
13. Block
14. Table
15. Box

At this point, please work through the following 12 lists and type in the solution word in the box that corresponds with the number of clues it took for you to determine it. Again, don't spend more than 15 seconds on each clue word.

List 1

1. Red
2. Nut
3. Bowl
4. Loom
5. Cup
6. Basket
7. Jelly
8. Fresh
9. Cocktail
10. Candy
11. Pie
12. Baking
13. Salad
14. Tree
15. Fly

Solution: Fruit

List 2

1. Hard
2. Fellow
3. Pan
4. Lamp
5. Bug
6. Spring
7. Cover
8. Dream
9. Table
10. Posts
11. Quilt
12. Spread
13. Night
14. Room
15. Soft

Solution: Bed

List 3

1. June
2. Crescent
3. Harvest
4. New
5. Song
6. Man
7. Rise
8. Blue
9. Half
10. Cheese
11. White
12. Quarter
13. Full
14. Shine
15. River

Solution: Moon

List 4

1. Stand
2. Oil
3. Read
4. Work
5. Cord
6. Black
7. Glow
8. Room
9. Soft
10. Dark
11. Chair
12. Floor
13. Study
14. Desk
15. Shade

Solution: Lamp

List 5

1. Head
2. Diamond
3. Sell
4. Nails
5. Edge
6. Muscle
7. Liquor
8. Life
9. Eggs
10. Fall
11. Luck
12. Knock
13. Floor
14. Stone
15. Rock

Solution: Hard

List 6

1. Sheet
2. Man
3. Beauty
4. Box
5. Book
6. Chair
7. Silence
8. Air
9. Score
10. Lover
11. Record
12. Chamber
13. Noise
14. Notes
15. Piano

Solution: Music

List 7

1. Soft
2. Star
3. Color
4. Morning
5. Wave
6. Idea
7. Desk
8. Mood
9. Source
10. Shine
11. Traffic
12. Ceiling
13. Window
14. Bulb
15. Sun

Solution: Light

List 8

1. Feeling
2. Cool
3. Royal
4. Nose
5. Angel
6. Cheer
7. Berries
8. Shy
9. Cross
10. Jeans
11. Lagoon
12. Navy
13. Jay
14. Eyes
15. Water

Solution: Blue

List 9

1. Boots
2. Ball
3. Rise
4. Skirt
5. Wide
6. Scaffold
7. Heels
8. Wind
9. Noon
10. Water
11. Kite
12. Dive
13. Chair
14. School
15. Mountain

Solution: High

List 10

1. Roads
2. Wild
3. Day
4. Water
5. Hand
6. Burlap
7. Weather
8. Cowboy
9. Dry
10. Chap
11. Going
12. Surface
13. Ready
14. Abrasive
15. Smooth

Solution: Rough

List 11

1. Hair
2. Sleeve
3. Hand
4. Cake
5. Stop
6. Time
7. Form
8. Word
9. Circuit
10. Sweet
11. Height
12. Story
13. Cut
14. Skirt
15. Tall

Solution: Short

List 12

1. Stop
2. Coat
3. Room
4. Button
5. Ball
6. Heart
7. Brick
8. Army
9. Crayon
10. Roses
11. Flame
12. Cross
13. Cap
14. Light
15. Wine

Solution: Red

Scoring the Accumulated Clues Task (ACT)

Time allowed to take the task: 15 minutes

(5 seconds per clue x 15 clue words = 75 seconds per list x 12 lists = 900 seconds / 60 = 15 min)

Scoring each list:

- 16 points if the person puts in an incorrect solution
- If correct solution word is provided, the number of points scored = the number on the list (ie: if they came up with the solution on the fifth clue, they get five points)

Scoring for the entire task (the score that would go in the Grade Book):

- Add all points achieved for each list together
- Divide that number by 12
- This is the score for the ACT (minimum = 1, maximum = 16)

Appendix C: Dyads of Triads Task (DOT) (Bowers, Regehr, and Balthazard, 1990)

Used with permission from C. Balthazard (personal communication, May 13, 2008) and G. Regehr (personal communication, April 16, 2008).

This task involves the solving of word problems. Each problem consists of two sets of three words. For each set, one list will have a solution (ie: all three words have something in common), and the other list will not have a solution (ie: there is no distinct connection between the three words). Note that under each set of words is a text box.

Please read each set of three words. Determine which set has a solution, and type the solution word (the word all three have in common) in the text box below that set.

It is possible that you will have a “hunch” about which set has a solution word, even if you are not sure what that solution is. In that case, type an “X” in the box below the set that you believe has the solution, even if the common word does not come to mind.

Here is an example:

A	B
Barrel	Still
Root	Pages
Belly	Music
<i>Beer</i>	

In this case, list A has a solution: All three words have the word “Beer” in common.

Now you are ready to complete the task. Please don’t take more than 30 to 45 seconds for each problem.

Problem 1

A	B
Playing	Still
Credit	Pages
Report	Music
Solution	
Card	

Problem 3

A	B
Deck	Silk
Stool	Cream
Pocket	Even
Solution	
	Smooth

Problem 2

A	B
Beat	Cotton
Barrel	Bathtub
Ball	Tonic
Solution	
	Gin

Problem 4

A	B
Bird	Goat
Pipe	Pass
Road	Green
Solution	
	Mountain

Problem 5

A
Sandwich
Golf
Foot
Club
Solution

B
Hard
Colors
Poke

Problem 10

A
Fountain
Sum
Molasses
Solution
Jack

B
Cracker
Union
Rabbit

Problem 6

A
Sour
Root
Atomic
Solution

B
Falling
Strip
Dust
Star

Problem 11

A
Base
Snow
Dance
Solution
Ball

B
Swan
Army
Mask

Problem 7

A
Bird
Herring
Steam
Solution

B
Salt
Deep
Foam
Sea

Problem 12

A
Bump
Throat
Sum
Solution
Lump

B
Club
Bubble
Broker

Problem 8

A
Stick
Light
Birthday
Solution
Candle

B
Party
Round
Mark

Problem 13

A
Deep
Nose
Wood
Solution

B
Plain
Tarzan
Dick

Jane

Problem 9

A
Quick
Dust
Kilt
Solution

B
Foot
Collection
Out
Stamp

Problem 14

A
Motion
Blue
Bag
Solution

B
Broken
Clear
Eye
Glass

Problem 15

A
 Cookies
 Heart
 Sixteen
 Solution
 Sweet

B
 Fourth
 Belly
 Swimming

Problem 20

A
 Clear
 Roll
 Force
 Solution

B
 Notch
 Flight
 Spin
 Top

Problem 16

A
 House
 Lion
 Butter
 Solution

B
 Magic
 Plush
 Floor
 Carpet

Problem 21

A
 Belt
 Deal
 Nose
 Solution

B
 Thread
 Pine
 Pain
 Needle

Problem 17

A
 Water
 Tobacco
 Stove
 Solution
 Pipe

B
 Sixteen
 Spin
 Tender

Problem 22

A
 Pure
 Blue
 Fall
 Solution
 Water

B
 Magic
 Bark
 Credit

Problem 18

A
 Strike
 Same
 Tennis
 Solution
 Match

B
 Trumpet
 Bathtub
 Grant

Problem 23

A
 Blade
 Witted
 Dreary
 Solution
 Dull

B
 Jolly
 Peg
 Angel

Problem 19

A
 Rabbit
 Cloud
 House
 Solution
 White

B
 Finger
 Speak
 Worm

Problem 24

A
 Love
 Floor
 Pain
 Solution

B
 Colors
 Numbers
 Oil
 Paint

Problem 25

A	B
Cloth	Big
Sad	Hair
Out	Scotch
	Solution
Sack	

Scoring the Dyads of Triads Task (DOT)

Time allowed to take the task: 12 minutes, 30 seconds (30 seconds per problem > 25 problems = 750 seconds = 12.5 minutes)

Scoring each problem:

- 0 points if the wrong dyad is chosen and incorrect solution word
- 1 point if correct dyad is chosen but solution word is incorrect
- 2 points if correct dyad is chosen and solution word is correct

Scoring the entire task:

- The score for the DOT is the sum of points achieved for each problem (minimum = 0, maximum = 5)

VITA

Kenneth Edwin Randall

Candidate for the Degree of

Doctor of Philosophy

Dissertation: PREDICTORS OF INTUITIVE DECISION-MAKING IN GRADUATE PHYSICAL THERAPISTS

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Personal Data:

Ken Randall is an Assistant Professor in the Department of Rehabilitation Sciences, Program in Physical Therapy, at the University of Oklahoma, Tulsa. He is Director of the OU Physical Therapy at Family Medicine Clinic, located in Tulsa, Oklahoma.

Education:

Bachelor of Science in Physical Therapy at Oklahoma University Health Sciences Center, Oklahoma City, Oklahoma, May 1986.

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Title of Study: PREDICTORS OF INTUITIVE DECISION-MAKING IN GRADUATE
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Pages in Study: 107

Candidate for the Degree of Doctor of Philosophy

Major Field: Educational Psychology

Scope and Method of Study: Correlational, structural equation modeling, and analyses of variance of various measures of intuition with age and gender, along with a measure of intuitive decision-making.

Findings and Conclusions: This study revealed significant correlations among the following variables: the *Accumulated Clues Task* (ACT) with the *National Physical Therapy Examination* (NPTE), gender with both the *Dyads of Triads Task* (DOT) and the Sensing-Intuition subscale of the *Myers Briggs Personality Type Indicator* (MBPTI). It determined that a model based on a theory proposed by Dreyfus and Dreyfus (1986) that used three measures of intuition and age along with gender was not significant at predicting intuitive decision-making in graduate physical therapists. It produced varying results on the measures of intuition when examined between genders, with females scoring as more intuitive on one measure (DOT), males higher on another (MBPTI), and no difference between them on the third measure (ACT) or on the measure of intuitive decision making (NPTE). Finally, it determined that the hunches formulated on correct solutions to the DOT did not occur any more frequently than if by chance.

ADVISER'S APPROVAL: Diane Montgomery, PhD
