AN EXPLORATORY CASE STUDY OF LEADERSHIP INFLUENCES ON INNOVATIVE CULTURE: A DESCRIPTIVE STUDY

By

Dale S. Deardorff

A Dissertation Presented in Partial Fulfillment

of the Requirements for the Degree

Doctor of Management in Organizational Leadership

University of Phoenix

January 2005

AN EXPLORATORY CASE STUDY OF LEADERSHIP INFLUENCES

ON INNOVATIVE CULTURE:

A DESCRIPTIVE STUDY

By

Dale S. Deardorff

January 2005

Approved:

FRANK MORELLI, Ph.D., Mentor

MARILYN SIMON, Ph.D., Committee Member

WILLIAM BELLOWS, Ph.D., Committee Member

ANN HERRMANN-NEHDI, Committee Advisor

KAREN STEPHENSON, Ph.D., Committee Advisor

Accepted and Signed:_____
Frank Morelli, Ph.D. Date

Accepted and Signed:_____
Marilyn Simon, Ph.D. Date

Accepted and Signed:_____
William Bellows, Ph.D. Date

_____ _____
Dawn Iwamoto, Ed.D. Date
Dean, School of Advanced Studies
University of Phoenix

ABSTRACT

This qualitative case study research on innovation concentrates on HBDI™ personal thinking preference survey data among leaders described as change agents at PLAY, an innovation and creativity consulting company. The case study explores the extent to which individual thinking preferences impact innovation inside PLAY's social environment. This case study investigates the phenomenon of innovation among 19 members of PLAY from 2002 through 2004. Utilizing the HBDI™ and descriptive research interviews, data gathering, data collection, and data presentation with the PLAY Company members in a case study provides the opportunity to expose a deep and rich study of thinking preferences in an operational innovation culture. Additionally, a initial study of thinking preferences among innovation change agents is collected from a series of structured, disciplined, and research-based series of organizational cultures. Leaders, organization, and change are not complementary concepts and the resistance to change can be translated to a potential resistance to innovation.

DEDICATION

To my son David and my daughter Dean'a, who have always reminded me how to laugh and love life even when this journey seemed never ending.

To my Mom and Dad, who have always accepted me for what I was, never what they thought I should be.

To John Young, who helped me put my vision for innovation into thousands of lines of code, which will be published as the Innovation Cube©.

To all systems thinkers who understand multidimensional thought and lead the way for others to experience and participate creating a positive organizational transformation.

ACKNOWLEDGMENTS

With this research study, there have been many paths in the journey through the dissertation process and completion. Because of several key individuals, the discovery of research has been enjoyable and positive:

To Dr. Frank Morelli, faculty advisor and mentor, who provided guidance, expertise, scholarly advice, encouragement, and friendship at all times.

To Dr. Marilyn Simon, committee member and systems thinker, who understood me from day one and helped me mature my research through the chaos.

To Dr. Bill Bellows, committee member, who constantly asked me the tough questions and never let me compromise my research values.

To Ann Herrmann, committee advisor, who endured tremendous density on my part until I understood the HBDI™.

To Karen Stephenson, committee advisor, who helped create a systems understanding and refine new definitions for *Individuator* and *Mini-Network*.

To Andy and the "gang" at PLAY company who taught me how to *Think about if Harder*.

To Hugh O'Brian, who personally challenged me to learn about my inner passion in leadership and inspired me to follow in his footsteps teaching others how to think—not what to think.

To Dr. Skip Eklund, who was my peer coach for the experience—he taught me how to listen closer when it was needed.

To Kim, Peggy, and Denys, who rounded out the "Killer Bees" and showed UOP that four type-A personalities can create something incredible without self-destruction.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: OVERVIEW

This study is an exploration of the change process as an organizational challenge for leaders$_{a,b}$ who embrace the need to continually innovate. A qualitative study is used to examine how leaders$_a$, or change agents, determine, describe, and use innovation to create novel ideas. These leaders$_a$ are responsible for a "two-way relationship where leaders and followers together achieve success by inspiring one another to set and accomplish both personal goals and a group vision" centered on innovation (H. O'Brian, personal communication, June 12, 2004).

To create a viable study connected to leaders$_a$ requires multiple operational definitions for research clarity. Within this study the word *leader*$_{a,b}$ has two distinct operational definitions. The first definition is a leader$_a$ who is directly linked to the premise of change as a change agent, as previously described. The second definition is a leader$_b$, called a *systems leader*. This definition is used to illustrate the leadership process and is used more globally to describe the leading of purpose, technology, relationships, interactions, teamwork, and community (Scholtes, 1998, pp. 372–373). All leader$_a$ references that are directly linked to the research study participants use the change agent definition.

The phenomenon of innovation is not created with a "silver bullet, a magic pill, or even a well-intended benchmarking trip" (Gundling, 2000, p. 14). Innovation is created by a connection to life-cycle theories of organizations and can be evolved in dynamic stages that contain an order "necessitated both by logic and by the natural order of Western business practices" (Poole, Van de Ven, Dooley, & Holmes, 2000, p. 61).

Innovation and creativity are seen as linkages with "specific advances in knowledge which improves the health and welfare of many in the population" (West & Farr, 1990, p. 3). Innovation "requires an incredible amount of sheer brain power and intellectual smarts. An ability to hold more than one idea in your head at the same time, to understand a contradiction, to listen to many voices" (Kantor, Koa, & Wiersema, 1997, p. 5). The term *creativity* can be based on the construct of "better ways of doing things, insights and new perceptions that at once make sense" (de Bono, 1993, p. xiv). The words *innovation* and *creativity* can be used as synonyms in this study due to their closely associated and interchangeable meanings (West & Farr, p. 3).

Much of the research collection and analyses is constructed from "logic models" (Bickman & Rog, 1998, p. 229) emerging from a descriptive case study. This research concentrates on Herrmann Brain Dominance Instrument (HBDI™) personal thinking preference survey data. HBDI™ is a measurement of individual and organizational thinking preferences separated into four brain quadrants. These brain quadrants are upper cerebral mode and lower limbic mode brain functionality and right-brain and left-brain cognitive preferences.

During the research process, specific and recognizable distinctions may arise, but the general definitions of creativity and innovation are the same (Broadbent, 1987; Nickolson & West, 1988). The way to prevent the nebulous distinction between innovation and creativity is to "juxtapose views from communities" (Ford & Gioia, 1995, pp. xxii–xxiii) that include both terms. This juxtaposed construction avoids the common misinterpretation of the terms *innovation* and *creativity*. Complex organizational problems may require novel ideas generated by repeatable and systemic processes. To

generate these novel ideas requires that leaders[a,b] assemble people into organizations that can "continually innovate, create and even reinvent" (Imparato & Harari, 1994, p. 130) themselves.

The ability to innovate is theoretically constructed on several cognitive levels that include the individual, the process, and the organization. Innovation is a forced proactive act, and the organizational definition of innovation is constructed by where the members exist in their need for new concepts and novel ideas. In addition, the creation of novel ideas requires utilizing diverse sources that can help in pattern "redefining, re-inventing, repositioning, re-thinking and re-forming" (Imparto & Harari, 1994, p. 275) within the organization.

The mind is a special environment that "allows information to organize itself into patterns" (de Bono, 1999a, p. 10). Further, innovation is dependent on a "system of patterns" (Oshry, 1996, pp. 2–5) and relationships among the organizational members. Hughes (2002) proposed that "creative leadership must facilitate positive relationships in organizations to produce profitable growth through innovation" (p. 12).

Innovation can become a deliberate result or offshoot of conflict (G. Morgan, 1998). This conflict can exist at an individual or organizational level inspired by a perceived need or search for something novel and different. Innovation may be characterized by the concept of novelty. Novelty is described as "useful, practically, aesthetically, theoretically" or, in general terms adaptive (Stein, 1974, p. 6), which makes it central to all proposed definitions of creativity. Novelty can be achieved by various methods including "trial and error, serendipity and problem solving: and it can be

regarded as the measure of the distance between that which is developed and that which existed" (Stein, p. 6).

Problem Statement

Innovation has been one of the most critical issues facing organizations today. Innovation and the creation of novel ideas are "critical to the development of new products which will allow companies to grow rapidly and maintain high margins" (Hippel, Thomke, & Sonnack, 2001, p. 31). Examples of this can be broken into three types: "innovation in market domains of existing business units, innovation connected to the 'white spaces' between a firm's existing business and innovation outside a firm's current strategic context" (Leifer et al., 2000, pp. 6–7).

Leaders$_{a,b}$ could benefit from a comprehensive and interconnected process for innovation and its components, which comprise individual thinking preference, social context, and the processes used to create novel ideas. Current leadership and organizational measurements available for analyzing innovation tend to concentrate on the individual person rather than the organization and social environment or a balanced mixture of all components. Ford and Gioia (1995, p. 21) stated that research on innovation has attempted to "identify personal characteristics of individuals that lead them to creative productivity." Amabile's (1983, 1988) research stressed the social setting and individual interaction as the major influence for innovation.

Sheil (2004) added that when looking at the individual's contribution to innovation, the connection between thinking preference or thinking styles that "affect human cognition and behaviors" (p. 13) and innovation are not understood. This lack of understanding is compounded by the confusion between the terms *creativity* and

innovation, which can mean different things to different people. Resolution of this issue requires a strong descriptive research strategy that can capture and analyze the multidimensional features of a current organization that specializes in innovation.

Background and Rationale for the Study

One of the critical requirements of current organizations may be the need to foster and adapt to innovation and change. "Social and economic change that started in the middle of this century is not subsiding; it is accelerating and spreading" (Imparato & Harari, 1994, p. xii). M. Kirton who developed the Kirton Adaptation Innovation Tool (KAI©), passionately stated that innovation broken down into its basic concept is nothing more than "change" (M. Kirton, personal communication, October 19, 2001). Kirton's premise is that "innovation is not an alternative to (or synonomous with) creativity but one pole of the style exhibited within its operation" (M. Kirton, personal communication, October 19, 2001). Change is a process of incremental or deep "transformation" from one mindset to another (O'Toole, 1996, p. 158). This basics approach to change can be interpreted as positive, negative, or both by organizational members. "Most organizations are inclined to be particularly resistant to change in their style and manner of operations (what system theorists call homeorhesis)" (Bergquist, 1993, p. 201). This resistance to change can be translated to a potential resistance to innovation.

Leaders$_a$, organization, and change are not "complementary concepts" (Quinn, 1996, p. 5). Change creates complex "life cycle models which contain incompleteness" (Poole et al., 2000, pp. 71–72). This incompleteness is based on both internal and external expectations, which can create predictable behavior by the inadvertent use of "group think" (Syer & Connolly, 1996, p. 374). Group think can create a mentality

among its members for acceptance of things that have changed in the past, but without recognizing that "change is constant" (Hesselbein, Goldsmith, & Beckhard, 1997, p. 87).

There are numerous examples in which changes were not made because the organization underwent a previous change and "everyone resists change—particularly the people who have to do the most changing" (O'Toole, 1996, p. 13). An example would be a situation in which someone with a fresh viewpoint starts interacting with the organization. A widely used example is when a pizza delivery boy is asked to stay and interact with the group to create a fresh new idea. It may be easier for an individual outside the organization to see that a new change or additional change needs to take place. By living inside the organization, people may be clouding the ability for leaders[a,b] and individuals to see the need for reframing change, thereby forcing a "dated or truncated vision" (Bollman & Deal, 1997, p. 5).

In the corporation of the future, new leaders[a,b] "will not be masters, but maestros. . . . The leadership task will be to anticipate signs of change, inspire creativity, and get the best ideas from everybody" (J. Welch & N. Herrmann, personal conversation between each other at General Electric, 1975, personal communication from A. Herrmann, June, 2004). This need for new ideas and visions from individuals inside current organizations requires the use of psychometric instruments such as HBDI™, which can "define issues of innovation" (Herrmann, p. xvii).

Two other psychometric measurement tools exist (FIRO-B, 16PF5), but have severe limitations for the measurement of multidimensional characteristics of innovation. FIRO-B is used for team building, determining leadership styles, and management development. The 16PF5 is used to objectively determine personality compatibility

within an organizational culture, but only provides input on introvert versus extrovert types of variables.

The KAI© instrument measures individual styles of problem definition and solution referenced to an adaptive, building, or analogical problem-solving style versus an innovative style. It measures the individual's ability to react to change (M. Kirton, personal communication, June 12, 2001). The Myers-Briggs Type Indicator (MBTI) instrument measures attitudes or orientations of individuals in extraversion–introversion and judging–perceiving. Additionally, it measures four functions of sensing–intuition and thinking–feeling, which are modeled into 16 distinct personality types (Michael, 2003).

Both the KAI© and MBTI instruments have limitations for measuring innovation due to their abstract definition of innovation referenced against the individual and the organizational environment. One generally accepted characteristic of innovation is that "creativity is well within the reach of anyone" (Herrmann, 1995, p. xvii) if that person is willing to recognize his or her thinking preferences and "apply this knowledge for self-development" (Coetzee & de Boer, 2000, p. 2). Thinking preferences are individual characteristics that are neither good nor bad; they are "assets or liabilities depending on the situation" (Coetzee and de Boer, p. 3).

A thinking preference is a mixture of right-brain and left-brain cognitive processing that determines how individuals interpret the world around them. This interpretation is based on their dominant thinking style, which controls how individuals react to problems and opportunities, experience situations, and behave and determines what leadership style individuals will embrace. Roger Sperry's human split-brain research in the 1960s led to a general understanding and acceptance that "the left and

right hemispheres are specialized" (Herrmann, 1995, p. 27) with "wiring patterns" (Gazzaniga, 1998, pp. 43–45).

This brings into practical focus the recognition of brain dominance and thinking preferences, which have a "bi-polar dimension" (Herrmann, 1995, p. 349). Kirton proposed the existence of an independent personality dimension in which "adaption and innovation represent polar extremes" in terms of thinking preference approaches (Skinner, Jillian, & Drake, 2003, p. 101). Personality dimension contributes to behavioral actions and thinking preferences seen as opposites, such as *introvert* (look within for information) versus *extrovert* (look outside), as measured by the MBTI (Herrmann, pp. 349–350).

Personality dimension measurements of MBTI results show that there is a "recognizable difference" (Herrmann, 1995, p. 350) between numerical mean scores of men (5.4) and woman (5.7) on the introversion versus extroversion scale of 1–9, where 1 is scored low and 9 is scored high. This mathematical expression is meant to show that there is a recognizable pattern to the differences in dimensions of personality. When assembling or building a team, its natural formation is a mixture of both introverts and extroverts.

Requests for increasing efficiency, competitive advantage, and flexibility within organizations lead to the use of "teams of people to do tasks that previously would have been assigned to individuals" (Nibler & Harris, 2003, p. 613). These teams can be seen as collections of right-brain and left-brain, introverts and extroverts, men and woman tasked with developing innovation using "group effectiveness" (Nibler & Harris, p. 614).

Organizations that have capitalized on the positive characteristics of group effectiveness have created a culture that supports the core environment characteristics of "being playful" (Myerson, 2001, p. 10). The "largest and probably the most innovative product design firm," as described by Ted Koppel from ABC News, is a company called IDEO (as cited in Myerson, p. 1). As a recognized benchmark in innovation, IDEO's founder and chief executive officer (CEO) David Kelley described the innovation environment as one that will "ask for forgiveness, rather than asking for permission" (as cited in Myerson, p. 40).

Two hundred years ago, political philosopher Edmund Burke argued that centralized power would always lead to "bureaucratic procedure that ultimately stifles innovation" (as cited in Handy, 1998, p. 37). Leaders$_{a,b}$ who use innovation to explore "possibility thinking" (de Bono, 1994**,** p. 23) around cultural vision, missions, and goals may be more successful. Translating this movement away from adversarial encounters means that the organizational members can explore the process of consensus and mutual ownership, ultimately moving organizations and their members toward a positive "organizational transformation" (Flamaholtz & Randle, 1998; Galliers & Baets, 1998; Nadler, Shaw, & Walton, 1998; Senge, 1999). The next section better describes the purpose of the research study and the relevant innovation variables.

Purpose of Study

The purpose of this qualitative case study is to explore the extent to which individual thinking preferences impact innovation inside the PLAY Company's social environment. As a deeper clarification of multidimensional innovation evolves through descriptive research, leader$_a$ will benefit by being able to understand the importance of

"thinking preferences" (Leonard & Straus, 1997b, pp. 111–112) measured by the HBDI™ that espouses the concept of "whole brain technology" (Sheil, 2004, p. 6).

A initial study of thinking preferences among innovation "change agents" (Ulrich, 1997) was collected from a structured, disciplined, and research-based series of organizational cultures. The results of this innovation case study can lead to a new understanding of the leadership constructs developed by the interaction of the individual inside the social and physical environment called "culture" (Sternberg, 1999, p. 339).

This culture can be described by the use of a descriptive "etic" perspective (Gall, Bog, & Gall, 1996, pp. 617–618), which should prevent the collection of research that is understandable only with PLAY Company mental models. This case study is collectively measured by the interconnections between the thinking preferences of the PLAY Company individuals, a collective thinking preference, and the social characteristics of the PLAY Company.

Significance of the Study

The significance of this descriptive case study is based on the unique inquiry exposed by the PLAY Company that provides a clear and valid view of the individuals, organization, and social culture required that specializes in innovation and change for leaders$_a$. Utilizing the HBDI™ with the PLAY Company in a case study provides the opportunity to expose a deep and rich study of thinking preferences in an operational innovation culture.

The term *innovation* is connected to change, creativity, and processes without a bounded understanding of what each feature or facet of the terms represent. This study

will lead to the creation of a new clear definition and cognitive model to describe innovation.

"Leaders of established companies acknowledge that radical innovation is critical to their long-term growth and renewal" (Leifer et al., 2000, p. 1). This study aims to contribute to the existing body of literature for change agents and leaders$_{a,b}$ as they search for an understanding of innovation and its influences on people, processes, and organizations "to frame their company's needs in the context of innovation" (Kelly & Littman, 2001, p. 3).

Significance of the Study to Leadership

The study of innovation is critical to the field of leadership and aligns "change-centered" research to the degree of doctor of management in organizational leadership (Quinn, 1996). This research addresses the necessity for the re-creation of "paradigms, myths, scripts, or frameworks" (Quinn, p. 46), which can define new action paths that successfully realign leaders$_{a,b}$ and change agents (Ulrich, 1997). The innovation and change research field can contribute to a new understanding from a leadership perspective because there is a need to "actively attend to the management of ideas" (West & Farr, 1990, p. 29).

The management of ideas establishes the need for "understanding that 'innovation and creativity, enterprises and entrepreneurship' are vogue words for the millennium" (Handy, 1999, p. 11). These new ideas can lead to new business markets, designs, and organizational knowledge that can "enhance the revenue side of the equation" (Imparato & Harari, 1994, p. 92).

Within the current understanding of *leadership in change* exists many new practical awarenesses of communication creating collaboration and synergies. These awarenesses can move organizations into a positive *organizational transformation* (Flamholtz & Randle, 1998; Galliers & Baets, 1998; Nadler, Shaw, & Walton, 1998; Senge, 1999). Specific studies and instruments used for research quantification are included in chapter 2.

Research Design Statement

This study employs two qualitative research components. The first research method is a initial study using HBDI™. The data from this initial study are analyzed with the HBDI™ grading software. The results of the data are translated into a graphical four-quadrant "whole brain" model plot (Herrmann, 1995). The initial inquiry population contains 151 participants from different organizations in the United States, England, and Canada. These research members have defined themselves as innovation change agents (Urlich, 1997) by agreeing to the research contract that they regularly create innovative ideas. To meet this criterion, they regularly participate in or interact with innovation. This continuous familiarity with innovation characterizes these members as the "few key people who can profoundly influence its success" (Christensen & Overdorf, 2001, p. 111).

The second component to the research is a micro descriptive research approach for the PLAY case study (Gall et al., 1996, p. 611). PLAY is an innovation and creativity consulting company that employs highly knowledgeable representatives who have been trained in the PLAY "Creative Collective Consciousness" (PLAY, 2003, pp. 6–8). This homegrown innovation process specializes in the "creation and leading of change"

(PLAY advertising handout, n.d.). The PLAY participants should provide a concentrated level of knowledge, interaction, and experience in change and innovation. These representatives are creative coaches for customers and subcontractors using the PLAY Company resources.

This case study investigates the phenomenon of innovation among 19 members of PLAY, a consulting company in Richmond, Virginia. The use of the HBDI™ in conjunction with interviews provides a view into the complex understanding of the organizational culture from an individual and composite perspective.

The research method could have utilized a quantitative, qualitative, or mixed-method design. Most quantitative methods contain "classical and modern measurement theories" such as Crocker and Algina (1986) and Cronbach (1990) that concentrate on statistical analysis and search for statistical patterns rather than organizational dynamics of change. A mixed-method research design was not selected due to the complexity of mixing multidimensional theory with multiple-inquiry methods. Yin, Maxwell, and Fetterman (as cited in Bickman & Rog, 1997) indicated the importance of triangulating methods in qualitative research. Qualitative research on innovation could be designed using grounded theory, phenomenology, or case study methods.

Grounded theory was dismissed due to the ultimate goal of "fracturing" the coded data and thereupon looking for differences in categories not creating "counts" (Bickman & Rog, 1997, p. 89). The HBDI™ data are ultimately plotted into a whole brain (Herrmann, 1995) mapping, which is based on creating counts (Bickman & Rog). Innovation in organizations and individuals can be recognized through a phenomenological research approach that concentrates on "how reality appears to people,

rather than the objective nature of reality" (Gall et al., 1996, p. 606). This "phenomenological approach" discounts the collective synergy of the collective group in a social setting" (Gall et al., pp. 606–607).

The case study process allows the exposure of the phenomenon of innovation with the use of a triangulation. Triangulation research was originated to capture the intense study of characteristics, patterns, and an etic (Gall et al., 1996, pp. 617–618) perspective of the members of a culture, which can be translated into relevant research questions. This multilevel inquiry may require an "applied researcher" (Bickman & Rog, 1997, p. xiv) experienced in a variety of disciplines. The disciplines used are innovation, psychology, and social archeology. Figure 1 illustrates the research framework for a qualitative case study that has a descriptive method for data collection, analysis, and handling.

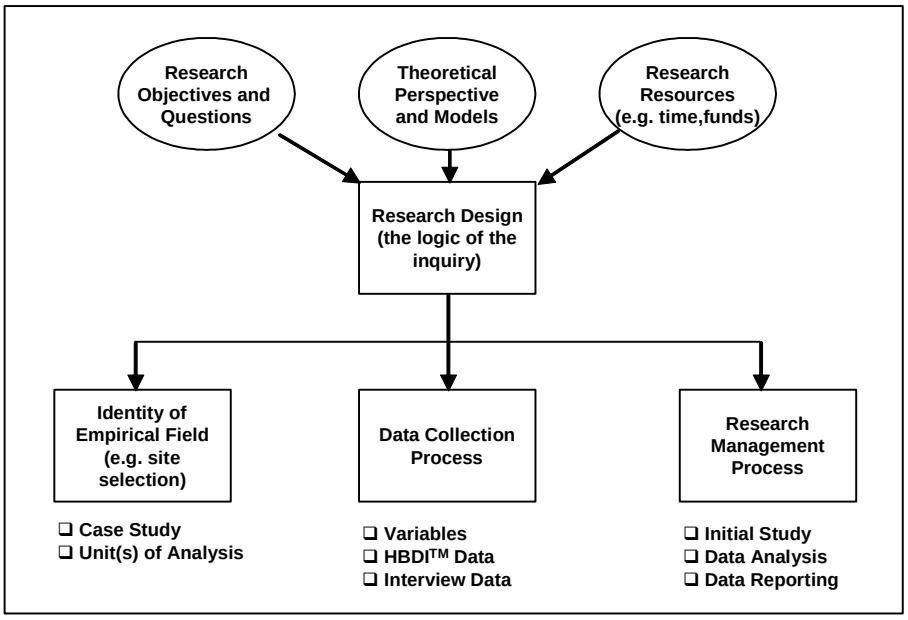


Figure 1. Qualitative case study research roadmap.

As seen in the case study research roadmap, a flow of research components connect together to form the method for establishing the research design and questions. The next section sets forth the research questions that guided the direction for the study.

Research Questions

Research questions serve two purposes for this inquiry. The first is to focus the study by showing the relationship of the research questions to the study's purpose and conceptual context (Bickman & Rog, 1998). The second purpose is to guide the researcher in how to conduct a qualitative study by revealing the relationships to study methods and validity (Bickman & Rog, 1998). In the development of a initial study and case study on innovation, three research questions were examined:

Research Question 1: How do change agents use different thinking preferences to measure innovation?

Research Question 2: How do change agents use different thinking preferences to measure an innovation culture?

Research Question 3: How do psychometric instruments measure innovation?

The following section describes the nature of the study and presents a view of the research design and the rationale for the appropriateness of the research method. It better identifies why the method has accomplished the study objectives.

Nature of the Study

This study is a qualitative initial study and case study that examines how leaders$_a$ determine innovation, describe innovation, and use innovation to create novel ideas. The research employs two methods to accurately describe innovation.

The HBDI™ was selected for this research into innovation because of its ability to better identify the research participants' thinking preferences. Other tools were researched and not chosen due to limitations in mapping exactly which location represented innovation in the cognitive brain model (Sperry & Sperry, 1982). This is elucidated in chapter 2. The initial study research population contains 151 HBDI™ participants, who were self-declared as innovation change agents from high-technology companies throughout the United States, England, and Canada.

The HBDI™ data provide a four-quadrant brain mapping of two modes of data. HBDI™ data can provide an individual and group representation of right-brain, left-brain mode and upper and lower brain mode for thinking preferences in a four-quadrant model. This data can be measured against 25 years of previously collected measurements from individuals and organizations around the world (Herrmann, 1995, 1996).

The next feature of the research is a case study from the 19-member innovation consulting company PLAY. The members participated in the research through the use of HBDI™ and a series of interview questions related to the applicability of HBDI™ to accurately measure innovation in the individual or organization.

A descriptive research method allows for a "the full range of qualitative data-collection techiques" (Gall et al., 1996, p. 613). Illustations and sketches from the PLAY Company in combination with interviews and communications with organizational members were collected and analyzed to provide cultural significance. The PLAY consulting company training and method for innovation was personally experienced by the researcher to provide insights into the company's innovation processes.

Additionally, the researcher partnered with the PLAY Company through multiple research interventions with the organizational members for 3 years from 2001 to 2004 to recognize, measure, and describe the evolving nature of the social culture as the group members increased and decreased in a case study report. The case study report documents the PLAY Company's methodological process from a "theoretical and evidentiary" (Bickman & Rog, 1997, p. 258) perspective.

Analytic reporting of the descriptive case study HBDI™ interview findings provides common themes and trends in the inquiry data, which can be coded from the transcribed interviews. This qualitative research approach allowed the researcher to "investigate the complex phenomenon known as culture" (Gall et al., 1996, p. 617). The research design, data collection, data analysis, data presentation, findings, and conclusions are fully described in chapter 3. The following section describes the conceptual and theoretical framework required to accurately clarify important issues, perspectives, and controversies in the field of innovation.

Conceptual Framework

The proposed research is generally presented using a postmodern constructed view of innovation inquiry as presented by Sternberg (1999) and West and Farr (1990). The term *postmodern* indicates that the majority of the research is conducted after the mid-1970s, when the crystallization of this "diversely social and cultural phenomenon began" (Connor, 1989, p. 6).

Individuals and organizations are required to formulate or create novel ideas to be considered innovative. Regardless of how original the concepts and theoretical ideas are, "only with methods in mind" (Poole et al., 2000, p. 3) can the social group generate

precise, meaningful conceptual models. These concepts are created as a syntactic or structural representation and they are individually constructed by the natural use of filters, “paradigms” (Kuhn, 1996), and “mental models” (Senge, 1999). Utilization of systemic innovation processes can possibly assist any individual, in any environment, to create a higher level of success, which can be measured as novel ideas.

Opposing views to syntactic or structural representation are presented by Stein (1974) and Amabile (1983, 1988). Stein argued that systemic and process-based approaches such as that of de Bono (1999b) were not empirically arguable as more successful than nonsystemic and process innovation approaches. The use of serendipity (Stein) was proposed as being just as constructive as any other method in certain situations. This opinion seems to be removed in current publications because of the inability to repeat serendipity versus the replicable process and systemic-based innovation models (de Bono, 1993).

Amabile’s (1983, 1986) approach was that the group structure and organizational culture for reward and fear are significant contributors or major drivers to the innovation and creativity process and the ability to be successful. Innovation is typically seen as a “social process” (West & Farr, 1990, p. 11) concentrating on events that happen between people, but creativity is also seen as an “individual cognitive process” (West & Farr, p. 11) contained within the person. Individual thinking preferences are seldom considered in this cognitive process. This may mean that special consideration may be made to create a stable culture of innovation when organizations need to produce “constructive change” (Poole et al., 2000, p. 68).

Another conceptual theory about innovation and creativity came during the middle of the 20th century when Guilford's (1950) structure-of-intelligence model proposed that there are three basic dimensions of intelligence. This psychometric interest in creativity was argued against by Cattell (1971) as "overrating the role of divergent thinking in creativity." The emergence of what Rand called "psycho-epistemology" (as cited in Ford & Gioia, 1995, p. 117) differentiates the creative from the uncreative person if both possess the same intelligence and knowledge. Guilford's theories merged with that of Russell Ackoff to propose that "the uncreative person memorizes facts; the creative person constantly tries to make connections between the facts, including those not obviously related" (Ford & Gioia, 1995, p. 117).

de Bono's *Lateral Thinking* (1999a) presented the methods and use of tools that explore the theory of breaking out of traditional pattern-building models and moving toward new alternatives or novel ideas. The next section provides clarification for certain variables, words, or phrases used throughout the research study.

Definition of Terms

The premise of defining terms is to create a grounded, common understanding of the linguistic usage in research to assist the reader in better understanding the research theory. This glossary includes direct, technical terms that may look ordinary or seem like jargon but in this research on innovation are used in a specific and precise way. The terms are broken into three distinct categories related to the research: innovation terms, psychological and psychometric terms, and organizational terms.

Innovation Terms

Adaption. Use of familiar and clearly articulated techniques and strategies (Skinner et al., 2003, p. 101).

Adoption. A decision to make full use of an innovation as the best course of action available (Rogers, 1995).

Algorithmic Innovation. A series of steps or procedures to follow to reach a solution or a problem. These steps or procedures do not generate solutions of themselves; instead they lead the individual to situations conducive to the discovery of solution concepts, such as the theory of Russian innovation (TRIZ) and the unified structured innovative thinking (USIT) methods (Sickafus, 1999, p. 477).

Heuristic Innovation. Innovation that follows right-brain associations created from new solution paths, such as lateral and parallel thinking methods (Plsek, 1997).

Idea Generation. The starting point for both incremental and radical forms of innovation (Leifer et al., 2000, p. 5).

Incremental Innovation. Emphasizes cost or features improvements in existing products or services and is dependent on exploitation rather than exploration competencies (Leifer et al., 2000, p. 5).

Innovate. The process of bringing something new to an environment measurable through a five-level novelty scale (WordNet 1.6, 1997).

Innovation. An idea, practice, or object that is perceived as new by an individual or other unit of adoption (Rogers, 1995).

Innovation Culture. An environment in which creative energies effect lasting changes in organizational arraignments (West & Farr, 1990, p. 193).

Novel Ideas. Containing one or more distinctive characteristics and some form of utility—usefulness, appropriateness, or social value (Sternberg, 1999, p. 450).

Process Innovation. A sequence of steps designed to achieve a goal, creating something unique and observable such as a novel idea (E. Maher, personal communication, May 15, 2002).

Radical Innovation. Concerns the development of new businesses or product lines, based on new ideas or technologies or substantial cost reductions that transform the economics of a business (Leifer et al., 2000, p. 5).

Psychological and Psychometric Terms

Behavioral Measurement. The extent, size, capacity, amount of time, or quality ascertained applied to actions considered from the standpoint of morality and ethics (*Webster's Revised Unabridged Dictionary*, 1998).

Cerebral Modes. The "processing center where most intellectual, spatial, mathematical activity and decoding of sensory data takes place" (Knisbacher, 1999, p. 55).

D-quadrant. Characterized as representing the HBDI™ upper-right quadrant of individuals who typically thrive on new ideas, possibilities, [and] incongruities and are often considered visionary and holistic by others. They are largely nonverbal, imaginative, colorful, artistic, fanciful individuals, preferring metaphors and pictures. They favor original nonlinear thinking, resist structure, and are often impersonal, choosing to focus on internal processes. (Bentley, 2000, p. 28).

HBDI™. Herrmann Brain Dominance Instrument (Herrmann, 1996, p. 7).

Jungian. The type of conceptual study that relates to a personality topology of psychological dichotomies of behavior, also referred to as Jungarian (Jung, 1990).

Left-Brain. Brain processing that is analytic, sequential, verbal, and temporal (Knisbacher, 1999, p. 53).

Limbic Modes. The "seat of the nervous system and emotion which regulates incoming data sense perception, memory and directs data to the appropriate areas of the brain" (Knisbacher, 1999, p. 55).

Multidimensional. Having, involving, or marked by several dimensions or aspects (*Webster's Revised Unabridged Dictionary*, 1998).

Paradigm. A set of commonly held values or beliefs that serve as a model for behavior within a particular school of thought (leadership, research, organization, community, or culture) and that define a theoretical, testable framework (Kuhn, 1996).

Physiological Measurement. The extent, size, capacity, amount of time, or quality ascertained pertaining or relating to the science of the functions of living organisms, such as physiological botany or chemistry (*Webster's Revised Unabridged Dictionary*, 1998).

Psychometric. The art of measuring mental processes or determining the time relations of mental phenomena dimensions and emotions (*Webster's Revised Unabridged Dictionary*, 1998).

Right-Brain. Brain processing that is holistic, spatial, and simultaneous (Knisbacher, 1999, p. 53).

Thinking Style. The "individual brain dominance, left versus right and Cerebral versus Limbic modes of processing" (Knisbacher, 1999, p. 17).

Organizational Terms

Change Agent. Individuals who serve as leaders$_a$ or catalysts for change, facilitators of change, and designers of systems for change (Ulrich, 1997).

Community of Practice. Collective learning that results in practices that reflect both the pursuit of enterprises and the attendant social relations. These practices are then the property of a kind of community created over time by the sustained pursuit of a shared enterprise (Wenger, 1999, p. 45).

Connected. The physical embodiment or flow of energy (verbal), information, or influence (Checkland, 1999, p. 313).

Constructive Change. Generates unprecedented, novel forms that, in retrospect, are discontinuous and unpredictable departures from the past (Poole et al., 2000, p. 68).

Culture. The accumulated shared learning of a given community, covering behavioral, emotional, and cognitive elements of the group members' total psychological functioning (Schein, 1992, p. 10).

Diversity. Human qualities that are different from one's own and outside the groups to which one belongs, yet are present in other individuals and groups distinguished between primary and secondary dimensions of diversity (Diversity at UMCP: Moving Towards Community Plan, 1995).

Diversity of Thought. Idiosyncratic association that leads to countless numbers of different trains of thought (Eisbach, 2001, p. 15).

Flexibility of Thought. The individual's ability to cognitively adapt a syntactic structural representation with an appropriate semantic (*Stanford Encyclopedia of Philosophy, 2004*).

Group Effectiveness. The accuracy of a group's decision relative to a correct solution (Nibler & Harris, 2003, p. 614).

Group Think. The phenomenon of groups desperately clinging to a failed strategy (Syer & Connolly, 1996, p. 374).

Heterogeneous. A collection or group of individuals who have different abilities (Stein, 1974, p. 158).

Homogeneous. A collection or group of individuals who have the same abilities (Stein, 1974, p. 158).

Interconnected. An interwoven connection reciprocally linked at a micro-macro level creating a higher mastery of meaning (McKay, 1998, pp. 77–85).

Intervention. Collaborative dialogue between employees, supervisors, managers, and researchers to identify organizational problems and design ways of alleviating them (Parkes & Sparkes, 1998).

Leader$_a$ (i.e., *Change Agent*). Selected or self-selected to fulfill the fate of the organization and highly constrained by organizational and external factors (Bass, 1990).

Leader$_b$ (i.e., *System Leader*). Leader of purpose, technology, relationships, teamwork, and community (Scholtes, 1998, pp. 372–373).

Leadership. A two-way relationship in which leaders$_{a,b}$ and followers together achieve success by motivating one another to set and accomplish both personal goals and a group vision (O'Brian, 1990, p. 4).

Mental Model. Deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world and how we take action (Senge, 1999).

Organizational Transformation. Learning and thinking that creates the multidisciplinary capacity for incremental or discontinuous change that helps produce organizational metamorphosis, strategies, and structures built upon inner shifts in peoples beliefs, values, aspirations and patterns of behavior. (Flamholtz & Randle, 1998; Galliers & Baets, 1998; Nadler, Shaw, & Walton, 1998, Senge, 1999).

Outbrief. Act or instance of giving precise instructions or essential information at the conclusion of an event (USAF Captain C. Hague, personal communication, June 14, 2004).

Primary Diversity Dimensions. Dimensions of age, ethnicity, gender, physical abilities and qualities, race, and sexual orientation (Diversity at UMCP: Moving Towards Community Plan, 1995).

Secondary Diversity Dimensions. Dimensions that can be changed and include, but are not limited to, educational background, geographical location, income, marital status, military experience, parental status, religious beliefs, and work experience (Diversity at UMCP: Moving Towards Community Plan, 1995).

Social System. A set of interrelated units engaged in joint problem solving to accomplish a common goal (Rogers, 1995).

Systemic. A whole whose essential properties, its defining functions, are not shared by any of its parts (Ackoff, 1999a, p. 8).

Whole Brain. A model that provides a useful and valid basis for determining thinking-style preferences lacking a location-specific, precise physiological construct (Herrmann, 1996, p. 18).

The above terms provide an operational description of specific words. If a word was used out of the context of the definition of terms, it was identified as being "used in the ordinary way." The following section sets forth the scope of the study, as well as the compromises that may have induced limitations to the study outside the researcher's control.

Scope, Delimitations, and Limitations of the Study

The scope of this study utilizes change agents and leaders$_a$ in a HBDI^{TM} initial study and a case study at PLAY in Richmond, Virginia. The HBDI^{TM} population of the initial study is 151 members from high technology companies in the United States, Canada, and England. The case study contains 19 members of the PLAY organization. As the organization grows or shrinks, the number of research participants evolves with it. After a 2-year research period (2001–2003), the PLAY organization had downsized to 12 original members, including the primary leadership owner who participated in the interview questions. This research is constructed from a combination of HBDI^{TM} profiles and interview responses searching for how the PLAY organization reacts to the premise of innovation in a case study. The interview responses are a connected representation of the constructed reality via PLAY "organizational frames" (Bollman & Deal, 1997, p. 17), PLAY "old paradigms" (Kuhn, 1996, pp. 84–85), and PLAY "mental models" (Senge, 1990, pp. 6–7).

As described previously, change agents and individuals that produce innovation regularly may be perceived to be a different population from the general organizational population. To locate and create a research study that better separates the

multidimensional characteristics of innovation required a separate PLAY case study research group.

This research from the PLAY organization requires a 100% HBDI™ sampling from that population, as it evolved and gained and lost members over time. These HBDI™ research data are compared to the initial study HBDI™ research group. The PLAY collected data should be more valid and efficient because of a higher level of tacit and explicit "domain knowledge" (Sternberg, 1999, p. 409) derived from constant interaction in change and innovation.

Summary

Complex organizational problems may require novel ideas generated by replicable and systematic processes. To create these ideas requires the ability to assemble individuals and organizations that can innovate. Innovation is multidimensional, and this study explores personal HBDI™ thinking preferences in current organizations striving for innovation. According to Drucker, successful change agents should use "systemic innovation" (Drucker, 1985, p. 31), which will ultimately lead to better thinking.

This process of better thinking for innovation can be accomplished with the use of a systemic process such as the PLAY Creative Collective Consciousness, divergent thinking, parallel thinking, and the theory of Russian innovation (Sternberg, 1999, pp. 313–316). Maslow (1963) stated, "It is not the outcome of the process that counts, but the process itself" (as cited in Sternberg, pp. 313–314). The leadership premise of organizational change requires a new direction for individuals and groups to "create thinking in order to stimulate seeing things from different points of view" (Sternberg, p. 5).

CHAPTER 2: LITERATURE REVIEW

This chapter explores the complex and multidimensional aspect of innovation theory by introducing and exploring the three primary elements of innovation: the individual, the group, and organizational theory. This chapter also examines the literature on thinking preferences that served as the foundation for this study. This chapter examines the foundation and development of the HBDI™ from its historical linkage and construction to circumplex models to the present. Finally, this chapter develops the social science of innovation, which describes new avenues of awareness in innovation for organizations. Figure 2 describes the literature review research as a framework for how the elements flow together.

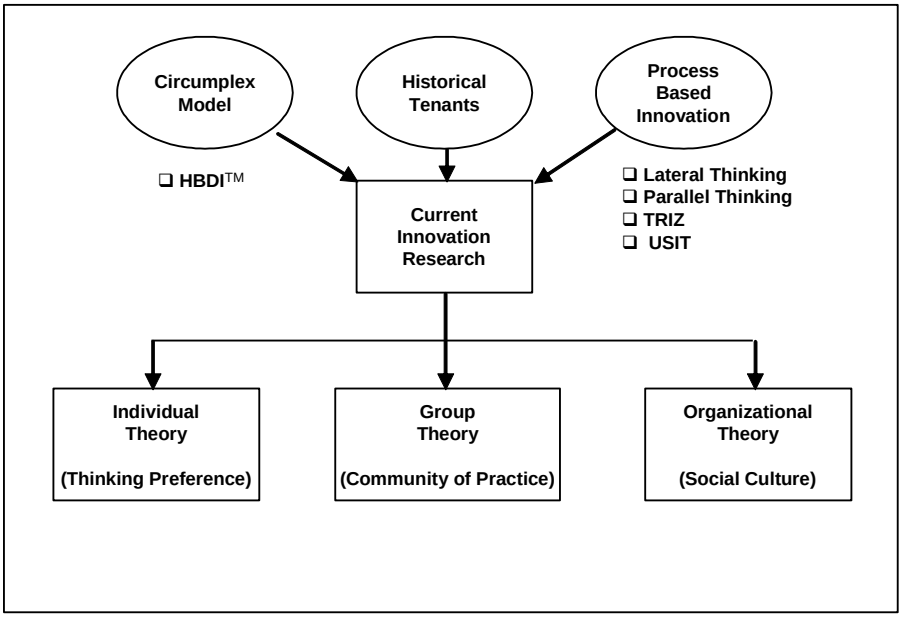


Figure 2. Literature review research roadmap.

Among the previous postmodern studies (Bergquist, 1993; Borgmann, 1993) are findings in the area of innovation that have narrowly and consistently focused on separations of reality and normal science paradigms (Kuhn, 1996). Current organizations are requested to become more innovative by their stakeholders to be successful.

Descriptions of current organizational innovation fall into business categories such as the following:

1. *Creating new market space*. Home Depot revolutionized the do-it-yourself market in North America by "becoming a 24 billion dollar business, creating over 130,000 new jobs in more than 660 stores" (Kim & Mauborgne, HBR, 2001, p. 4).
2. *Knowing a winning idea when you see it*. Southwest Airlines recognized that the largest group of potential customers (economy class) was purchasing ticket seats on average for $400.00, Southwest successfully changed pricing to "about $60.00 for the cost of going the same distance by car" (Kim & Mauborgne, HBR, 2001, pp. 89–90).
3. *Learning from lead users*. The 3M internal innovation process is utilized by Sony to develop a Web site to support hackers interested in exploring and developing new types of games that can be played on the Sony PlayStation platform. "It quickly attracted 10,000 participants" (Von Hipple, Thomke & Sonnack, HBR, 2001, p. 53) mobilized as pseudo in-house software developers.
4. *Challenges of disruptive change*. Cisco Systems' acquisition process has concentrated on small companies that were less than 2 years old in the early stages of market value primarily comprised of people resources. Cisco "plugged those resources into its own effective development, logistics, manufacturing and marketing processes" (Christense & Overdorf, HBR, 2001, p. 123).

5. *Discovering new points of differentiation*. Blyth Industries analyzed customers' experiences and options to "grow from a $2 million U.S. candle manufacturer into a global candle and accessory business with nearly $500 million in sales and a market value of $1.2 billion" (MacMillian & McGrath, HBR, 2001, pp. 131–132).
6. *Enlightened experimentation*. Systematic testing of new ideas allows companies to "create and refine their products" (Thomke, HBR, 2001, p. 180). "New technologies such as computer simulation, rapid prototyping, and combinatorial chemistry allow companies to create more learning more rapidly, and that knowledge, in turn, can be incorporated in more experiments at less expense" (Thomke, HBR, p. 181).

Additionally, the study of innovation literature is typically separated into three levels of empirical analysis theory, which are the "individual, group and organizational—focused on in a particular study" (Staw, 1984). These three cognitive separations or theories become the backbone to any multidimensional and interconnected research on innovation.

1. *Individual theory*. An individual paradigm describing "what a given person has learned from his or her own experience and therefore has a quality of absolute truth to that person" (Schein, 1992, p. 99). That truth or normal science is research directed toward "articulation of those phenomena and theories that the paradigm already supplies" (Kuhn, 1996, p. 24).
2. *Group theory*. A group paradigm called group think that creates "a mode of thinking that people engage in when they are deeply involved in a cohesive

group, when the members striving for unanimity override their motivation to realistically appraise alternative courses of action" (Janis, 1973).

3. *Organizational theory*. Societal paradigm that acknowledges "it is impossible to escape the reality that corporations must be innovative in order to survive" (Amabile, 1988, p. 124). Many established processes have been developed without acknowledging the dependence of all features of the organization that influence innovation. It cannot be expected to use innovation to resolve "scientific, technological, and social problems, unless we also remember that using creativity techniques for such purposes implies a set of social values" (Stein, 1974, p. 10).

Individual, group, and organizational theories are a system of interconnections that formulate the visible realities of innovation. Nonvisible realities, sometimes referred to as metaphysical, include positive energy, synergy, and spirit and are not included in this research. System theorists understand the premise that the "predisposition to take systems apart and treat the parts separate is a consequence of analytic thinking" (Ackoff, 1999a, p. 11). This analytic thinking cannot reveal the perceived reality and structure of the innovation system and how it works. To understand that requires synthesis and aggregation of these cognitive concepts. Synthesis requires a different approach to create this understanding; it requires a practical approach of unveiling. This unveiling is the premise of the literature review, which is to guide the reader from an analytical history of innovation and thinking preferences through the use of the HBDI™ in a case study at PLAY, a current innovation company.

Pragmatic or practical interpretations of innovation lead to the exploration of a synthesized understanding of the historical tenants, organizational innovation, process-based innovation, the circumplex and HBDI^{TM} models, and finally, what could be best described as social science. To fully utilize the practical interpretations requires integration of these approaches into a case study, accompanying research, and the discussion of societal culture and values. These values are created from social psychology (Amabile, 1983) and are used to judge creativity.

To meet these expectations requires that for something to be innovative it must be "novel and appropriate, useful, correct, or valuable" for the social environment (Koa, 1991, p. 15). This means reproducing ideas must be right-brain heuristic rather than left-brain algorithmic. Algorithmic means that the innovation is controlled by fixed rules where the solution or idea has been conceptualized before, making a logical translation into the new idea. Examples of this are innovation process tools such as G. Alshulter's TRIZ and M. Basadur's SIMPLEX models. A heuristic approach means "there is no established path to the solution" causing a new solution relevant to an individual, group, or social environment (Koa, p. 15). Examples of heuristic innovation tools are de Bono's *Lateral and Parallel Thinking* (1999a, 1999b), Michalko's *Thinker Toys* (1991), and von Oech's *A Whack on the Side of the Head* (1998).

Historical Tenets

To prevent becoming sidetracked into the debate for an ambiguous separation between modern and postmodern, the ontological conception of reality is utilized to create the lines of thought. This "Post-Modern Realism" (Borgmann, 1993, pp. 48-49) is a paradigm shift (Kuhn, 1996) moving beyond the modernist, Newtonian science of

knowledge. Within this new knowledge exists a new movement, away from the "boring, pretentious, and elitist, European and American high modernism" (Best & Kellner, 1997, p. 124). The new movement for innovation requires a mixture of the past, present, and future integration of people, systems, and processes to create unique ideas.

Backing into the historical tenets framework requires a timeline or evolution for innovation. This framework requires the identification of specific events in time and where they are placed on the journey leading to the postmodern information age. The journey starts with the introduction of the taming of fire in roughly 500,000 B.C. by Homo erectus. Modern man's appearance did not happen until 50,000 B.C. (Homo sapiens). Innovation, which is the creation of something in the mind, was responsible for the invention of weapons, domestication of animals, agriculture, pottery, weaving, and irrigation systems between 20,000 B.C. through 5000 B.C. In roughly 4000 B.C., the use of copper-smelting techniques was discovered and used for making tools and weapons. The invention of the wheel in 3500 B.C. was followed closely by the abacus; the 12-month, 365-day calendar; sundial; and standardized coinage.

All of these pieces of the timeline set the stage for an appearance of the pre-Christian view of genius, which was seen as a "mystical power of protection and good fortune" (Sternberg, 1999, p. 18). Greek acceptance of an individual "daimon" (Hillman, 1996, p. 39) provided an acceptance of an inner spirit or voice, which directed innovation in a positive and negative direction. The social value of creativity during the time of Aristotle saw an association between it and "a madness and frenzied inspiration which reappeared during most of the nineteenth and the first half of the twentieth century" (Sternberg, p. 18). It was not until Christianity shaped the philosophy of individuals that

we see movement away from the precept of "One Supreme Being, One Truth" (Imparato & Harari, 1994, p. 13) toward a medieval mind that represented a new individual perspective and outlook.

The church was no exception to this epoch, and members of the clergy were dying even with the prayers of the believers behind them. During this period, the black plague devastated the world's population in all sectors of society. This led to a self-centered period in history that concentrated on the here and now. The practices of observation and empiricism were not as important as the "age of faith" (Imparato & Harari, 1994, p. 14). The use of the printing press spread after the publication of the Gutenberg Bible in 1455. As the printed word was made available to the masses, information on an unprecedented scale was suddenly available to everyone. The arrival of printing is considered the helping hand or new dawn to a "capitalist economy, [in which] printing revolutionized the structure of everyday life" (Imparato & Harari, p. 16).

The availability of information and knowledge in books provided new ideas and thoughts about scientific revolution (Kuhn, 1996). These revolutions led to innovations in ship riggings, the quadrant, and the magnetic compass. This drive to control nature by challenging universal thought provided the environment with a "more secular, less religious, and more quantitative" worldview (Imparato & Harari, 1994, p. 28). In 1543, Copernicus created new thought about the revolution of the earth around the sun, which constituted a dramatic departure from the foundation of Greek thinking. In the 1600s, the industrial revolution began, which provide a new awareness about civilization, that "organizational life is being created by people who are not sure what it is they are creating" (Imparato & Harari, p. 29).

According to Sternberg (1999), the 18th century set the stage for four distinct theories about innovation and creativity that are the foundation for present-day beliefs:

1. Genius was divorced from the supernatural.
2. Genius, although exceptional, was a potential in every individual.
3. Talent and genius were to be distinguished from one another.
4. Their potential and exercise depends on the political atmosphere at the time.

Political atmosphere is the social, political stability, or influence upon change. It is this change in thought that led to the creation of the interpretation of social consequence about romanticism by Jean-Jacques Rousseau (1712–1778) that concludes genius is "original, manifested in someone seeming to come out of nowhere, out of reach of education and immune from the rules and obligations of ordinary talent" (Sternberg, 1999, p. 22).

All innovation prior to the introduction of electricity neglected practical applications that had social merit rather than scientific merit. This is important because an initial theory of the electron by the Greeks around 600 B.C. introduced a revolutionary discovery. This innovation was that when two pieces of amber were rubbed together they acquired a property of attracting light objects. In 1600, Dr. W. Gilbert first recorded the word "electric" in the *Report on Theory of Magnetism*. This led to the technological development of electricity for the next 350 years. The interconnected journey leading to the creation of the electrical lamp was established, and the light produced by fire in 500,000 B.C. by Homo erectus was duplicated in September 1882 when Thomas Edison illuminated the streets of New York City. New discoveries continued to establish the

foothold for the Machine Age moving forward through postmodern studies (Bergquist, 1993; Borgmann, 1993).

Machine Age

As a continuation of the analytical exposure of the historical tenets, the period possibly responsible for the most industrial paradigm (Kuhn, 1996) changes in history may have been the Machine Age. The Machine Age in America can be identified as a specific time frame between 1918 and 1941 and was seen as a defining force that created a unique civilization between the "two great wars" (Wilson, Pilgrim, & Tashjian, 2001, p. 16). The rapid growth of innovation and creativity exhibited in art, household appliances, industrial growth, and building construction made this American time period unique. This historical period was called the Machine Age because of the "dominance of machines in all areas of American life and culture and the creation of that special sensibility, informing modernism" (Wilson et al., p. 23). The proposed organizational social culture during the Machine Age had a stronger connection "during the 1920's and 1930's than there [was] for the past forty years" (Wilson et al., pp. 16–17). One specific physical and social evolution of American innovation began in "the nineteenth century reaching a new tempo in the 1920's and 1930's" (Wilson et al., p. 25).

The new tempo was that "even human beings were viewed as machines in scientific management" (Wilson et al., 2001, p. 25), thereby inspiring leadership and management models by Frederick Taylor that reflected mentality. Taylor's scientific management theories and general practices led to disciples such as B. Frank, L. Gilbreth, I. Pavlov, and T. Watson, who is claimed by many to be the father of behaviorialism and who claimed he "could build any man, starting at birth" (Wilson et al., p. 25). This is

important because of the popular belief that machines were more than an extension of the individual, and the individual was nothing more than an operator for the machine. The thinking man was not seen as an asset to the machine unless he created the machines.

One of the key inspirations and facilitators for Machine Age innovation was the widespread introduction and acceptance of electricity in American homes, where it rose from "24% in 1917 to nearly 90% by 1940" (Wilson et al., 2001, p. 25). Electricity was the catalyst to control personal machines such as coffee pots, vacuum cleaners, and washing machines, which changed the human interaction required in certain household tasks. Mechanical refrigerators in "1924 numbered 65,000" and grew to "7 million ten years later" (Wilson et al., p. 16).

This opportunity for innovation development was established because of the availability of electricity to the American public. This wider application of electricity lead to innovation advances in microphones, which were used at political rallies to spread the message of communication, and telephones, which linked people across towns, the country, and the ocean (Wilson et al., 2001, p. 26). There were "1 million phones in 1900" in America, which expanded to "7.5 million in 1920" and exploded to over "20 million by 1930" (Wilson et al., 2001, p. 26). The machine was accepted everywhere in daily life. Another product of the machine age was the motion picture. A new nationwide culture was established in which "the family attended the movie house at least once a week" (Wilson et al., p. 26).

Machines had impacts everywhere, but there was no impact more influential in American life than the automobile, which became a "status symbol and cult object for the working class" (Wilson et al. 2001, p. 26). In 1910, streets were filled with streetcars,

horses, buggies, and horse-drawn wagons with only an occasional automobile. But by 1920, the "horse was a rarity and the automobile existed everywhere" (Wilson et al. p. 26).

The expansion of the automobile led to a need for machines to build, maintain, and service the automobile industry. This expansion caused a co-explosion in innovation "dependent on the government to provide the setting in which the symbol could operate" (Wilson et al. 2001, p. 27). This was because no machine was considered too complicated or too costly if the benefit was a savings to man hours (Wilson et al. 2001, p. 27).

In the 1920s, the businessman was seen as a "popular hero" who was substituted in the "1930's by the more creative engineer, scientist and industrial designer" (Wilson et al., 2001, p. 38). All these tasks were required to keep the renaissance of innovation growing. The Machine Age popularized the belief of "a stubborn and ceaseless effort to harness the forces of nature . . . of gigantic engineering feats and colossal mechanical construction" (Wilson et al., p. 38).

In an age that required new innovation, heroes were the keys to a new world in which "machinery is accomplishing in the world what man has failed to do by preaching, propaganda or the written word" (Wilson et al., 2001, p. 16). Historically, America has always been the land of the machine where early Americans "faced with abundant natural resources and limited labor, looked to machines to help with their work" (Wilson et al., p. 27). The social climate during the 1940s and 1950s in America was one of envy from Europe where they "looked to America for inspiration"(Wilson et al., p. 16).

The Machine Age included the "legend of Yankee Ingenuity," which was a declaration of a spirit for innovation, but it was Europe that invented the automobile,

along with “the Spinning Jenny, the Flying Shuttle, the Steam Engine, the Factory and the Locomotive” (Wilson et al., 2001, p. 27). This social and economic environment for abundant natural resources described by Adam Smith has been reversed and in the postmodern “Newtonian-positivism methodology” (King, 1994, p. 2) the opposite situation exists.

Today, three dissenting movements are responsible for a methodological splintering of innovation, providing direction into substantially different points of influence. King proposed that “quantum holography, chaos theory and neo-evolutionary theory” are all “bifurcation points” that will redefine “systemic degrees of innovation and change” (King, 1994, p. 63). The theoretical groundwork has been developed to understand systemic innovation and process-based innovation, but personal and organizational thinking styles must be explored.

Organizational Innovation

The Machine Age established boundaries for organizational innovation. It moved innovation reality into the forefront, where “there is a conflict between creative individuals and bureaucratic organizations” (Ford & Gioia, 1995, p. 25). Countless paradigm shifts (Kuhn, 1996) in social science were developed and implemented. Individual innovation and organizational innovation are seen as two distinctly different settings. Kanter believed that “innovation stems from individual talent and creativity[;] it is the *organizational context* that mediates the individual potential and channels it into creative production” (Sternberg, 1999, p. 383).

This mindset establishes the need to determine whether innovation-dependent companies create new insights and strategies around the relationship between

organizations and environments. Clarity of dependence requires understanding the interrelationship of the three elements of this analytical framework, which are as follows:

(a) "Person: Innovation comes into being through the non-obvious efforts of people,

(b) Directional Frame: What a given group of people or an organization understands about the innovation need.

(c) Organizational Context: The outside world and immediate setting in which innovation takes place" (Koa, 1991, p. 5).

Individual Theory

The innovative person described by Ford and Gioia (1995) has certain characteristics that are repeated, consistent, and can be demonstrated as; (a) the ability to see things in situations in different ways, (b) the boldness to try things before they are proven, (c) having a high level of curiosity, (d) an insatiable appetite for knowledge, (e) a contrarian style, (f) a dislike of the status quo, (g) a serendipitous capability, (h) the tolerance for appearing like a fool and (i) a willingness to learn from their own and others' mistakes. (p. 285)

The attributes above are a measure of practical intelligence rather than Intelligence Quotient (IQ). Individual creative performance increases with intelligence up to a certain threshold. Anything around or above an IQ of 120 does "little to enhance creative ability further" (Ford & Gioia, 1995, p. 30). It is possible that "too much education may actually prevent the ability to be creative" and individual innovation may ultimately suffer (Simonton, 1983). Innovative production has been determined to peak when people are relatively young.

de Bono (1992) describes this in three phases. The first is 0 to 4-year-olds, which is the age of why. Next is 5- to 12-year-olds, which is the age of why not, and beyond that is "because." De Bono proposed that there are two reasons that may cause this:

1. Natural cognitive skills that contribute to innovation may diminish throughout individual careers.
2. Individual goals become more stability oriented as people get older.

This relationship between individual age and performance correlates with individual motivation and talent (Mumford & Gustafson, 1988). Another possibility is the establishment of cognitive patterns.

The last feature of innovative individuals is the recognition that they have a "higher degree of self-confidence" (Stein, 1974, p. 7). This self-confidence or psychological characteristic is necessary for the creative process and has appeared in multiple publications. Galton's book *Hereditary Genius* (1870) was one of the first to describe individual creativity in psychological features of motivational and personal characteristics. Guilford's 1950 APA presidential address called attention to the need for psychologists to "pay attention to what he found to be an extremely neglected but extremely important attribute, namely, creativity" (as cited in Sternberg, 1999, p. 3).

Stein and Heinze (1960) expanded upon this body of knowledge about the cognitive characteristic of perception, thought processes, and problem-solving behavior. They formulated the theory that if creative individuals are known to be more creative, then "we can expect to develop techniques that will stimulate or foster self-confidence with the expectation" (Stein, 1974, pp. 7–8) that this goal is attained and that the probability of an individual becoming creative is enhanced. In addition to self-

confidence, “flexibility of thought” is a secondary person unique characteristic that can be expected.

One strategy for increasing individual innovative capabilities is to improve or enhance self-confidence and “thought flexibility” (Stein, 1974, p. 8). Thought flexibility can be described as the individual ability to cognitively adapt a syntactic structural representation with an appropriate semantic. Examples of this would be universal, gradient, inherent properties of a mentally projected world. A semantic for a language assumes that the language refers to a recognizable paradigm (Kuhn, 1996) and describes the minimal conditions that must be satisfied in order to assign an appropriate meaning for every expression in the language called an interpreted behavior.

Interpreted behavioral changes can be self-directed. This change can be accomplished through the natural process of maturing and aging over time or by the individual’s motivation to change and wish to become more innovative.

Group Theory

Strategic leadership and structural restraints have an impact on the innovation potential of the organization. This impact can be seen as the climate or culture (Duncan, 1973; Weick, 1960) that can exist and be measured by information available to individuals or by different activities. These activities determine the new markets and technologies the organization sees as its “potential possibilities for successful innovation” (West & Farr, 1990, p. 144). The majority of the research and publications available on innovation tends to identify individual characteristics that lead to innovation productivity. The circumstances for which those innovations were established are typically not described and are underestimated in their importance. Weisburg’s *Creativity, Genius and*

Other Myths (1993) is a testament for removing this illusion of success. What has been ignored in the past is "when and where" (Ford & Gioia, 1995, p. 21) these innovations were created.

External factors can play a "critical role in blocking or facilitating the creative process" (Stein, 1974, p. 9). This can be seen by the experiences of individuals who have learned new methods for innovation and come back into their organizations to try them. Upon failing, it is recognized that the work environment that supports this new knowledge does not consider it valuable in the organizational hierarchy of values. This core ideology of implementing innovation takes time and energy, which are in limited supply.

Other key innovation values that constrain creativity are the reward systems and diversity. Typically, "any behavior can be positively reinforced," but evidence suggests that the complex understanding of extrinsic rewards may actually work against innovation (Ford & Gioia, 1995, p. 63). In certain individuals and groups, the aim of being rewarded can be confused with the organizational strategy to create new ideas.

Amabile (1988) described the nine constraints that undermine intrinsic motivation and creativity along with the percentage of research respondents that mentioned the factor at least once. An inappropriate reward system in the organization was ranked in the first constraint with 62%. Her explanation is that "if the employees feel that every move they make is tied to bonuses, awards, salary increases, or promotions they are unlikely to take risks trying out new ideas" (Amabile, p. 149).

Diversity of membership for individuals and groups supporting innovation group composition has long been seen as a positive influence. It is suggested that "diversity

enhances group creativity, while homogeneity serves as a constraint" (Ford & Gioia, 1995, p. 63). Additionally, autocratic leadership styles and ridged Machiavellian structures tend to prevent innovation.

Organizational Theory

The organizational context is the performance of the organization or group as it is constrained or enhanced by outside influences. These influences can create the organizational "artifacts, espoused values or shared basic assumptions" about innovation (Schein, 1992, p. 17). These organizational characteristics create a unique reality that exists for members of this organization. Their personal and collective attitudes, actions, and interrelations are shaped by these. Organizational innovation because of these interrelations is "no doubt more than the sum of its individual parts" (West & Farr, 1990, p. 295). Major contributors to these influences are as follows (West & Farr, p. 295):

1. The internal economic conditions of the organization
2. The external economic conditions of the organization
3. The situational factors of the members
4. The organizational structure of the members
5. The power distribution of the members
6. The communication patterns utilized by the members.

The level of impact or compromise each one independently has on innovation is impossible to predict. What are created or codified are the organizational norms and consensual agreements (Nemeth & Staw, 1989; Pfeffer, 1982). Within this organizational context Amabile (1988) proposed that there are four criteria for a general model of organizational innovation:

1. The entire process of individual creativity must be considered as a crucial element in the process of organizational innovation.
2. The model must attempt to incorporate all aspects of the organization that influence innovation.
3. A model must show the major stages of the organizational innovation process.
4. A model of organizational innovation must describe the influence of organizational factors on individual creativity.

These four criteria define a model of innovation that is very mature and understanding of organizations that are fully developed but does not take into account the fluidity of organizations today. Groups, teams, and individuals are loaned across organizations, companies, and cultures to create innovations in a radical innovation process.

This radical innovation methodology understands that excessive familiarity can create ridged mindsets that are unreceptive to innovation (Sternberg, 1997). This model explores the premises that highly skilled individuals can become so entrenched in their own ideas that they are willing to disregard others due to this influence. Kanter (1988) referred to this as "trained incapacity" and described it as a symptom of focusing on a certain area without the ability to move into a divergent thinking model.

The balance is creating an innovation infrastructure that has the ability to look into the future and understand the required needs. This will lead to the anticipation of the "customer needs one customer ahead" of the current organizational deliveries or capabilities. This context forms an infrastructure based on "design, systems, knowledge base, competencies, networks, relationships, leadership and vision" (Imparato & Harari, 1994, p. 94), which sets up synergies for further innovation.

The challenge for future organizational contexts that are truly innovative is to understand what inhibits or fosters creativity. Sternberg's (1988, 1997) theory is that the "individual creative thinking styles must be encouraged" (Sternberg, 1999, p. 401) and employees must also be rewarded as opposed to punished, which is typically seen as the norm in most organizations.

Process Innovation

The most common method of process innovation that is generally accepted within organizations is brainstorming. This structured approach was originally described by A. Osborn (1953, 1963) as a technique used by groups and individuals to provide "free reign" (Sternberg, 1999, p. 401) of ideas in a social context. The technique of brainstorming is based on associationistic psychology and has historical tenets in the Greek philosophers of logic (Stein, 1974, p. 86). This theory of psychology includes associations, thoughts, or ideas that are created "because of contiguity, similarity or contrast" (Stein, p. 86). These terms are seen as:

(a) Contiguity – Two stimuli that occur together.

(b) Similarity – Two stimuli that are similar to each other.

(c) Contrast – Two stimuli that are different from each other.

A basic assumption in the operation of an association is that it follows a sequential path to create a chain of logic. These logic chains can be long or short and some happen early in the innovation process while some happen at the end. Within the sequence, logic chains that "occur early are regarded as the most habitual," meaning they are very common associations and have a lesser value in creativity (Stein, 1974, p. 87). The logic

chains that occur later in the sequence are considered more unique and "hence likely to be the more valuable for creativity" (Stein, p. 87).

In the 18th and 19th centuries, these laws of association were taken over by British Empiricists such as John Locke (1632–1704), George Berkeley (1685–1753), David Hume (1711–1776), and John Stuart Mills (1773–1836), who believed that the sensory experience and role of basic principles of contiguity, similarity, and contrast explained how the mind worked. The a priori axioms revealed truths, but they believed that a posteriori knowledge and deductive reasoning reveal the logical connection between truths and associations. These left-brain mathematical connections were precursors to TRIZ formulas for innovation models. The "most complicated mental functions could be accounted for by the laws of association" (Cramer, 1968, p. 3). These laws of association, such as brainstorming, look for patterns to reveal themselves while trying to create new ideas.

When using brainstorming for technical problems, it is most likely that the leads will need to be further refined. With problems that have multiple solutions, "brainstorming works best" (Stein, 1974, p. 211). During the use of the brainstorming tool, there should never be any criticism of the output or ideas. This elimination of criticism during the idea-creating session provides stimulation to the other group members to express or share creative dialogue in an "uninhibited fashion" (Sternberg, 1999, p. 401).

Brainstorming also allows participation that is more accessible by removing the barriers for what is expressed. "Lowering the normal level of self-criticism" is questioned

by some researchers as the ability to lower one's tendency to be critical and provide credibility to ideas that may seem too far fetched (Parloff & Handlon, 1964).

Systemic Process Innovation

Systemic process innovation is involves systematically following a sequence of steps to achieve a creation of something in the mind. The mind is not a machine; it is a special cognitive environment that organizes information into patterns (de Bono, 1999a, p. 10). "Thinking is the operating skill through which intelligence acts upon experience," not a measure of one versus the other (de Bono, 1994, p. 2). In this cognitive system, it is easier to add or combine patterns than it is to deconstruct or restructure them. "Insight and humor both involve the restructuring of patterns" (de Bono, p. 11). To accomplish this requires cognitive thinking methods, which can provide movement in one of three different conceptual directions: vertical, lateral, or parallel thinking.

Many times problem solutions can only be visualized by hybridizing or spiraling out to different levels of converging and diverging to create understanding from a specific point. It becomes impossible for the innovator to see the solution because of artificial boundaries; "they can not see what they do not know" (Kanter et al., 1997, p. 115). Thinking is the most important human skill for both the individual and society, and thinking should be recognized as a skill that is not difficult to learn. This skill can have a tremendous impact on organizations or societies that can be recognized by how much time organizations or individuals spend rethinking what they do. These features would lead to clarifying the time spent looking at things in a different way.

Vertical thinking. The theory of vertical thinking is a description of a philosophy for generating new ideas that follow a series of sequential steps that are justified through

either logic or mathematics. This thinking process is based on taking knowledge that is currently known and then developing concept patterns. The "emphasis in education has always exclusively been on vertical thinking" (de Bono, 1999a, p. 39) because it is designed around a philosophy of selecting cognitive pathways of thinking by excluding others.

If there is no perceived direction in which to cognitively move, the thinking stagnates and can go no further. When the thinking process is moving in a vertical direction, it is looking for a different approach until it identifies what is perceived to be the "most promising direction" (de Bono, 1999a, p. 40) in an analytical and sequential path. These steps arise directly from the previous step, and the fundamental technique guarantees that they create a logical thinking chain, which is firmly connected and provides "at least a minimum solution" (de Bono, p. 44).

Lateral thinking. Lateral thinking and vertical thinking are complementary cognitive skills. Both are required, but the need for lateral thinking "arises from the limitations of the behavior of mind as a self-maximizing memory system" (de Bono, 1999a, p. 14). Lateral thinking is a description for the type of thinking required to change perceptions and concepts. The purpose of this thinking style is to provide a more deliberate method for pattern switching. This emphasizes methods that are not controlled by mistake or accident. These are representational of the pattern switching created by insight. By switching to a new pattern, we can see that something has possibilities and is reasonable or obvious. The common mistake that is typically made is thinking that a decision or choice that was made in hindsight is logical. This can also be called "paradigm paralysis" (Kuhn, 1996**,** pp. 43-45).

Lateral thinking can be accurately defined as pattern switching within a patterning system. The results that are typically produced two to three times the idea-generating output of a brainstorming session without the use of process and systemic tools. The "constructivist view of the brain is that it has a common mechanism that solves the structure of all problems" (Gazzaniga, 1998, p. 15). Within this common mechanism is an innovation problem space that confronts language with a distinction that "any old part of the brain, can't learn any old thing" (Gazzaniga, p. 15). De Bono referred to this portion of the brain when discussing learning and unstructured brainstorming and described it as "flopping about" (de Bono, 1999a, pp. 1-30). Lateral thinking is a series of tools that provide multiple-idea-generation capability with a history of over 30 years of use. The uses of tools, which are systemic in nature, produce expected and repeatable results very different from the unstructured experiences of allowing free associations to come up with serendipitous ideas. These systemic tools require the discipline of focus, technique, and time.

One example of a nonsystemic or process-driven idea-generation occurrence is the serendipitous situation in which a cat roaming through a laboratory knocks over a beaker, which causes a mixture of chemicals and creates a new innovation. To repeat this process, people might be found throwing cats into laboratories, closing the door, and waiting for them to knock over beakers. This attempt to duplicate a serendipitous event is not a consistent or predictable method for idea generation or innovation.

As with any process, its benefits are repeatability and the ability to improve use through practice. By using these tools, the user will become more proficient with its use and able to generate consistent results. As the user becomes more experienced with the

function of the tools, the transition into the innovation mindset becomes minimal and capitalizes on the ability to quickly focus.

Part of the execution of the lateral thinking tools suggests that the ideas created should be "wild, woolly and crazy" (de Bono, 1992, p. 128). Because the environment for innovation and ideas is a "Parallel Thinking Green Hat" (de Bono, pp. 3-4) situation, participants of the idea-creating group are encouraged to say whatever pops into their head. Additionally, they are asked to verbalize their logical thinking as it is happening for the rest of the group to hear. This requires a strong environment of trust to prevent ridicule and dismissal of the process as simplistic or naive (de Bono).

Parallel thinking. Parallel thinking is a nontraditional method for group thinking in which two individuals views [OK?], in parallel, no matter how contradictory, look in the same direction (de Bono, 1999b, p. 4). Random entry, random word, or random association processes are examples of lateral thinking associative logic. Random entry allows the use of unconnected input to open up new lines of thinking. Various cultures in the past have used interaction with oracles to help people look deeper into their own minds (Von Oech, 1998, p. 143).

Greeks used the Delphic Oracle, who was consulted in real life and mythology for important decisions. Some of these decisions could be answered by the yes or no of corresponding stones, while others required the inspired responses of the priestess, Apollo. The Chinese used I Ching, which refers to a free and spontaneous state in which life itself is created and self-organized in new and intelligent ways. The tarot was used by the Egyptians and is useful for learning about the individual self and individual reactions to life's seemingly never-ending struggles. These struggles increase self-awareness and

possibly create a new point of view of life itself. Scandinavians used alphabet tablets called runes, which symbolize system. The context of the letter's names relates to all aspects of their secular and religious lives, thus transforming simple pictographs into a magical alphabet. This alphabet could be used for talismans, magical inscriptions, and divination. Lastly, North American Indians used medicine wheels. Medicine wheels are Native American symbols for the wheel of life, which is constantly evolving and bringing new lessons and truths to the walking of the path.

Responses from an oracle can be phrased as an enigma, which is "something, that baffles understanding and cannot be explained, for how it got out . . . is a mystery" (Von Oech, 1988, pp. 7-10). This deliberate alteration of the circumstances generates an external stimulation that is fundamentally different from vertical thinking, which deals with what is relevant and does not utilize unrelated or irrelevant information to create a new constructed association. A functional example of following that random logic could be presented as the following:

> Yellow makes me think of banana, bananas make me think of gorillas, and guerillas make me think of brute force—Let us use brute force to solve our problem.

As others hear the logical thinking, they formulate their own pattern associations, which may follow vocally such as:

> Bananas make me think of bunches—Let's bunch everything together and work on all of it at one time.

The initial word *yellow* can be derived from a list of "random input" (de Bono, 1999a, p. 195). This random input can be words from a dictionary, book, journal,

magazine, or newspaper or the use of some “routine object” (de Bono, p. 195) that creates a cognitive path for movement. Random stimulation only works because the mind functions as a self-maximizing memory system. Within this system is a “limited and coherent memory span” (de Bono, p. 196) that forces the connection of two thought patterns to create a cognitive connection. This connection is achieved by deliberately holding the two independent pieces of thought in the same level or setting, which creates a “connection that will eventually form between the two” links (de Bono, p. 196).

TRIZ (Theory of Russian Innovation)

TRIZ combines the left-brain knowledge of the disciplines of process-based nature, human behavior, society, and artificial objects and formulates them into a science to address technical thinking problems. These problems can be descriptions of features, aspects of technical systems, technological challenges, or the cognitive process for innovation. TRIZ methodology is divided into different functional thinking phases that define complex technical engineering or scientific problems. In complex innovation problems, “at least one critical step to a solution is unknown” (Savransky, 2000, p. 4). This unknown step to the solution can be in the definition of the desirable solution, in the complexity of the initial situation, or in the cognitive hidden search directions used to solve the creative problem. A creative problem is a problem in which “resolution is non-obvious” (Savransky, p. 4), but a technical solution must satisfy the following:

1. Physical possibility—Solution is within the realm of physical possibilities. *Invisibility* is a law of nature that is not possible; therefore, design solutions centered on invisibility are not feasible.

2. Technical possibility—Solution must be technically possible. The premise of *metallic air* is a technical impossibility.
3. Economic possibility—Solution must be economically possible. If the design solution is outside the economic feasibility of the available financial funding to support the solution, it is not a possibility.

With these three levels of possibility integrated, TRIZ innovation can be explored at a level that is classically represented as system ideality (Savransky, p. 77):

$$\text{Ideality} = \Sigma \text{ benefits}/(\Sigma \text{ expenses} + \Sigma \text{ harms})$$

The formula for system ideality balances the quantifiable benefits of the innovation solution benefits on one side divided by the innovation solution harms plus the cost. By following this formula for innovation creation, a solution is identified that would never have or induce more harm into the system than the original idea. This creates the "Ideal Final Result" (Savransky, p. 78), which allows the right problem to be solved the first time. These first-time solutions are derived from a series of "TRIZ heuristics that helps solve non-routine problems" (Savransky, p. 24). According to Savransky, "95% of the inventive problems in any particular field have already been solved in another field," thus providing the ability to use analogies to abstract the problem situation and then proceeding through a process to the solution (Savransky, p. 27).

D. Pye (1983), a professor of design at England's Royal College of Arts, wrote, Most design problems are essentially similar no matter what the subject of design is. This commonality in predictable design solutions became a methodology for innovation in the former Soviet Union, where "TRIZ was as popular as brainstorming was in the Western countries" (Savransky, 2000, p. 28). One of the founders of TRIZ is Genrich Altschuller

who in December 1948 wrote a letter to Josef Stalin "pointing out to his countries [*sic*] leader that there was chaos in the USSR's approach to innovation and inventing" (Shulyak & Fedoseev, 1998, p. 11). Altschuller was an inventor who in 1946 developed an innovation for escaping from an immobilized submarine without diving gear. This invention allowed him to accept a position in the patent office where the young inventor became a local resource for people looking for solutions to problems (Sickafus, 1997, pp. 43-44).

At that time, Russian "scientists claimed that inventions were the result of accidents, mood, or blood type" (Shulyak & Fedoseev, 1998, p. 11). Altschuller decided that a methodology for innovation should be developed and proposed that "innovation is nothing more than the removal of a technical contradiction with the help of certain principles" (Shulyak & Fedoseev, p. 12). The methodology proposed by Altschuller, called TRIZ, has a basic four-step process. This is accomplished by reformulation of the original problem or focus statement to a TRIZ-centric focus statement. Following a formula of known systemic processes path to the general TRIZ solution, that solution is then pushed back down into the solution as a path to the answers of the specific problem.

The TRIZ methodology describes a four-step path to a potential problem solution as systemic and process oriented, which is much different from typical serendipitous innovation creation. The language of TRIZ is different in form from a typical problem formation written in mathematical or chemical terms, as seen in Table 1.

Table 1

Problem-Modeling Philosophies

Field	Model of Problems	Tools	Model of Solutions
Math	2 X 10	Multiply	20
Chemistry	HCI + NaOH	Periodic Table	Water Table+ salt
TRIZ	Engineering Contradiction	Contradiction Matrix	1 - 40 Principles
TRIZ	Initial Su – Fields	System of 76 Standard Solution	Final Su - Fields
TRIZ	Physical Contradiction	Separation Scientific Effects	Principles Scientific Effects
TRIZ	Function Analysis	Scientific Effects	Scientific Effects

Table reprint authorized by S. Ikovenka (2002)

S. Ikovenko described the uniqueness of TRIZ with this model of solutions. "TRIZ is a human oriented knowledge based systemic methodology of inventive problem solving" (as cited in Savransky, 2000, p. 22), which provides knowledge-based approaches because the knowledge about the generic problem is extracted from a patent database. These patents provide a proposed finite number of "objective heuristics that are based on an evolution of trends of technique" that identify potential solutions in these known knowledge domains (Savransky, p. 23).

These design solutions are extremely successful for highly technical or complex interconnected problems in which the solution space is limited by advances in material

technology or areas of nonexistent science. The TRIZ methodology allows the user to cognitively spiral down through multiple layers of functional and physical understanding. Additionally, this allows the user to better see where the application of the TRIZ design solution can improve the system. TRIZ is very elaborate and has branches to other pieces of logical tools such as the 76 standard solutions to invention problems, separation principles, and substance field analysis. Two interconnected innovation and problem-solving tools are discussed: the 40 inventive principles and the contradiction.

Contradiction. A contradiction is a "basic law of materialistic dialectics" (Savransky, 2000, p. 59) in which there is a proposition that proposes apparently opposite or incompatible events or things. Berkeley (1710) introduced the concept, which was a main point of critique of formal logic developed by George Wilhelm Friedrich Hegel (1812, 1816) as a popular concept for introducing dialectic ideas (Savransky, p. 59). TRIZ supporters present the premise that "the most effective invention solution of a problem is the one that overcomes some contradiction" (Savransky, p. 60). TRIZ contradictions fall into one of three areas:

1. Administrative contradiction–When two opposing administrative properties are required from the same technical system. An example of an administrative contradiction would be where there was a need to increase quality and decrease cost.
2. Technical contradiction—When two opposing technical properties are required from the same item in a technical system. An example of a technical contradiction would be a contradiction within the technical system, such as a situation requiring a product to be both fast and slow at the same time.

3. Physical contradiction—When two opposing physical properties are required from the same item in a technical system. An example of a physical contradiction would be where an insulation liner was required to be hot on one side and cold on the other at the same time.

Typically, contradictions seem to be competing ideas that are not achievable without making a concession that ultimately provides only innovation or design solutions that trade off between the two characteristics. These contradictions may require analysis of the "ability to change space, time or the physical state of a substance" to provide a valid solution (Shulyak & Fedoseev, 1998, p. 12).

40 inventive principles. The TRIZ methodology is built from an initial database of research covering roughly 200,000 patents. Altschuller started noticing design patterns and contradictions that could be resolved by utilizing his 40 inventive principles (Ideation, 1999, pp. 7–8). These 40 principles are used to challenge the given system to identify useful solution concepts. To determine which of the 40 principles to use for a specific design challenge requires the user to review the TRIZ contradiction table looking for two different design characteristics that are in contradiction. Across the left side of the chart are features to improve and across the top of the chart are features of conflict that cause an undesired result. By intersecting these two categories, we are directed to a location box, which contains up to four principles in nonnumeric random order, i.e., 4,17,6,22. The order in which the principle or principles appear in the box does not reflect the number of previous patents identified.

The 40 inventive principles are trigger words such as asymmetry, spheriodality, copying, or antiweight. Each of the principles has a specific definition for what that

principle means, for example, asymmetry—replace a symmetrical form with one that is asymmetrical. By utilizing that concept, the user reviews the current design or idea solutions to see where the use of asymmetry could resolve or adapt the design conflict. This becomes a methodically systemic process-developed solution for incorporating lessons learned from a patent database of known solutions. It was introduced in the United States in 1991 and has had limited acceptance since then. By using this tool and spiraling down to an element interaction level, design solutions, which are a hybridization of multiple elements, are visible. But in traditional design conceptualization methods, they are not (Sickafus, 1997, p. 44).

Other fields of science drive concept patterns for idea formulation not necessarily cognizant to the idea creator. An example would be a situation in which a hillside tunnel keeps caving in on itself. Using pattern recognition for concept development to identify design solutions, the user will be directed toward ideas that focused around supporting the sides of the tunnel with shoring material to keep it from falling back in on itself. This is an example of a standard mechanical design solution. Using TRIZ and the contradiction matrix in conjunction with the 40 principles, the user may explore a series of typical solutions from the field of biomedicine such as angioplasty. By supporting the tunnel with a liner and pressurizing it like a blood vessel or artery, we have a nontraditional design solution that could never have been identified within the original field of study. TRIZ has a subset of tools inside its field called the algorithm of inventive problem solving (ARIZ). This method spirals deeper into the understanding of "fields and substances" (Sickafus, 1997, p. 45).

Circumplex Models

When trying to understand how the individual fits into the equation as an element of innovation, it is necessary to dissect specific characteristics of personality and thinking. To accomplish this necessitates a model related to interpersonal psychology, which can measure and cognitively map dominance characteristics. Individuals have many personality characteristics and emotions that can lead to innovation traits.

The *circumplex model* is a study of personality structure developed by "Cattell, Eysenck and Guilford in the in the 1940's" (Plutchik & Conte, 1997, p. 1). It was created as a "schematic representation of the empirical interrelation" identified in mental abilities (Wiggins & Trobst, 1997, pp. 57–80). In diagnosing and describing personality disorders, the circumplex model has helped in the "construction of several psychometric instruments" (Plutchik & Conte, p. 9) that focus on the personality traits that are part of the human species.

The circumplex model is a circular geometric shape with "between 4 and 16 basic dimensions needed to describe the structure of personality" (Plutchik & Conte, 1997, p. 1). This theory has evolved into "one or another of five broad dimensions of personality" (Plutchik & Conte, 1997, pp. 449-450) called the five factor model, which contains extroversion, agreeableness, conscientiousness, emotional stability, and openness to experience. All of these factors can be "organized conceptually and mathematically" (Plutchik & Conte, p. 2) in the form of a circular iconic model, which has properties that the elements exhibit indication of (a) similarity, or adjacent elements on the circle model; (b) bipolarity, or opposite elements on the circle model; or (c) dissimilarity, or further apart on the circle model.

This circular model can be defined in terms of "patterns of correlations as well as mathematical procedures" (Plutchik & Conte, 1997, p. 2). The Greeks described "4 Temperants" (Plutchik & Conte, p. 25), which could be thought of in bipolar terms.

1. Phlegmatic type—A description of personality that is controlled, persistent, and calm.
2. Choleric type—A description of personality that is exhibitionistic, hotheaded, and active.
3. Sanguine type—A description of personality that is sociable, easygoing, and serious.
4. Melancholic type—A description of personality that is anxious, suspicious, and serious. (Eysenck, 1970, as cited in Maher, 1970)

These Greek philosophical tenets were not recognized by American psychologists until "Cattell (1946) carried out a series of factor analysis studies" (Plutchik & Conte, 1997, p. 25) to describe bipolar labels creating the model for the *standard reduced personality sphere*. This led to the circular model of personality described by Stern (1958) and used as a "basis for psychometric tests of personality" (Plutchik & Conte, p. 26), which focused on a series of personal indications for likes versus dislikes.

The term *circumplex* was introduced by Schaefer as a "circular ordering of variables," which was a phrase adapted from the work of Guttman (1954) who proposed that "the geometric implications of a correlation matrix systemically increase and then decrease" (Plutchik & Conte, 1997, p. 26). This decrease reveals a two-dimensional circular ordering of the personality data after factor analysis. Factor analysis is focused on finding out what "factors explain the correlations between different items" (Herrmann,

1995, p. 52) driving toward a hypothesis that is mathematically substantiated. To accomplish this requires sorting the factors to determine which ones are common to each other and the logical link between them.

Emotion and personality are considered key criteria for personal innovation and, aside from thinking preference, are seen as one of the personal characteristics that are a basic dimension. The previous description of self-confident by Stein (1974) as an aspect of innovation has a bipolar opposite description of "anxious" (Plutchik & Conte, 1997, p. 27). Other bipolar personalities are "accepting versus stubborn [and] quarrelsome versus peaceful" (Plutchik & Conte, p. 25), which describes a domain of interpersonal behavior previously ignored by traditional innovation research. This circumplex personal make-up of the individual is important because it ties the bond and interrelation between the introversion and the extroversion bipolarity issues.

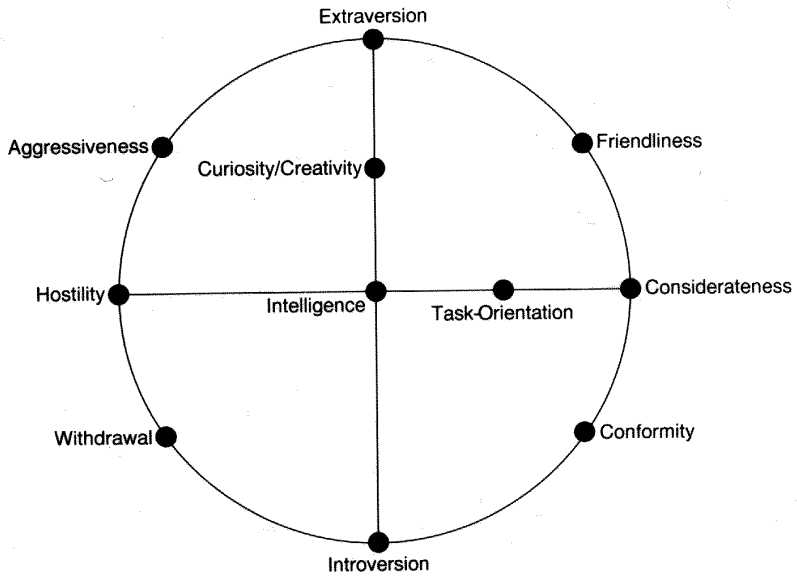


Figure 3. Spherical model of child adaptive behavior©.

In Schaefer and Edgerton's (1982) circumplex and spherical model©, shown in Figure 3, it can be seen that the introversion and extroversion characteristics are

considered opposites (Plutchik & Conte, 1997, p. 144). The basic structure is a four-quadrant model in a circular format that includes the characteristics or factors required to understand the philosophy behind the model. A traditional hierarchal structure for factor representation has been superimposed onto a radial structure with a common axis for all of the variables to be plotted in accurate alignment with each other (Plutchik & Conte, pp. 133–153).

The variables are placed on the two-dimensional circular continuum to provide visibility into the scaling or strength of the variable. In the Schaefer and Edgerton (1982) figure, it can be seen that creativity or innovation is on the extroversion axis but between the hostility and considerateness points. The concentrated research of the circumplex model occurred during the late 1960s by E.Schaefer and J.Rinn (1965), N. Bayley (1968), A. Aaronson (1970), J. Rimmer (1924), and J. Wiggins (1979). These studies led to Plutchik and Conte's (1997) demonstration that there is an "intimate connection between emotion and personality," (Plutchik & Conte, p. 9) which would have been available to Ned Herrmann when he was conceptualizing his HBDI™ model and metaphor.

Herrmann Brain Dominance Instrument™

The HBDI™ is a personal thinking preference indicator tool that was developed by N. Herrmann in the mid-1970s when he worked for General Electric. His research originated in conjunction with contemporary reports on a new theory of brain hemispheres that scientifically explained that "the right-brain controls functions used in artistic thinking. The left-brain controls functions used for scientific thinking" (Herrmann, 1995, p. 1).

This means that the HBDI™ measures the behavioral characteristics "resulting from our mental preferences" (Herrmann, 1995, p. 7), which are considered a cognitive expression of human thinking dominance corrolated to the dual brain philosophy. The HBDI™ measures a person's preference for "both right-brain and left-brain thinking which includes conceptual or experimental" (Leonard & Straus, 1997b, p. 115). This dual brain philosophy was explored by Broca, a French physician, in 1865, and by Wernicke, a German neurophysiologist, from 1848 to 1904, who "deduced from clinical observations of brain damaged patients that the left-brain spoke" (Herrmann, p. 8).

The observation was a clarification of specific left-brain hemispheres and their capability to control the auditory functions. These functions can cause "alphasia or speech deficiencies" when the left hemisphere is damaged (Herrmann, 1995, p. 8). Among current researchers, it is acknowledged that "the most widely recognized cognitive distinction is between left-brain and right-brain ways of thinking" (Leonard & Straus, 1997b, p. 111).

Sperry (1973), along with many other researchers, challenged traditional brain topology theory and explored additional research to "isolate and reveal the functions of each hemisphere" (Herrmann, 1995, p. 9), which led to new clinical enlightenments and a Nobel Prize in 1981. This research demonstrated the following:

1. Sensing and motor control are distributed to one hemisphere or the other.
2. The hemispheres are specialized in function.
3. The corpus callosum exists largely to unify attention and awareness and to allow the two hemispheres to share learning and memory. (Herrmann, p. 10)

Sperry's work was responsible for establishing the theory of the dual brain being "lateralized" (Herrmann, 1995, p. 11), where speaking, thinking, reading, and writing are considered left-brain functions. Spatial, mental map making, geometric, and functions associated with the "rotation of shapes are performed predominantly in the right hemisphere" (Herrmann, p. 11). In the 1970s, R.Ornstein used the electroencephalographic (EEG) technique to "demonstate scientifically that hemispheric specialization was not limited to abnormal people" and could be seen, measured, and mapped in individuals (Herrmann, p. 13). The EEG accuratley measured brain-wave activity, "which determines brain dominance or hemisphericy" (Rowe & Waters, 1992, p. 12).

The comprehensive EEG research conducted by Herrmann in 1977 was referred to as the Berkeley Brain Tests and confirmed the "validity of hemispheric specialization," but did not produce a viable measurement for brain dominance (Herrmann, 1995, p. 50). General Electric's "quest was to make the staff more innovative" (Herrmann, 1996, p. 300), which required the creation of a tool to measure creativity. The retention of Kendrick Few of the Opinion Research Corporation helped Herrmann perform factor analysis on the results of the Berkeley tests and on his data from the Brain Update Workshops, thus arriving at a "roughly crude, consistent correlation, which had emerged in the correct locations" (Herrmann, p. 52). This correlation into brain dominance was refined and is the origin of the HBDI™.

HBDI™ Individual Profile

The brain can be logically separated into upper cognitive processing skills and lower visceral feeling skills. This separation is then further developed into a series of four

quadrants by adding right brain and left brain to the HBDI™ model. This construction of four quadrants is a metaphor representing a physiological map, which divides "four conscious modes of knowing" (Herrmann, 1996, pp. 8-9) and the associated behaviors with a whole brain model (Figure 4).

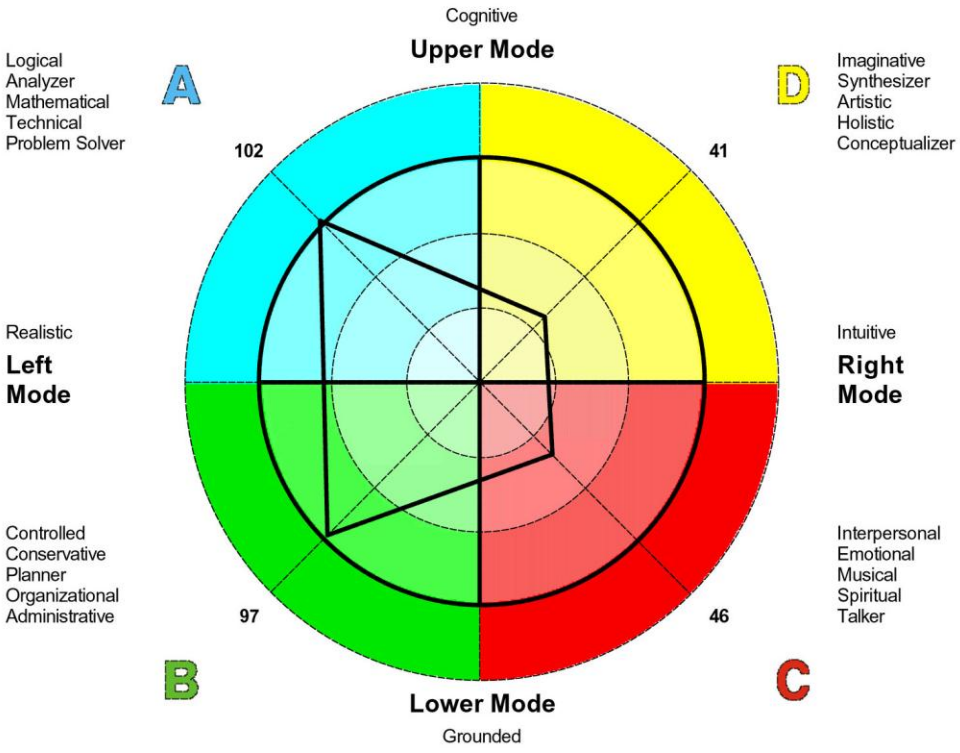


Figure 4. HBDI™ whole brain thinking preference (1122).

The HBDI™ data are plotted on a four-quadrant graphic to create a whole brain view of the individual's thinking preferences. *Whole brain* is a metaphoric model of "the four thinking styles of the brain" (Herrmann, 1996, pp. 6-7), not a clinical one, but does include the representation of the two halves of the cerebral cortex (Sperry) for upper brain functions and the limbic system (Maclean) for lower brain functions (Herrmann, 1996, p. 18). In this model the thinking is a series of four interconnected clusters of specialized mental process modes that function together "simultaneously and

interactively" (Herrmann, p. 6), which defines a thinking system in which one specific quadrant becomes dominant or multiple quadrants exhibit dominance.

The thinking system is a series of pathways for brain functioning through interactions. In Figure 5 the paired thinking structure model exhibits this multiple quadrant theory.

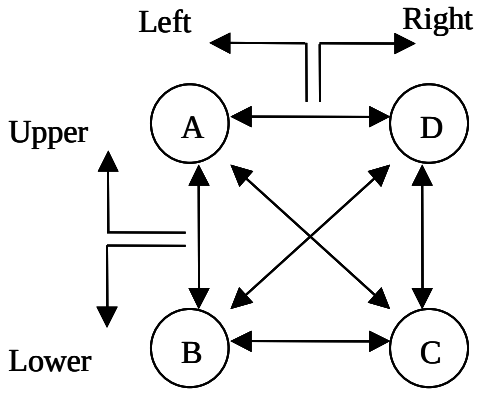


Figure 5. Paired thinking structure.

The translation from one thinking structure to the other can be seen as a "coalition of the individual's thinking preference" (Herrmann, 1996, p. 16) creating a brain dominance. Brain dominances are the "physical characteristics that nature has provided" (Herrmann, p. 16) that ultimately creates a mental preference. These preferences are determined by our relative "attraction to or aversion for" (Herrmann, 1995, p. 31) each of the four thinking modes:

1. A-quadrant thinking model = rational self
2. B-quadrant thinking model = safekeeping self
3. C-quadrant thinking model = feeling self
4. D-quadrant thinking model = experimental self

The HBDI™ survey contains approximately120 items that can be profiled and displayed on a four-quadrant grid that overlays the whole brain metaphor model in four principle thinking structures. The east/west positions represent the separation between left brain and right brain. A north/south position references the separation between cerebral and limbic brain. These separations can be seen in an "analytical, logical and sequential approach to problem framing and solving" (Leonard & Straus, 1997b, p. 111), for example, left-brain cognition, which are clearly different from an "intuitive, value-based, and nonlinear approach" (Leonard & Straus, p. 111), which is a right-brain cognition.

The cerebral modes encompass "cognitive and intellectual thinking preferences" (Herrmann, 1996, p. 30), while limbic modes encompass "visceral, unstructured and instinctive" thinking modes (Herrmann, p. 30). The HBDI™ contains four quadrants that indicate a score on a circular grid of a primary, secondary, or tertiary preference, which map individual thinking style profiles.

1. Primary–A score of 67 or more indicates a strong preference and primary thinking style (1).
2. Secondary–A score of 34 to 66 is an indication of a secondary thinking style, which is neither preference nor avoidance (2).
3. Tertiary–A score of 0 to 33 is an indication of tertiary thinking style, which is a very low preference and possible avoidance that is highly visible in individuals (3).

The scoring codes use the numeric values 1, 2, and 3 and associates them to the quadrants "starting with upper left A and proceeding clockwise around the continuum to

upper right" D-quadrant (see Figure 6) (Herrmann, 1995, p. 71). The four quadrants with three preference scores can create close to mathematical possibilities but "about 12 profiles account for over 80% of the population surveyed to date" (Herrmann, pp. 71–72).

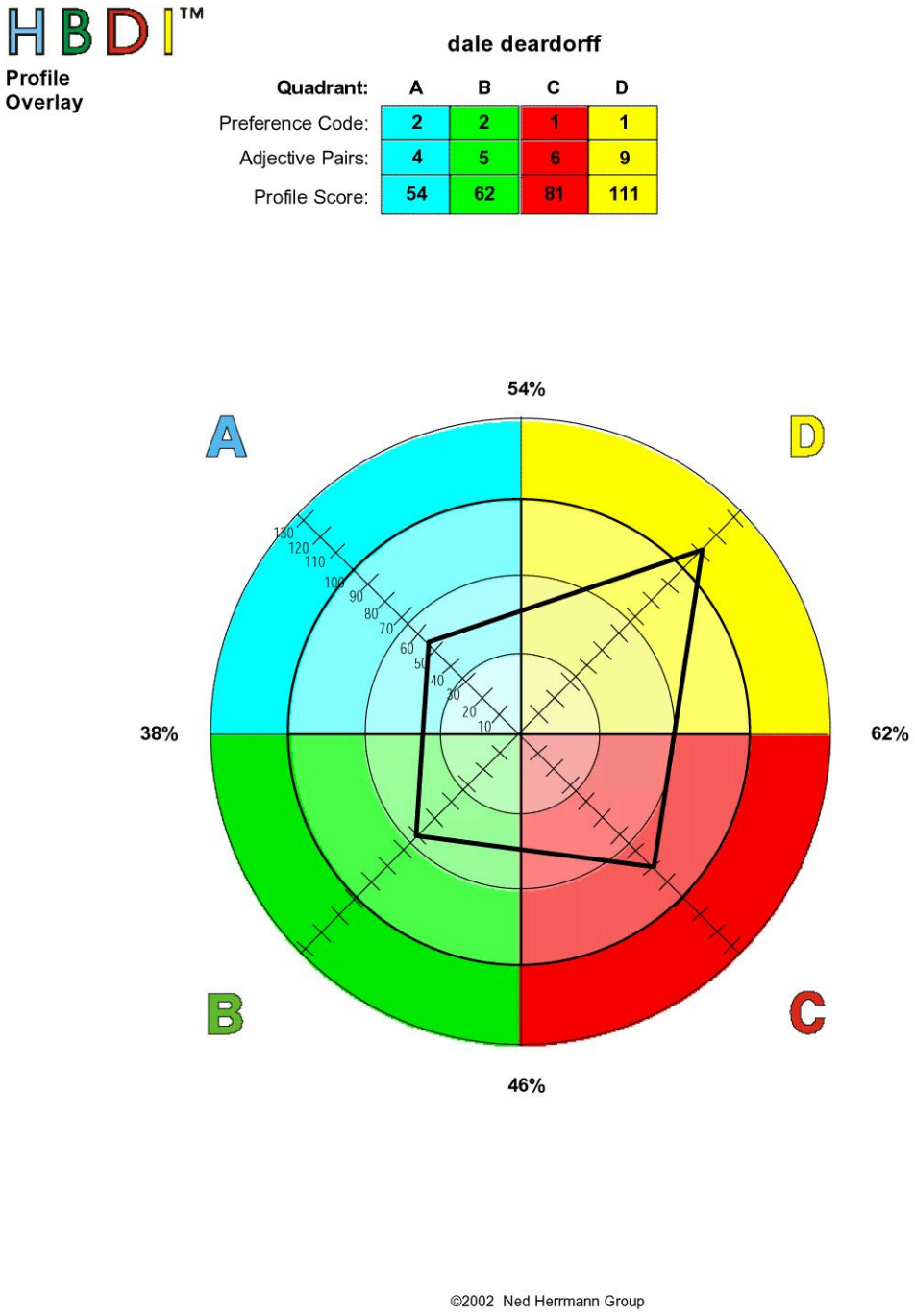


Figure 6. D-quadrant preference model (2211).

A-quadrant Dominant Profile

The A-quadrant is a cognitive upper brain representation of an individual who is left-brain. This upper brain cognitive feature means that conceptualizing is more valuable than feeling as a thinking style. The A-quadrant is a description of individual personal thinking characteristics that are typically described as "authoritarian, directive and business" oriented focused on tasks (Herrmann, 1996, p. 103). The tasks provide a level of comfort that is found in interaction with definite technical information. Domination in these thinking preferences is exhibited by members who are content working on problems to focus effort toward "thinking, processing and analytical interpretation" (Herrmann, p. 103) versus dialogue and informally talking through solutions to problems.

These people tend to live in a rational, technical world where things are explained through logic and factual orientation. Opinions are not considered important unless substantiated with empirical evidence and they can be characterized as "authoritarian or directive" (Herrmann, 1996, p. 105). The reason for this is the need and preference for clear lines of authority and rules. The A-quadrant thinking methodology is to reduce the complex to simple and the unclear to clear generating an output that takes the form of "principles, mathematical formulas and conclusions about where to go to next" (Herrmann, 1995, p. 79).

B-quadrant Dominant Profile

The B-quadrant is a visceral lower brain representation of an individual who is left-brain. This lower brain cognitive feature means that instincts are more valuable than the theory behind them as a thinking style. The B-quadrant is a description of individual personal thinking characteristics that are typically described as "highly traditional and

conservative" (Herrmann, 1996, p. 105). These people tend to excel in structure and enjoy detail and order in the work environment. Things are very black and white when it comes to decisions and rules, which are a valuable structure in the environment. The work performed would be productivity-based first in the form of a "documented procedure and strict schedules" (Herrmann, p. 105).

The B-quadrant is a verbal thinking preference that "takes a linear approach to things and rejects ambiguity" (Herrmann, 1995, p. 80). Part of the work ethic is to understand what has been worked on in the past so the future can be neat and organized and provide an environment for dependable decisions to be made according to long-established procedures. To accomplish this requires things to be done timely and correctly the first time around. A high level of "safety exists in the B-quadrant to the extent that they typically lack a sense of possibility" (Herrmann, p. 81) and sacrifice that for detail, clarity, and efficiency.

C-quadrant Dominant Profile

The C-quadrant is a visceral lower brain representation of an individual who is right-brain. This lower brain cognitive feature means that how things feel is more valuable than the theory behind them as a thinking style. The right-brain feature means that they are traditionally more intuitive, are immediately perceptive of change, and react "in a soothing or conciliatory way" (Herrmann, 1995, p. 82).

The C-quadrant exhibits a high degree of bodily-kinesthetic intelligence (Gardner, 1983) in that "perception and communication are experienced as a free flowing sequence of body sensing and movement" (Herrmann, 1995, p. 83). The primary mode is very spiritual and emotional, which is exhibited through nurturing and empathy. Most of what

the C-quadrant is communicating is very hard to verbalize in conversation flow but is built upon an established connection that is more important than the context of the message. They can be interpreted as talkative and are seen by others as "frustrating, unfocused and demanding" (Herrmann, p. 84).

D-quadrant Dominant Profile

The D-quadrant thrives on the excitement of creating new ideas or concepts that can lead to new possibilities or surprises. The ability to create vision exists, but the ability to complete the task does not. Within the preferences of the D-quadrant are inadequacies in the form of "explaining even something they are very clear about" (Herrmann, 1995, p. 85). This lack of clarity can be seen as impersonal because of the focus on oddities, incongruence, and questions that seem obvious.

Everything is created at a pace that is comfortable for the D-quadrant individual; they tend to not slow down to let someone else catch up" (Herrmann, 1995, p. 85). Structure "feels like it stops the flow of ideas and energy" by creating an unnecessary boundary at which logic prevents the free flow because it is based on a fixed interpretation of the past (Herrmann, p. 85). The D-quadrant individual can seem "holistic, risk-oriented, adventurous and entrepreneurial" (Herrmann, 1996, p. 113).

HBDI™ Group Profile

A group profile is a composite profile of all the members within a collective population. They will ultimately be describable as either homogeneous or heterogeneous (whole brain) in their composite and makeup for an overall thinking preference. Homogeneous means that there is a "coalition of mental preferences" (Herrmann, 1996, p. 124) among the members of the group. This ultimately means that everyone seems to

immediately feel they are aligned on the same thought or on the same wavelength. This team will "establish group norms or culture quickly," which can have a dual effect: they can focus and produce results in an accelerated environment, but the results can be poor (Herrmann, p. 125). Homogeneous groups of either gender makeup or concentration tend to "reach early consensus and settle on mediocre conclusions" (Herrmann, p. 125), which ultimately creates immature exploration of the subject and thinking as a product. When group members are not diverse among themselves, they have a tendency to fall into a groupthink mentality (Janis, 1973).

Heterogeneous of whole brain means there is a mixture of thinking preferences within the group. These different "diversity in thinking" styles can produce characteristics such as "synergistic, positive, hostile or disruptive" and their associated positive and negative impacts (Herrmann, 1996, p. 127). The hostile or disruptive characteristics of the group can mean that it is "difficult to reach consensus" (Herrmann, p. 128), but the positive side of the heterogeneous thinking group is the ability to explore diversity on many levels. This diversity can be seen in "respect and honor" (Herrmann, p. 128) associated with the recognition that the composite group contains common capabilities.

The A-quadrant was described by the females as requiring "technical, numerical, logical and analysis diagnostic work" which was seen as "boring and nitpicky" (Herrmann, 1996, p. 53). The men saw the C-quadrant as "relationship based involving people as individuals, teams or communities which requires the understanding of feelings and interpersonal transactions," which turned them off because of the sensitivity required (Herrmann, p. 53). The rest of the thinking preference was split evenly between the B-

and D-quadrants. Equal gender-balanced heterogeneous environments consume all the time available and typically ask for more, but they produce "the highest most imaginative, creative results" (Herrmann, p. 56). If change is constant for society to compete with the challenges of innovation, then leaders$_{a,b}$ "must function in all four of the brain's different modes" (Herrmann, 1995, p. 125) to communicate accurately to teams and their members.

HBDI™ Whole Brain

In the HBDI™ plot, all four quadrants are measured to determine which of the quadrants receives a primary thinking preference score. This provides a map of the individual thinking preference of the survey respondent and can be analyzed, interpreted, and substantiated through 25 years of previous research publications. A review of recent studies of large survey samples identified that only 7% are single dominant, 60% double dominant, 30% triple dominant, and 3% quadruple dominant. Whole brain is a philosophy for using all four quadrants of the brain and understanding that everyone has powerful dominant areas of thinking and other quadrant areas that are less instrumental in thinking methodologies. The ability to constructively access all four quadrants as a "mental function" (Herrmann, 1995, p. 127) is a powerful capability.

The quadruple dominant 1111 profile exhibits this accessibility of four quadrants. This profile occurs "three times more often" in the CEO of companies "than in any other population as a whole" (Herrmann, 1995, p. 131). Within this CEO population there is a sampling ratio that has a statistical breakdown for CEO profiles which is 9% quadruple dominant, 33% triple dominant, 41% double dominant, and 17% single dominant (Herrmann, p. 131).

The ability to think in the whole brain model is exhibited in the ability to communicate with others by "speaking the language" (Herrmann, 1995, p. 131) and then switching to understanding other quadrants' personality and thinking style. Juggling the practical application of common sense with logic manifests itself in the "ability to translate ideas from the language of one quadrant to that of the next" (Herrmann, p. 132). This translation is a thinking preference that is "evenly distributed through all four quadrants" (Herrmann, p. 134) and is potentially seen within the individual as a stronger right mode than exhibited by the surrounding group. Accessing the right mode preference allows the D-quadrant to provide "vision, global thinking and a bridge to the future" within the person (Herrmann, p. 134).

Accessing the D-quadrant is critical for encouraging innovation. Intrepreneurship, which is defined as entrepreneurship inside organizations, is carried out as a "D-quadrant function in a B-quadrant frame of reference" (Herrmann, 1995, p. 138).

HBDI ™ Innovation Thinking Preference

The D-quadrant is recognized as the innovation quadrant due to its placement in the upper cognitive brain and its position on the right-brain "intuitive, value-based, and nonlinear side" (Leonard & Straus, 1997b, p. 111). Two perfect examples of innovative individuals are Frederick Kekule and Albert Einstein. The nature of their thinking preferences and capabilities identifies them as a "minimum being double dominant in the A and D-quadrants" (Herrmann, 1995, p. 196). Kekule was struggling with defining the molecular structure of Benzene and all the traditional structures did not seem to fit. The use of a metaphor and an image of a "snake grabbing its own tail in its mouth" (Herrmann, 1996, p. 196) came to him in a dream. This is an example of the use of the

"A and D-quadrant together" (Herrmann, 1996, p. 197) to create something that neither quadrant could conceive independently.

Einstein dreamed of "himself riding on a beam of light" prior to the conceptualizing of the theory of relativity (Herrmann, 1996, p. 197). This ability to use both quadrants allows an individual to go back and forth between the brain's corpus callosum "bringing two different mental processes into a synergistic whole" (Herrmann, p. 197). Creativity and passion may provide an answer to the question of what makes us innovative. Children use their energy and passion, turning it outward toward exploration and inward toward feelings. They "reach out for everything they can—spiders, flowers, butterflies, blocks, hands, eyes, cats, food, wind, water, worms, you, music—everything," which creates that unique ability to ask the question why (Herrmann, p. 199). They follow their own interests, seek out and risk experimenting with new things, pay attention to their own rhythms, honor dreams and daydreams, and consider mistakes as information and play (Herrmann, pp. 200–202).

This ability to explore the D-quadrant is present in all but a few individuals. Its dominance provides a natural ability in innovation, but innovation is much more than just a thinking preference. It is a process requiring a personal framework such as the HBDI™ to understand and explore it and a cultural framework called the Innovation Cube that integrates the two to create a full understanding of innovation.

Social Science of Innovation

The term *social science* is used to generalize an area of thought and experience that incorporates what may be referred to as social settings that contain chaos, thereby establishing an autopoetic structure (King, 1994, pp. 68–69). A social setting is more than

one individual or a group working toward a goal, which it represents as the culture. This innovation culture is composed of features such as interconnections, systems thinking, water logic, paradox and duality, and bifurcation. It is a combination of semantic (i.e., meaning) and formal (e.g., temporal) information across auditory and visual channels creating perceptions.

Physiognomic perception relates to idea concepts in a personal "group technique for stimulating creativity called Synectics" (Stein, 1974, p. 86), which may also be utilized by individuals for concept generation. Synectics (Gordon, 1961) provides a unique approach to creative thinking that depends on looking at what appears on the surface as unrelated phenomena and draws relevant connections. Synectics uses prior learning and symbolic representation to create knowledge. This diverse knowledge provides "absorptive capacity, which allows new knowledge to be utilized in creative ways" (Cohen & Levinthal, as cited in Ford & Gioia, 1995, pp. 349–350).

New knowledge, thinking, and personal behavioral skills can lead to positive creative action or idea generation. "Prior knowledge of a domain is critical to, and may even be a prerequisite for, creative performance" (Amabile, 1988; Simon, 1986). Synectics creates new knowledge through the use of fantasy and analogy to "create solutions to existing problems" (Gordon, 1961), while adhering to the fundamental principles of brainstorming.

Within this format, group members are selected for a variety of experiences and expertise, which can be personally translated to the problem. "The use of wishful goals" (West & Farr, 1990, p. 209) produces a unique image that the group members use to help create solutions or ideas. This imagery is translated to the physical body of the group

members. An example would be the problem imagery of a teakettle that overheats. The group members (synectors, or those who practice synectics) might imagine there was a burner under their butt that was overheating and translate the natural physical reaction into ideas. As far fetched as it sounds, ideas around objects that expand to move away from the burner or place insulation in the way to prevent burning are the direction the synectics tool searches for. This can be accomplished through four kinds of psychological analogy that allow modeling of a general or specific problem.

1. Direct analogy. Similarity in some respects between things that are otherwise dissimilar.
2. Symbolic analogy. Describe problems as two contradictory words.
3. Magical analogy. Used like a magic wand where a person would ask the wand "what it wants to do."
4. Personal analogy. Empathy image created by the personal members in the group. (Ikovenko, June 15, 2002, personal lecture)

Analogous innovation is the "embodiment, combination, and/or synthesis of knowledge in novel, relevant, valued new products, processes or services" (Leonard & Swap, 1999a, p. 7).

Interconnections

To establish the current glossary definition of the term *interconnection* required assembling pieces of definition logic from specific areas. A connection is a simple joining of two elements together, but an interconnection is more. The closest technical discipline to describe it closely comes from brain research. In brain research, the process of thinking is described by the web of neurons that are connected multiple times, which

the different sections of the brain. The thinking process is a constant search for natural patterns that make sense.

Interconnections are a feature of innovation because they represent the dynamics of a "systems connection" (Ackoff, 1999b, pp. 23-25). This systems perspective on innovation is based on the view of "aspects, which previously were not seen, perceived or even suppressed in normal science" (Bertanlanffy, 1969, p. 18). Normal science does not recognize idea-creating systems because of the interconnected nature of the perceptions involved. When an idea is formulated through an innovation process, it assumes that a stimulus was used for an input to start with and a response creates the output. The stimulus–response (S-R) nature of a system "misses realms of play, exploratory activities, creativity, self-realization, etc." (Bertanlanffy, p. 107). This traditional perspective of a system is described by the actions of the elements, not the interactions of the connections between those elements inside the system. A system is a whole consisting of two or more pieces that maintain the following five conditions:

1. The whole has one or more defining properties or functions.
2. Each part in the set can affect the behavior or properties of the whole.
3. There is a subset of parts that is sufficient in one or more environments for carrying out the defining function of the whole; each of these parts is necessary but insufficient for carrying out the defining function.
4. The way that each essential part of the system affects the behavior or properties depends on (the behavior of properties of) at least one other part of the system.

5. The effect of any subset of essential parts on the system as a whole depends on the behavior of at least one other such subset. (Ackoff, 1999a, pp. 6–8)

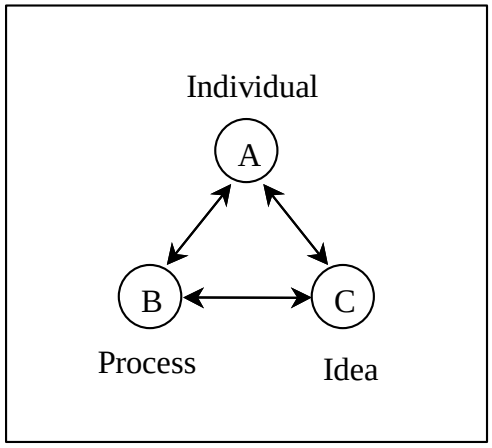


Figure 7. Bidirectional affect relationships.

Interconnections can be described as relationships as illustrated in Figure 7. This is a three-element diagram for a basic system that shows connections through bidirectional arrows indicating relationships that exist between the elements. The relationship between these elements could be positive, such as synergy or intuition, or negative, such as conflict and fear. Elements define the relationship between themselves and are sometimes referred to as variables where "the value of the outcome = a specified relationship between the controlled variables and the uncontrolled variables" (de Bono, 1993, pp. 16-28).

Classical systems theory integrates mathematics such as calculus to define or state principles that are reflective of general or open-and-closed innovation systems. Stated in a general way, specifically known innovation properties will apply to any "entity *qua* system even when its particular nature, parts, relations, etc., are unknown or not investigated" (Bertanlanffy, 1969, p. 20). This can be modeled or communicated in

ordinary language as a guiding idea even when it cannot be modeled mathematically and referred to as a "soft system" or "social system" (Checkland, 1999). Within the systems approach, innovation trends may be modeled as mechanistic or organic. The wholeness of the analysis may be reflected in linear, circular, or causality interactions that are also recognized as social dynamics. Understanding innovation systems performance is clear in a theory in which the system identity depends on how the innovation pieces or parts interact with each other and external characteristics such as individuals. These individuals create the interconnection through vision, which "can die if people forget their connection to one another" (Senge, 1990, p. 230).

A system is a whole whose essential characteristics and functions are not shared by any of the individual parts. For innovation, this refers to characteristics such as focus, adaption, and methodology. The optimal performance of innovation systems can be classified as "the *efficiency* with which it does whatever it does [and] the *effectiveness* of what it does" (Ackoff, 1999b, p. 10). The interconnection between effectiveness and efficiency must be evaluated with a perception to recognize how to do the right thing and the value of that action. According to Ackoff (1999b, p. 1), "It is better to do the right thing wrong than the wrong thing right." The clarity of this innovation systems theory is historically derived from the scientific movement, which was composed from the consequence of analytical thinking.

This thinking style was divided into analysis and synthesis. Analysis is synonymous with the Western philosophy of breaking separate pieces apart and trying to understand how the system works at an elemental level. If the individual elements do not interact with each other, they form an aggregation, not a system. This immature

understanding of the parts of the system is then "aggregated in an effort to explain the behavior or properties of the whole" (Ackoff, 1999a, p. 12). Synthesis is the understanding of the outer-containing system (subsystem or super system), which is disaggregated to identify or clarify the functions of the system being analyzed.

These outer-system conditions are referred to as the innovation environment, which is defined at a functional level. These functions can determine if an innovation system is open or closed. An open innovation system cannot be sufficient to function in all environments. Thus, an outside influence can determine the predictable functionality of the innovation system. A closed innovation system can operate in a predictable pattern with variation inside it, but it has no outside influences that modify its behavioral functionality.

Systems Thinking

To recognize the interdependence of innovation in social settings requires systems thinking, which is a discipline for interpreting and seeing wholes. It is a thinking framework for seeing interrelationships rather than pieces. It is a thinking shift of mind from seeing individual parts to seeing the whole and from seeing people as helpless reactors to situations of active participants shaping perceptions, change, and reality. Innovation requires creating the vision and the transition to the future. The innovation perception shift allows an understanding of the difference between detail complexity and dynamic complexity. Systems thinking provides the framework for seeing interrelationships rather than linear cause-and-effect chains and the awareness of the concept of feedback.

The limitations of system thinkers are in the recognition of circles of reality rather than the fragmentation of straight-line thinking. Plato's *Republic* presented this challenge of continual awareness as a challenge to man. "Therefore in an ideal state, as I conceived it, man would not be problem free, but would be capable of solving a continual flood of increasingly challenging problems" (as cited in Ackoff, 1999a, p. 141). To be successful takes understanding and recognition of both types of thinking. The integration of the understanding of detail complexity and dynamic complexity will allow a visual and cognitive clarity.

Water Logic

To better recognize innovation system properties requires an understanding of the perceptions, flowscapes, and directional impacts of *rock logic*. Rock logic is a tradition based on identity and the perception of *have* and *inclusion*, which may have been Aristotle's greatest contribution (de Bono, 1993, p. 9). Water logic is based on the premise of "what does this flow to–what does this lead to–what does this add up to" (de Bono, p. 9). It is unrealistic to believe that the behavior of relationships within a system needs to be "expressed in mathematical symbols which most people do not understand" (de Bono, p. 5). By reviewing a bidirectional affect relationships figure and adding three additional innovation components to it, the complexity of the Innovation Cube© theory can be systematically mapped.

The model of the Innovation Cube© has been symbolically unfolded and the "arrows between the blocks define the flowscapes, which describe perception" (de Bono, 1993, p. 5). Arrows illustrate "multi-directional repeating loops" (de Bono, p. 42), which allows a self-organizing system of stable loops. These loops allow entry and exit into the

described innovation system at any location in the theoretical cube. De Bono's water logic theorem for this states that "from any input a system with a finite number of stable states and a tiring factor will always reach a stable repeating pattern," which can be seen in Figure 8 (de Bono, p. 42).

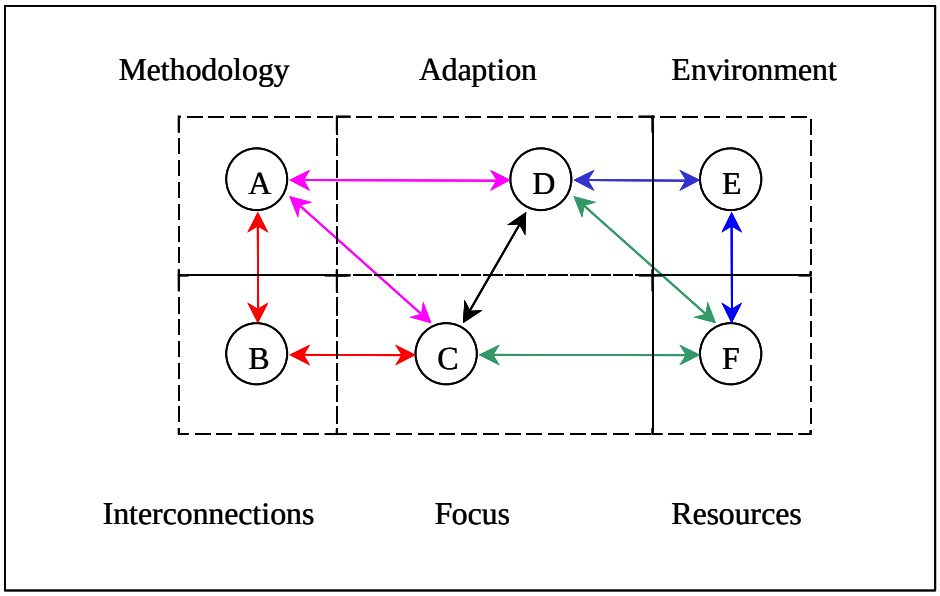


Figure 8. Multidirectional interconnected relationship.

The Innovation Cube© conceptual model can be translated into a system of flowscapes that will allow users to lead themselves to "different ideas" (de Bono, 1993, p. 14) depending on the path they choose. The purpose of any conceptual model is to provide something useful; otherwise, models remain mere descriptions and "one description is as good as another" (de Bono, p. 75).

The Innovation Cube© flowscape model is meant to describe the inner world perception of a system of innovation as opposed to the traditional recognition of separate characteristics and the random integration of individual pieces. Deming (1994) captured the spirit, necessity, and essence of this type of system by recognizing that "if the whole is optimized, the components will not be" (p. 58).

Paradox and Duality

Exploration into the cognitive balance uncovers the concept of paradoxical intention, which is very much like a metaphysical paradoxical equation. In logotherapy theory, the mind and how we construct meaning are projected to the future. The realism of the situation is forced cognitively toward inventing an existence in the mind (Frankl, 1984, pp. 119–157). This new dimension creates tension dynamics in a polar field allowing the opportunity for innovation in a "Bifurcation Area" (Morgan, 1998n p. 225). It is proposed by G. Morgan that innovation existentialism is a philosophy that emphasizes the uniqueness and isolation of the individual experience in a hostile or indifferent universe, it regards human existence as unexplainable, and stresses freedom of choice and responsibility for the consequences of one's acts: free will versus consequentialism.

V. Frankl (1984) described the existential world or culture and the existence of a specifically human dimension called "Noögenic Neuroses" (p. 120). *Noös* comes from the Greek root meaning mind dimension. This neurosis is a cognitive tension between the current situation and another situation that exists in another time, typically the future, establishing an environment for personal cognitive paradox. As described, the symptom diminishes and finally atrophies, but individuals are cognitively warned by instinct that there exists a dangerous misconception that must be avoided in striving for equilibrium.

The human mind requires cognitive stability that is independent of this. Any questioning or challenging of the "basic assumptions" (Schein, 1992, p. 23) releases a defense mechanism that causes anxiety. This means that cognitively as meaning is

constructed, it contains an inherent situational paradox, and along with that tension comes the opportunity for innovation.

These paradoxes become the internal conflicts that are visible and experienced at one specific time and place and provide the underlying assumptions visible within the social environment. Paradoxes are exhibited as conflict between each other if they can be recognized (Schein, 1992, p. 17). De Bono (1993) described this as "a sort of paradox in the mind that is extremely good at recognizing things and yet poor at noticing things" (p. 149). Therefore, unless a specific effort is made to recognize the paradox, it is invisible and not noticeable.

Bifurcation

This paradox is typically not understood at an individual definitive level. It is authored by G. Morgan (1998) that the area of paradox conflict intersects or combines and is referred to as a bifurcation area. The sudden appearance of a problem is the uncomfortable trigger alerting us that a conflict exists and there is a lack of balance between the paradoxes. When the two features coexist in balance, they are not recognized as competing. They simply exist as being there.

The resurgence of this conflict can be exhibited as trying to solve a problem that has been previously solved or repeatedly creating innovation that has been previously created (G. Morgan, 1998, p. 249). Further, during naive analysis of the situation, sometimes the initial response or objective is to make the competing theory go away, but the "paradox cannot be successfully resolved by eliminating one side" (G. Morgan, p. 251). The equilibrium between the two is unbalanced, caused by a swing in the polarity and an area of potential innovation called bifurcation.

That bifurcation area and the interaction that happens in it are graphically represented referencing the organizational problems associated with the competing theories of working together versus working independently. The bifurcation area exists when two competing ideas collide or mix together. Suddenly, the competing theories cause organizational conflict and three possibilities can exist:

1. *Rebalance of paradoxes*. A shift back from the intersection by one side or the other will allow both sides to regain equilibrium, which will make the conflict appear to disappear.
2. *Remain competing*. The organization ignores the conflict and the imbalance continues, which causes organizational conflict and problems but only for those who immediately experience the paradox.
3. *Innovation*. A conscious or nonconscious event is initiated to create a new idea or combination of existing or new ideas forming a new paradox with historic lineage back to the two original competing paradoxes.

Managing Innovation

The premise of managing innovation is a challenge at best and a frustrating journey of schedule and product challenges that relate to never-ending people problems. When the "professional manager finally reins in the mess, they can create order out of chaos, but they can also kill the entrepreneurial spirit" (Collins, 2001, p. 121). Senior management must team with radical innovators to create an "innovation friendly culture" consisting of a positive organizational structure (Leifer et al., 2000, p. 181).

This double-edged sword challenges mangers to create rules, but many entrepreneurs have a different philosophy. For them to succeed they may need to "flaunt

conventional rules" (A. Morgan, 1999, p. 196). One of the hardest tasks for a manager is the changing of a cultural direction. To accomplish this requires "changing the basis reference points and changing the core vocabulary to describe the task ahead" (A. Morgan, p. 197). This requires shaping the organization in ways that make "radical innovation a more natural, accepted and valued activity" (Leifer et al., 2000, p. 164). This an be accomplished by creating organizational challengers who are responsible for questioning why things are the way they are, which will allow a "flying instability" in the "organization to provide flexibility and innovation" (A. Morgan, p. 196). This flexibility in innovation should be seen as management taking steps to minimize unnecessary obstacles.

Once the flexible and innovative structure is in place, a special environment will start to flourish. This environment will contain "an investigative spirit" for innovators that will "encourage their work and provide recognition and rewards" (Leifer et al., 2000, p. 65). This sets the stage for organizations that understand the need to "incentivize and reward people for being innovative rather than playing it safe" (A. Morgan, 1999, p. 199). The social and psychological environments are important, and managers must strive to create a culture that is "safe, desirable and even for the group members to express creativity" (Leonard & Swap, 1999b, p. 165).

This moves beyond traditional supervisory roles and requires "managing creativity which inspires passion and enables serendipity" while mixing cultural differences to aid the positive features of creativity (Leonard & Swap, 1999b, p. 165). Passion is a unique feature of personality that cannot be manufactured. Organizations and

managers must strive to “discover what ignites passion and the passion of those around” them to fuel entrepreneurial success and imagination (Collins, 2001, p. 109).

Innovation Stories

The history and stories told within the social setting and culture have a direct impact on the ability of people to perform today and in the future. One of the strongest innovation cultures documented exists at 3M, where everyone talks about “D. Drew the inventor of Scotch tape” (Gundling, 2000, p. 73). The culture of previous success is translated into Appledorn’s citing of three vital factors in fostering innovation: culture, communication and style” (Gundling, p. 72). That history concludes that managing technical innovation successfully requires the following:

1. Heroes, freedom, excitement and anticipation, never giving up, understanding there is value in failure and fun
2. Mentoring, a clear vision, ambitious goals, planning, opening doors, interfacing with the customer and rewards
3. Personal involvement, being a servant, eliminating barriers, breaking the rules, trust and credibility, risk taking, being a champion, taking time, giving credit, and empowerment (Gundling, p. 79)

IDEO, a creativity and innovation company in Northern California, has tried to establish what it calls “organizational lobbies” (Leonard & Swap, 1999b, p. 158). These are similar to the homes of the people who work there: “they tell a lot about the culture and values of the inhabitants” (Leonard & Swap, p. 158). IDEO strongly believes that “creativity groups are made not born” (Leonard & Swap, p. 164) and that a group of “ordinary intelligent people in a creative environment are more likely to innovate than a

group of creative people in a stifling environment" (Leonard & Swap, p. 164). Moreover, the company has written two books about the IDEO culture and environment to tell the story for others to understand.

MCI's Richard Liebhaber sees innovation as a key element in risk taking and visa versa. Liebhabners philosophy is that MCI does not shoot people who make innovation mistakes: "we shoot people who do not take risks" (Leonard & Swap, 1999b, p. 165). Amgen, a biomedical company in Southern California, which has taken over some of Abbott Pharmaceuticals' products, has created a very "disciplined organization" (Collins, 2001, p. 123) when it comes to innovation but not in a "linear way of thinking" (Collins, p. 123). Amgen uses financial discipline as a way to provide resources for really innovative projects. A by-product of this culture is people who take "disciplined action" which tries to do the following:

1. Build a culture around the idea of freedom and responsibility within a framework
2. Fill the culture with disciplined people who are willing to go to extreme lengths to fulfill their responsibility
3. Don't confuse a culture of discipline with a tyrannical disciplinarian. (Collins, pp. 123–124)

SAS was challenged with a traditional bureaucratic model for power and authority, which desperately needed to change for the company to survive. Jan Carlzon selected one person from the organization and instructed that person that he was "putting them in absolute power of delivering this goal" (A. Morgan, 1999, p. 197). The individual was not allowed to have budget control over the goal, but did hold "ultimate power" (A. Morgan, p. 197) and was responsible for turning the organizational pyramid

upside down and providing accountability and responsibility at the lowest level where it could be effective.

Herb Keller from Southwest Airlines described his recruitment strategy as being "primarily a search for a sense of humor, for the right attitude" (A. Morgan, 1999, p. 199). These stories provide a glimpse into what is required as a collective innovation and creativity-centered environment or culture. The impact of the stories personalizes the message into a form that everyone can understand in relation to his or her own position in a company.

Summary

This literature review revealed that there are historical relationships between the multidimensional aspects of innovation (Rogers, 1995), the individual and group thinking preferences offered by Herrmann (1996), process innovation (Maher, 2001), social science (King, 1994), and the characteristics of innovation culture (West & Farr, 1990). The literature, however, did not explicitly determine which innovation features are required to create an innovation culture in the PLAY consulting company in Richmond, Virginia.

This literature review sought to explain and clarify current literature related to innovation characterized in six areas:

1. Literature that defines the historical tenets.
2. Literature that defines organizational innovation.
3. Literature that defines process innovation.
4. Literature that defines circumplex models.
5. Literature that defines the HBDI™

6. Literature that defines the social science of innovation.

Moreover, this literature review sought to explore the current literature in relation to the following research questions:

Research Question 1: How do change agents use different thinking preferences to measure innovation?

Research Question 2: How do change agents use different thinking preferences to measure an innovation culture?

Research Question 3: How do psychometric instruments measure innovation?

This study seeks to explore the characteristics available for innovation leaders$_a$ and to understand the interconnected nature between those features as revealed through the use of the HBDI^{TM}, interviews, and conversations.

Chapter 3 describes in detail (a) the nature and source of data, (b) the research design, (c) validity and method appropriateness, (d) qualitative approaches, (e) the research process, (f) the study instruments, (g) use of research tools, and (h) the study's feasibility and appropriateness.

CHAPTER 3: RESEARCH METHODS

As presented in chapter 1, the purpose of this case study is to explore the role of the HBDI™ as a measure of innovation by change agents and leaders$_a$ in a creative social structure. Bass (1990) supported the use of qualitative research for leadership by stating, "Qualitative research is needed and is likely to find its way into the study of leadership as the limitations of quantitative methods in dealing with organizational complexities become increasingly apparent" (p. 887). Qualitative research provides "verbal or visual descriptions of a phenomenon" (Strocchia, 2003, p. 68). A case study approach to identifying innovation and change agents clarifies this as a valid qualitative study (Lincoln, 1985).

Additionally, the study seeks to present characteristics and social science factors that contribute to innovation, an ingredient that business leaders$_{a,b}$ require to assist in creating novel ideas. These novel ideas may determine the success of product and process development and create change. The research required instruments that "can reveal information about aptitudes, academic achievement, and various aspects of personality" (Gall et al., 1996, p. 245). Creswell (1994) defined a qualitative study as "an inquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting" (p. 1).

Strong qualitative research measurements were collected from a triangulation of initial study HBDI™ data, PLAY case study interviews, and PLAY HBDI™ data as seen in Figure 9. The HBDI™ research includes objectivity, standard conditions of administration, and scoring and produce normative data with reliability and validation.

The use of triangulation reduces the risk of "systemic distortions inherit in the use of only one method, because no single method is completely free from all possible validity threats" (Bickman & Rog, 1998, p. 93). Researchers begin the process of measurement by defining the construct of interest operationally and then identifying the activities used to measure it.

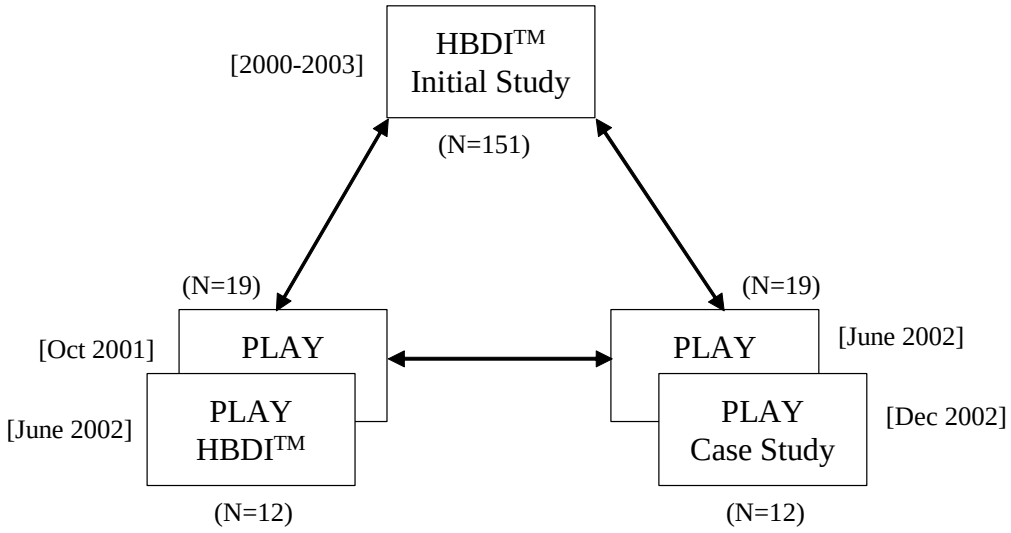


Figure 9. Research triangulation.

These activities or tests were designed so that an individual's performance was assigned a numerical score. "Inferences can be made about how individuals differ in the construct measured by the test" (Gall et al., 1996, p. 246). The inquiry measurements provide insights into "aspects of personality, self-concept, learning styles, attitudes, values, interests and other related constructs" (Gall et al., p. 246).

Research Design

The qualitative study performed is a triangulation of a HBDI™ initial study, a PLAY case study composed of HBDI™, individual interviews, participant observations, and data analysis. This triangulation of empirical data-gathering methods provides

accurate measurements of the characteristics of innovation in a current organizational social culture, as seen in Table 2.

Table 2

Empirical Research Material Sources and Instruments

Source	Purpose	Instrument
Initial Study	Collect personal thinking preference of a wide range of change agents.	HBDI™
PLAY Company Case Study	Collect personal thinking preference from a small intact social setting.	HBDI™
PLAY Company Case Study	Gather history and information unavailable through observations.	Interviews
PLAY Company Internal Illustrations	Gather information unobtrusively and provide additional insights into actions of the research participants.	Documents
PLAY Company HBDI™ Intervention	Gain information as it evolves from participants learning process.	Intervention
PLAY Company Innovation Training	Gain insights into Innovation process at PLAY through participating as a learner.	Training

The research data from this study are both nonnumeric and numeric. The term *empirical data* is used for the non-HBDI™ inquiry research. Figure 10 shows the relationship between empirical material sources, purposes, and instruments. Triangulation of data collection methods in the design of this case study includes interviews, participant observations, and document analysis (Locke, Silverman, & Spirduso, 1998).

The HBDI™ initial study community was defined as 151 individuals who are self-declared as innovation change agents within their organizations. The purpose of the

initial study was to draw a large group of organizational individuals into a sample population to determine if the D-quadrant thinking preference was dominant and primary.

The PLAY descriptive case study allowed for a wider research context than other research designs and encouraged the gathering and comparison of inquiry data from multiple sources. A case study is useful to "uncover the interaction of significant factors characterizing a phenomenon" such as innovation (Merriam, 1988, p. 10).

Specifically, HBDI™ data consisting of numeric and symbolic characterizations of a phenomenon (an object, a process, a system) generated numeric descriptive equations characterizing this phenomenon and qualitative conditions under which these equations apply. These equations were then used for predicting the behavior of this system or process. Within the PLAY case study design was the exploration of the 19-member organization at many levels. The primary component was the exploration of the PLAY individuals and their thinking preferences that were captured with the HBDI™.

An additional component to the research triangulation was the use of interviews with the PLAY case study participants. These interviews determined the individual applicability of the HBDI™ when added as components to an innovation social organization containing different thinking preferences. This triangulation of innovation research required a sophisticated knowledge about the multiple paradigms presented (Kuhn, 1996). A qualitative research design allows for exploration of the innovation components that "form an integrated and interacting whole" (Bickman & Rog, 1998, p. 71).

Qualitative research sampling means "to take part of some population to represent the whole population" (Alreck & Settle, 1995, p. 54). To accomplish that sampling

required the consideration of not only the data but also limitations, biases, and potential sampling errors that could have occurred when creating and finalizing the sample frame.

The PLAY case study sample frame was comprised of 19 members from an innovation consulting company located in Richmond, Virginia. The sampling of this innovation population was based on employment by the consulting company, but not necessarily at the Richmond location. The company had additional employees in Seattle, Washington and New York. All members shared common criteria of membership as a change agent (Ulrich, 1997) of innovation. This is considered a common demographic research characteristic.

In any research there are "reasonable (even inevitable) compromises with the ideal" (Locke et al., 1998, p. 55). To increase confidence in the research, 100% of the population employed by the PLAY Company was utilized for the HBDI™. The company was observed for the duration of roughly 2 years. Due to organizational downsizing, only 12 participants of the original 19 member PLAY population were included in the case study interviews.

Appropriateness of Methods

A qualitative research approach was justified and appropriate because it considered a deeper view of the human experience through the use of "converging lines of evidence" (Bickman & Rog, 1998, p. 231). Yin (1994) identified six sources of evidence to provide a complete array for research triangulation: documentation, archival records, interviews, direct observations, participant observations, and physical artifacts.

The qualitative research approach contrasts the quantitative research approach, which separates the researchers from the experience that theoretically minimizes internal

and external biases (Creswell, 2003). Qualitative descriptive research does not imply any fewer rigors, but rather "the researcher enters the field with an open mind, not an empty head" (Bickman & Rog, 1998, p. 473). Biases can be controlled and channeled to produce positive results to focus and limit the research effort. Triangulation is seen as a check on the negative influence of bias.

A case study researcher is like an archeologist and human instrument who is allowed to use personal observations within an organization to identify and classify the individuals, culture, and social science interactions. The descriptive research report is described by Dobbert as having five parts:

> (1) a statement of the study questions and the situations and problems that led to them, (2) a description of the background research and theory used to refine the study questions and design the study, (3) a detailed review of the study design, (4) a presentation of the data, and (5) explanation of the findings. (As cited in Gall et al., 1996, p. 617)

In summary, the use of a qualitative HBDI™ initial study, a PLAY HBDI™ study, and a PLAY case study was completely investigated with the use of a descriptive inquiry approach. The immersion of the researcher into the group and culture led to a valid documentation of predictable patterns of human thought and behavior.

Research Instruments

The researcher used two qualitative research instruments to identify innovation within individuals and the social culture: The HBDI™ personal thinking instrument and a descriptive case study. According to Lundsford (1980), a descriptive and archeological view of innovation will potentially lead to identification of the inability "to

‘conceptualize and generalize’ the personal direction required to reason out the interconnections between personal experiences and the lives of others” (Bizzell, 1994, pp. 132–133).

HBDI™ Research Instrument

To accurately define innovation requires the identification of individual features or characteristics for thinking preferences. It is said that creative or innovative people think differently from other people around them (Sternberg, 1999, pp. 189–212). One measure of that innovative characteristic is the HBDI™.

The HBDI™ is a personal thinking preference indicator, developed by Ned Herrmann when he worked for General Electric in the early 1970s. His research focused in the area of cognitive measurement tools that generated research in the split-brain (Sperry & Sperry, 1982) and four-quadrant theory (Herrmann, 1995). This is different from the Jungian psychological type preferences achievable through the MBTI or the behavior mapping available from PDI Profiler®, a 360-degree assessment tool.

Herrmann (1995, 1996) believed the individual knew himself or herself better and more accurately and the use of an individual or personal psychometric evaluation (HBDI™) was more insightful to determine one’s thinking preference. The brain is divided into upper cognitive processing skills and lower visceral feeling skills. This separation is then developed into a series of four quadrants by adding right brain and left brain to the model. The HBDI™ is plotted against a four-quadrant separation of the thinking preferences. All four quadrants are measured in the HBDI™ data plot to determine which of the quadrants receives a primary thinking preference score. These quantitative data provide a map of the individual thinking preference of the survey

respondent and can be analyzed, interpreted, and substantiated against 25 years of previous research publication, individual data plots, and theory assumptions. The research home page is available in Figure 10.

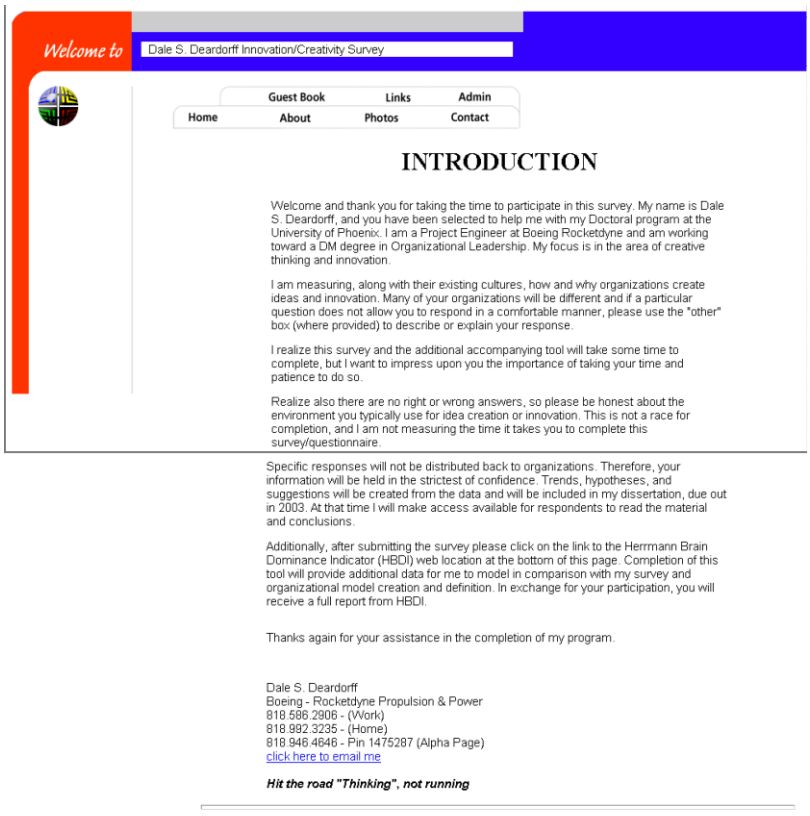


Figure 10. Internet survey research portal.

PLAY Case Study Research

Interviewing the members of the case study provides results that are a descriptive "recollection and introspective reflection" of the organizational culture for documentation (Piantanida & Garman, 1999, p. 142). Innovation is more than just the organizational culture; it is also a personal description of the individuals.

The case study interview process is an "attempt to describe and elucidate the meanings of human experience" (Rudestam & Newton, 2001, p. 38). Much of the detail and observation for this heuristic research required the researcher to unveil and create

new meaning at a level of structure and experiences by listening and observing (Moustaka, 1994, as cited in Rudestam & Newton, p. 38).

This interview structure consisted of 10 questions targeted at separate levels of innovation: individual, group innovation, and leadership. The questions are a mixture of closed and open ended. The closed-ended questions were used to "quantify behavior patterns" (Bickman & Rog, 1998, p. 482) of innovation. Open-ended questions were used to allow the research participants to paraphrase in their own words the confirmation or denial of the closed-ended question. The aim of these questions was to produce a consistent identification and description of the group's cultural norm. Case study interview questions were designed as follows (Appendix A):

Individual centered: This set of questions explored whether the HBDI™ thinking preference report for the individual was valid and consistent for identifying the measurements of the Herrmann four-quadrant whole brain model.

Group centered: This set of questions explored whether the HBDI™ composite report for the group was valid and consistent for identifying the measurements of the Herrmann four-quadrant whole brain model.

Innovation centered: This set of questions explored whether innovation could be identified within the construct of the HBDI™ model, the indicators of innovation, and the weaknesses within the HBDI™ model for measuring innovation.

The primary $leader_a$ of the PLAY Company had an additional component of three questions targeted around transformational leadership (Appendix B). This set of questions explored from the $leader_a$'s perspective whether the HBDI™ could identify organizational weaknesses. The questions exposed whether deliberate changes were made

due to the HBDI™ profiles and whether those changes were initiated by the PLAY individuals or the PLAY leader$_a$. In the past two decades, "leaders who are on the cutting edge have embraced the notion of whole-brain thinking and have taken steps to ensure that their organizations benefit from it" (Cassidy, 1998, p. 725).

A paper copy of the questions was supplied to the interview participants immediately prior to the interview. The questions were read to the participants by the researcher from the paper copy prior to their responses.

The HBDI™ results data will be presented to the case study innovation consultant company in the form of interventions and outbrief reports to the members. Once the HBDI™ material was understood, the case study interviews were conducted. During the interviews of the research participants, a process questionnaire checklist was used to mark off the responses once they were completed.

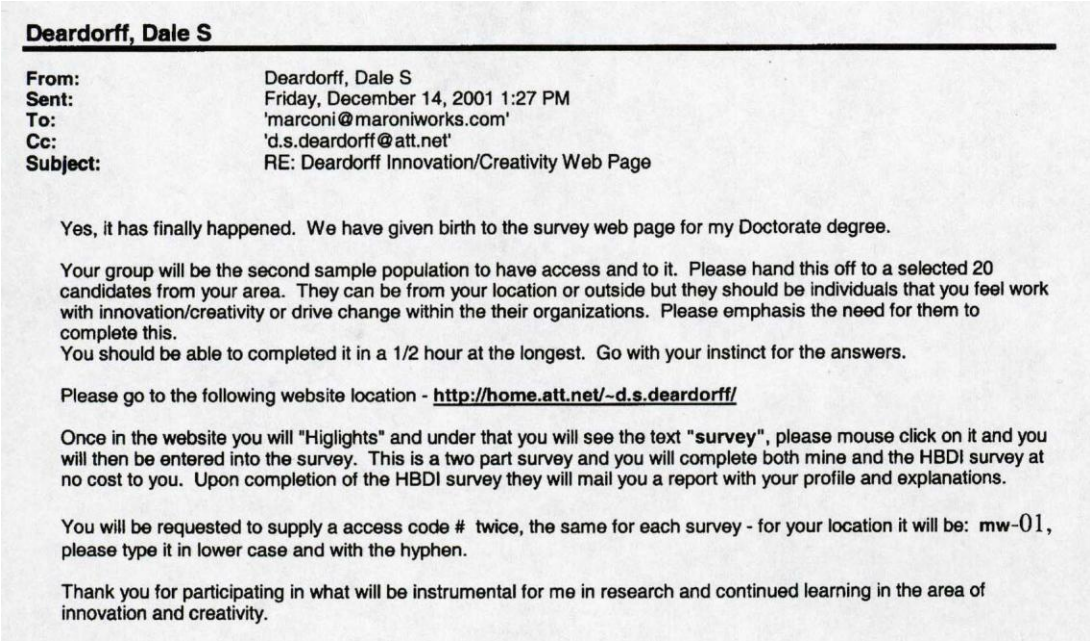
Sampling Methods

A sample is defined as a "model of the population or a subset of the population that is used to gain information about the entire population" (Bickman & Rog, 1999, p. 102). The research was composed of two different nonprobabilistic sample populations: a initial study sample and a case study sample.

HBDI™ Initial Study Sample

The initial study is a combination of convenience and snowball sampling (Gall et al., 1996, p. 234). Research partners from approximately 40 different high-technology companies across the United States, Canada, and England were contacted and asked to participate in a initial HBDI™ profiling study. These partners agreed that they could be described as innovation change agents (Ulrich, 1997) within their organizations and were

allowed to select an additional 10 to 20 candidates from within their social culture who met these criteria. This snowball strategy allowed group members to identify additional members to be included in the sample. An introductory e-mail letter was sent to the participants that outlined these research criteria seen in Figure 11.



Deardorff, Dale S

From: Deardorff, Dale S
Sent: Friday, December 14, 2001 1:27 PM
To: 'marconi@maroniworks.com'
Cc: 'd.s.deardorff@att.net'
Subject: RE: Deardorff Innovation/Creativity Web Page

Yes, it has finally happened. We have given birth to the survey web page for my Doctorate degree.

Your group will be the second sample population to have access and to it. Please hand this off to a selected 20 candidates from your area. They can be from your location or outside but they should be individuals that you feel work with innovation/creativity or drive change within the their organizations. Please emphasis the need for them to complete this.
You should be able to completed it in a 1/2 hour at the longest. Go with your instinct for the answers.

Please go to the following website location - **http://home.att.net/~d.s.deardorff/**

Once in the website you will "Higlights" and under that you will see the text "**survey**", please mouse click on it and you will then be entered into the survey. This is a two part survey and you will complete both mine and the HBDI survey at no cost to you. Upon completion of the HBDI survey they will mail you a report with your profile and explanations.

You will be requested to supply a access code # twice, the same for each survey - for your location it will be: **mw**-01, please type it in lower case and with the hyphen.

Thank you for participating in what will be instrumental for me in research and continued learning in the area of innovation and creativity.

Figure 11. Introductory research partner e-mail.

The sample population captured for the initial study was 151 (n = 151) participants who met the original criteria. Henry (1990) indicated that a response to initial research contact is often as low as 50%. To maximize the response participation, a series of reminder e-mails was sent to the research partners to pass along to the potential research participants to remind them of research deadlines, participation constraints, and cutoff dates.

PLAY Case Study Sample

The case study sample was 100% of the employed 12 members of the PLAY organization at the time of interviews in June 2003. Those 12 members did not require

sampling since they represented the entire population. Original contact with the PLAY organization was with 19 organizational members in 2002 who all participated in the HBDI™. These members were all considered full-time employees in Richmond, Virginia, or satellite employees located in Seattle, Washington, and New York.

Due to organizational and business economic fluctuations, a downsizing of the permanent staff occurred, which left 12 original members who were included in the case study interviews and HBDI™ profiling. Nonresponse could not produce a sampling error in this study; however, bias errors could occur if the interview respondents who chose not to participate were different from those who did. A HBDI™ composite profile for the PLAY organization was created for the population of 19 members and 12 members to provide indication as to a potential shift in the organizational personal thinking preference profile. Any part-time or intern members who may have been present in the organization from 2002 to 2004 were not included in the research population.

Validity and Design Limitations

The qualitative research method is limited in many systematic ways. Each source of empirical evidence contains feature strengths and weaknesses. Triangulation is used to balance the descriptive research providing validity by "testing one source of information against another to strip away alternative explanations" (Bickman & Rog, 1998, p. 495). General methods for increasing the validity of the qualitative study require that the researcher "search for, and defend, the criteria that best apply to his or her work" (Clandinin, 1990, p. 7). The criteria that best fit this case study are as follows (Glesne, 1999):

1. *Prolonged engagement and persistent observation.* Requires extended time in the field to develop trust, learn the culture, and check hunches.
2. *Triangulation.* Requires the use of multiple data collection methods, multiple sources, multiple investigators, or multiple theoretical perspectives.
3. *Peer review and debriefing*. Requires external reflection and input on inquiry work.
4. *Negative case analysis.* Requires the continuous search for negative cases and unconfirmed evidence to refine the working hypothesis.
5. *Clarification of researcher bias*. Requires reflection upon self-subjectivity and how it will be used and monitored it in the research.
6. *Member checking.* Requires sharing interview transcripts, analytical thoughts, and drafts of the final report with research participants to confirm they and their ideas are correctly represented.
7. *Rich, thick description.* Requires that the writing allows the reader to enter the research context.
8. *External audit*. Requires an outside person to examine the research process and product by auditing field notes, research journal, analytical coding scheme, and so on. (Cousier, 2001, pp. 72–73).

Initial Study Research Validity

Creswell (1998) suggested using the term *verification* instead of *validation* when using qualitative research. Verification is a construct of the trustworthiness and authenticity in data (Lincoln & Guba, 1995). This trustworthiness for the initial study research is embedded in the reliability of the HBDI™. The HBDI™ validity is

constructed through numerous research and dissertation studies. The following six specific studies are cited in Herrmann (1995, p. 352):

1. *Study 1.* A literature review conducted in 1979, which spanned multiple-measurement domains, including cognitive aptitudes, personality, thinking styles, learning styles, and learning strategies.
2. *Study 2*. External construct validation containing a factor analysis of the 1979 version of the instrument applied against a set of scores derived from the current participation survey and 20 questions instruments.
3. *Study 3.* Internal construct validation containing an item factor analysis of 439 cases that include both General Electric and non-General Electric participants in management education workshops.
4. *Study 4*. External construct validation containing a second factor analysis, which used the old instrument but the new scoring procedure, and applied the same data set described in Study 2.
5. *Study 5*. External construct validation containing the third factor analysis performed by Olson and Bunderson in 1982 using the new instrument and a battery of cognitive ability tests, several instruments measuring personality dimensions, and learning and thinking styles and strategies.
6. *Study 6.* Internal construct validation containing a study conducted in conjunction with Ho's doctoral work in instructional science at Brigham Young University (Ho, 1987). The study contained about 8,000 HBD instruments obtained through a variety of workshops conducted by Herrmann and his colleagues during 1984, 1985, and 1986.

HBDI™ Validity

Validity of a test or questionnaire instrument refers to the appropriateness, meaningfulness, and usefulness of specific inferences made from the test scores. It is not the test scores themselves that are valid or not valid, but rather the specific inferences made from the test scores. There are several types of evidence used to support the validity of different HBDI™ inferences. These include content-related evidence, criterion-related evidence, and construct-related evidence (Herrmann, 1995).

Context-related evidence of validity. Refers to the closeness of the match between the HBDI™ content categories involved in some description of a content domain and the context of the items in the instrument, but it is not a test of knowledge (Herrmann, 1995).

Criterion-related evidence of validity. Refers to the HBDI™ scores themselves, which may be used as a criterion to select groups of people of distinctly different profiles to validate inferences about how these people will react or perform on some other measure of interest (Herrmann, 1995).

Construct-related evidence of validity. Refers to concepts about some type of human trait, capability, kind of process, and so forth that is not directly observable (Herrmann, 1995). Herrmann's ideas of left and right brain and four-quadrant dominance are theoretical constructs.

The HBDI™ is appropriate for use in, but is not limited to the future;

> (a) better understanding of self and others, (b) enhanced communication, (c) enhanced productivity through teamwork, (d) work climate for creativity, (e) authenticity, (f) enhanced teaching and learning, (g) better management, (h)

counseling, (i) and, building composite learning groups (Bunderson, 1980; Sheil, 2003)

HBDI™ Research Generalizability

The generalizability of the HBDI™ is an indication of how the instrument is valid across different situations or contexts. "The scores should be construct valid for either sex and for different cultures" (Bunderson, 1980). The generalizability of qualitative studies is typically not based on explicit sampling of a defined population but more often the "development of a theory which can be extended to other cases" (Bickman & Rog, 1998, p. 95). Bickman and Rog (1998) propose that the generalizability of the study would be consistent for any organization that duplicates the same assumptions followed in this inquiry.

Case Study Research Validity

There are multiple steps for validity of the PLAY case study. Nonstatistical procedures for trustworthiness include continuous observation, peer review and debriefing, clarification of research bias, updated member checks, and accurate journaling comprised of rich and thick descriptions (Braud & Anderson, 1998; Creswell, 1998). A strong rigor can be applied to journaling, which matches Michael Patton's (1990) 10 suggestions for conducting qualitative research.

This research captures different kinds of data gathered from "different perspectives, plus the perspectives of a few dedicated sources to give perspective and clarity to historical information" (Carten, 2002, p. 25). Two key resources from PLAY were instrumental in providing their wisdom and unique perspective for cross-validation and triangulation of the data as "informants" (Patton, 1990).

The grounding of the concepts of the study came from rich textual data transcribed directly from the recorded conversations. These conversations represent constructs that are created by the "generation of increasingly focused interviews based on information which was initially determined to be important to the local culture" (Hitchcock, 2003, p. 41). This method for validation included the researcher's observation of the PLAY surroundings, paralanguage, body language, and interpreted social culture (Banaga, 2000; Moustakas, 1994).

The interviews were audio taped. A hired transcriptionist with no personal knowledge of the change agents and the HBDI™ was used for transcribing these tapes. The researcher and the case study participants signed the confidentiality and consent form on which the researcher explained the purpose of the research, the provisions to ensure confidentiality, the participants' rights, and the academic purpose of the research. In addition, the transcriptionist signed a statement of confidentiality. The interview transcripts were shown to the PLAY interview members to ensure the accuracy and clarity of the responses for a validity check. This was done to prevent any misinterpretation of what was said by the case study coresearchers during the interview process. These textual descriptions were sent via e-mail attachments.

The data collected from the case study interviews were validated by allowing a second observer to review the written transcripts and provide concurrence or alternate descriptions of any themes or trends that were identified. Additionally, participant observation after the conclusion of the interview was documented. Any potential bias or skewing that the researcher or second observer recognized was captured in research

notes. This allowed accurate participant observation of the innovation phenomenon (Bickman & Rog, 1998, p. 247).

Assumptions

In this descriptive study a variety of assumptions were made that need to be identified to prevent bias and maintain neutrality in the "epic" (Gall et al., 1996, pp. 617–618) research process. Case studies are generally designed to develop a true and accurate understanding of a social phenomenon that has the advantage of being able to "distinguish between etic and emic perspectives" (Hitchcock, 2003, p. 41). Emic perspectives represent how research members of a specific culture perceive their world, whereas, an etic perspective represents the research participant's assumptions made by the researcher (Gay & Airasian, 2003). This insider's perspective of multiple realities leads to accurate documentation and understanding of "why people think and act in different ways" (Bickman & Rog, 1998, p. 476). The assumptions list follows below:

1. Innovation is a phenomenon that can be discussed.
2. Research participants are innovation change agents.
3. Research participants answered HBDI™ questions accurately and honestly.
4. Research participants were invited to participate voluntarily without any level of coercion.
5. No outside influence by the participants was imposed by the researcher or coresearcher.
6. The HBDI™ scores for the participants will not change the primary thinking preferences.

7. The case study research sample is a representation of the population, even though the participants are volunteers.
8. The "features of social reality have a consistency across time and settings" (Gall et al., 1996, p. 23) and these variables can be identified, measured, and expressed in numerical form.
9. The limits to generalize the population of the study are under the researcher's control by having access to the saturation level of the PLAY Company case study population.
10. The design of the HBDI™ grading tool has been statistically tuned to provide normalization of the results through weighted mean adjustments.
11. The literature review is complete and accurate.

Research Reliability

The HBDI™ reliability is derived from an external validation report by Bunderson (1980). It states that the "whole-brained construct acknowledges that a person's brain dominance scores can change over time" (Bundersonn, pp. 1-28). The construct reliability measurement scores for the HBDI™ characteristics are documented in Tables 3–6. The data are breakdowns of the cerebral and limbic scores based on a 1988 doctoral dissertation by Ho based on a population of 7,989 individuals (Herrmann, 1995, p. 348). The first measurement identifies the overall right- and left-brain dominance.

The following measurements are breakdowns of the HBDI™ four-quadrant construction. In these results, the upper left indicates a thinking preference for mathematical, analytical, and logical thinking. The lower left indicates a thinking preference for a sequential, organized, and ordered approach. The upper right indicates a

thinking preference for an imaginative, visual, and general holistic approach. Finally, the lower-right quadrant represents a thinking preference for emotions, musical talents, communication, and people orientation (Knisbacher, 1999, pp. 90–91).

Table 3

Left and Right Summary Breakdown

Summary and Breakdown of Left Upper and Lower HBDI™

	Upper			Lower		
	Low	High	Mean	Low	High	Mean
Men	14	138	75.1	9	140	68.1
Women	11	128	53.3	18	129	68.8
Combined	11	138	68.6	9	140	68.3

Table 4

Left Upper and Lower Summary Breakdown

Summary and Breakdown of Left and Right HBDI™

	Left Scores			Right Scores		
	Low	High	Mean	Low	High	Mean
Men	18	151	95.2	17	165	86.0
Women	27	141	81.0	32	173	102.3
Combined	18	151	91.0	17	173	91.0

Table 5

Right Upper and Lower Summary Breakdown

Summary and Breakdown of Right Upper and Lower HBDI™

	Upper			Lower		
	Low	High	Mean	Low	High	Mean
Men	15	179	73.9	8	128	55.5
Women	17	164	79.1	23	126	74.9
Combined	15	179	75.5	8	128	61.2

Table 6

Cerebral and Limbic Summary Breakdown

Summary and Breakdown of Cerebral and Limbic HBDI™

	Cerebral (Upper)			Limbic (Lower)		
	Low	High	Mean	Low	High	Mean
Men	40	156	99.0	33	153	82.1
Women	37	136	87.9	36	148	95.4
Combined	37	156	95.7	33	153	86.0

Table 7

Test–Retest Reliabilities for 78 Repeated Measures

HBDI™ Measurement	Reliability Number
Left	.96
Right	.96
A-quadrant	.86
B-quadrant	.98
C-quadrant	.94
D-quadrant	.97
Cerebral	.98
Limbic	.91
Intro/Extrovert	.73

According to this research, the overall reliability pattern indicates stability. This test–retest reliability for the 78 repeated measures shown in Table 7 "showed the same brain dominance in a large data set" (Knisbacher, 1999, p. 91). To confirm the HBDI™ reliability, a research test–retest approach was used against five members of the initial study research population. This population was measured with a substantial time interval between the first and the second tests.

Cogent Statements

According to the *American Heritage Dictionary,* cogent statements are appealing to the intellect or powers of reasoning. The research conducted contains three main theories that interact with each other. These cogent statements are the precursor to research variables, which can be formulated about the theory. These cogent statements are broad scientific interpretations about variables "revealing of the nature of things" (Kuhn, 1996, p. 25).

The first cogent statement is centered on the research subjects. The concept is that only certain people are creative or innovative and these people are more successful at

creating novel ideas. Creative people are D-quadrant dominant according to the HBDI™ four-quadrant thinking preference model. "Most descriptions of creativity refer to it as a strictly right-brain process" (Herrmann, 1996, p. 216). This is sometimes referred to as "flexibility of thought" (Stein, 1974, pp. 29-33; Sternberg, 1999, p. 280).

The second cogent statement is one based on the social culture in which creative ideas evolve. The general feeling is that a repeatable process cannot be created for innovation that does not have serendipity at its center. This means that innovation is not predictable or repeatable, and methods to create it cannot be learned.

The third cogent statement is that idea-creating sessions must take place in a serendipitous culture of people who think until any idea comes along. The story of the cat that runs through the laboratory knocking over a beaker of solution, which mixes with another creating something new, is an example of this type of serendipity.

The research cogent statements identified portray a basic indication of the proposed PLAY case study research innovation system. This causal system encompasses the individual, social structure, and innovation process mapping at PLAY. A system has been established to identify research variables for categorizing. The names of the variables were used to maintain a data coding catalog to document arithmetic transformations, recoding procedures, value-labeling statements, and routine procedures (Bickman & Rog, 1998, p. 395).

Data Collection Techniques

Data collection for the research was separated into two different thrusts: the HBDI™ initial study and the PLAY case study. The triangulation technique research also

encompassed interviews, observations, documents, and a HBDI™ intervention in the case study.

HBDI™ Data Collection

Authorization from Herrmann International was required to utilize the HBDI™ research tool. The HBDI™ is a personal thinking preference indication tool that archives and collects the responses to survey questions. These survey questions provide numeric and graphical interpretations of each respondent's individual thinking preference.

The HBDI™ survey instrument was accessed through a web-link location at HBDI.com that provides a portal entry into the researcher's location with the entry of an access code. This access code was provided to the research participants as a secure information e-mail attachment, which prevented unauthorized participation. Herrmann International retains a master database of all research profiles and, through the use of HBDI™ grading software, the researcher's access to this database was allowed.

Within this doctorate research database are multiple populations of HBDI™ profiles organized by access codes. Approximately 30-40 different access-coded locations contain completed profiles that form the initial study database. The initial study database consists of 151 valid participants who were self-declared innovation change agents and completed the HBDI™.

The second research database is a case study representation of the PLAY innovation consulting company of 19 participants who volunteered and consented to participate in the research. All research participants were provided "adequate information regarding the research and have the power of free choice, enabling them to consent voluntarily or decline participation" (Polit & Hungler, 1997, p. 134). The PLAY data

collected were graphically plotted and supplied to all case study participants along with a 2-hour intervention to explain the results at the Richmond, Virginia, location.

PLAY Case Study Interview Data Collection

The data collection method for the PLAY case study interviews was captured in two forms. The first was the audio taping of the participants' responses to questions structured around the HBDI™. A series of 10 structured questions were asked of the participants. These interviews were transcribed into a written document that captured the responses to the questions. This written collection of responses was provided to the case study participants for editing or clarification to ensure accuracy.

Observation. The primary researcher kept a field notebook during the research period to document observations, experiences, critical conversations, and perceptions of innovation characteristics within the individuals and social culture. Observations of the PLAY participants were not controlled, noncontinuous, and unstructured during the 4-year window of research data gathering from 2001 to 2004. The primary researcher attended PLAY's 3-day creativity training in Richmond, Virginia, and captured reflections of the organizational innovation process, PLAY training members, and outside training participants.

Documents. Document gathering of PLAY internal illustrations and cartoons for creativity describing the innovation process and social culture were gathered on trips to PLAY in December 2002, June 2003, and October 2003. The documents that help tell the story of the creativity and innovation process of PLAY were also collected from the PLAY creativity training manuals for 2002 and 2003. Other documents collected were charters, agendas, scope statements, principle statements, future state statements, current

state statements, recommendations, and white papers available from the PLAY Company Web site.

HBDI™ Intervention

The results from a descriptive study are a cultural description; however, this description can only emerge "from a lengthy period of intimate study and residence in a given social setting" (Van Maanen, 1982, pp. 103–104). It also required "first-hand participation in some activities that take place there, and, most critically, a deep reliance on intensive work with a few informants drawn from the setting" (Van Maanen, pp. 103–104). After the HBDI™ profiling of the 19 original members of PLAY was completed, an intervention was conducted to explain to the participants what the instrument results were for individuals and the PLAY group. The individual profiles were personally debriefed by the researcher to all PLAY members in December 2002. As a collective group, the individual and group composite profiles were presented and explained.

A second intervention in June 2003 profiling the remaining 12 original members of the PLAY organization was conducted as a refresher prior to interviewing the members. The output of the interventions is a collective understanding of the PLAY composite mental models (Senge, 1999), shared basic values, and assumptions (Schein, 1997) that creates an innovation "community of practice" (Wenger, 1999).

Managing and Recording Data

Managing HBDI™ Data

The goals for the data analysis were to operationalize and represent research variables using numbers or identifiers as groups such as ABC or 123. Completion of this task promoted the understanding that the significance of the inquiry "lies not within the

data *per se* but in the meaning they make from the data" (Piantaida & Garman, 1999, p. 145). With the HBDI™ inquiry data, Herrmann International software is available to trend and correlate the research results. This correlation could identify the individual respondents' profiles mapped against a library of previous thinking preference profiles that are HBDI™ D-quadrant. Additional trends, cluster preferences, and overall profiles of the group can be derived. The numeric summary of the HBDI™ data was added to an HBDI™ data file, which will act as a managing repository to provide the research with a level of audit worthiness (Freedland & Carney, 1992).

Managing PLAY Case Study Data

For the case study data, individual participants received a numeric reference to manage their responses that was added to a case study data file. An example would be John Doe = Case Study Participant 1 and Jane Doe = Case Study Participant 2. This data file is a repository for a minimum of three categories of assessment data that also includes research variables and information related to the data collection effort. "Arrhythmic transformation, recording procedures, value labeling statements and routing procedures" (Bickman & Rog, 1998, p. 395) may be cataloged to provide a deeper historical record. This may provide visibility into the differences between "the frequencies that are obtained from the inquiry data" (Rea & Parker, 1997, p. 167).

The interview data were recorded on individual audiocassettes, which will archive the responses to the research questions. These audiocassettes were assigned numeric files to indicate which member's responses are included in the data collected. The inclusion of these rigorous steps in the inquiry process should ensure successful execution of the research.

Data Presentation

HBDI™ Data Presentation

The HBDI™ individual profile provides a thinking preference indication of the survey respondent. Those data are presented in Figure 12 and describe the dominant fields and numeric score in those fields. “Several recent studies of large samples have indicated that approximately 6-7% of these are single dominant, 60% double dominant, 30% triple dominant and about 3% quadruple dominant” (Herrmann, 1995, p. 85). A dominant status for a thinking preference (1) is a score of 67 or above on a 130-point axis. A score of 34–66 is considered a secondary profile (2) and indicates neither a thinking preference nor avoidance. A score of 0–33 is considered a tertiary profile (3) and indicates an area of potential thinking avoidance.

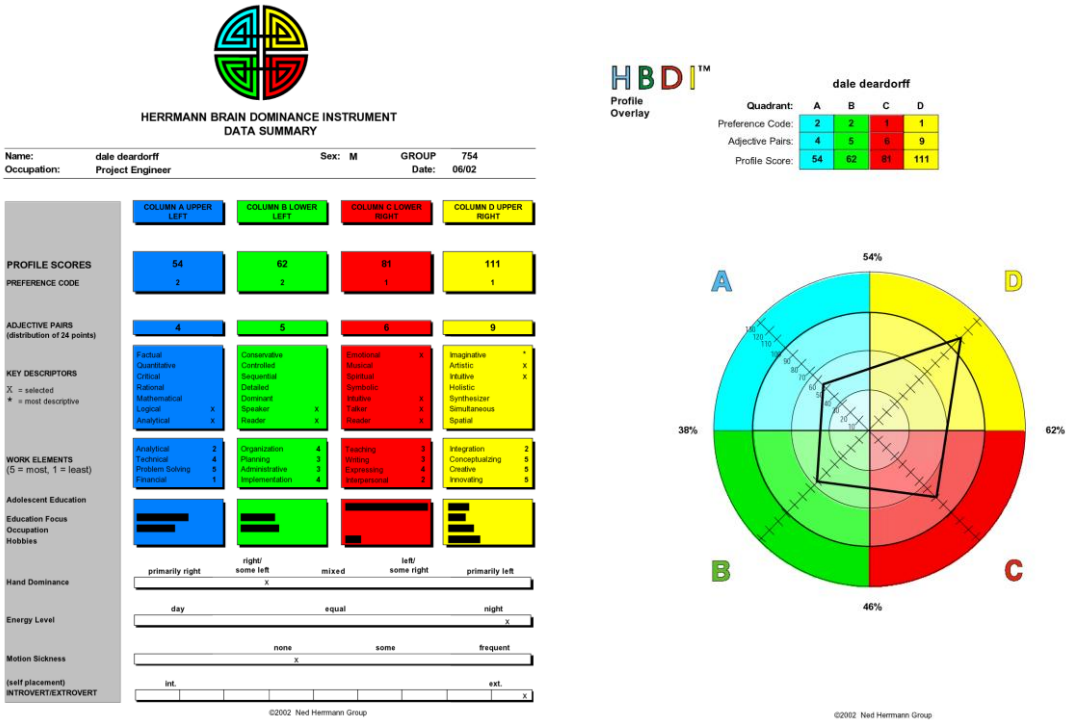


Figure 12. HBDI™ 2211 individual profile.

A scoring code is provided for each profile, which uses 1's, 2's, and 3's assigning this value to the plotted tool quadrants starting with upper left and proceeding counterclockwise around the model. As seen in Figure 12, a 2211 (double dominant) scoring code indicates a secondary preference in Quadrants A–B and a primary thinking preference in Quadrants C–D. When multiple members of a research group are evaluated, the individual data plots can be overlaid to create a composite profile as seen in Figure 13.

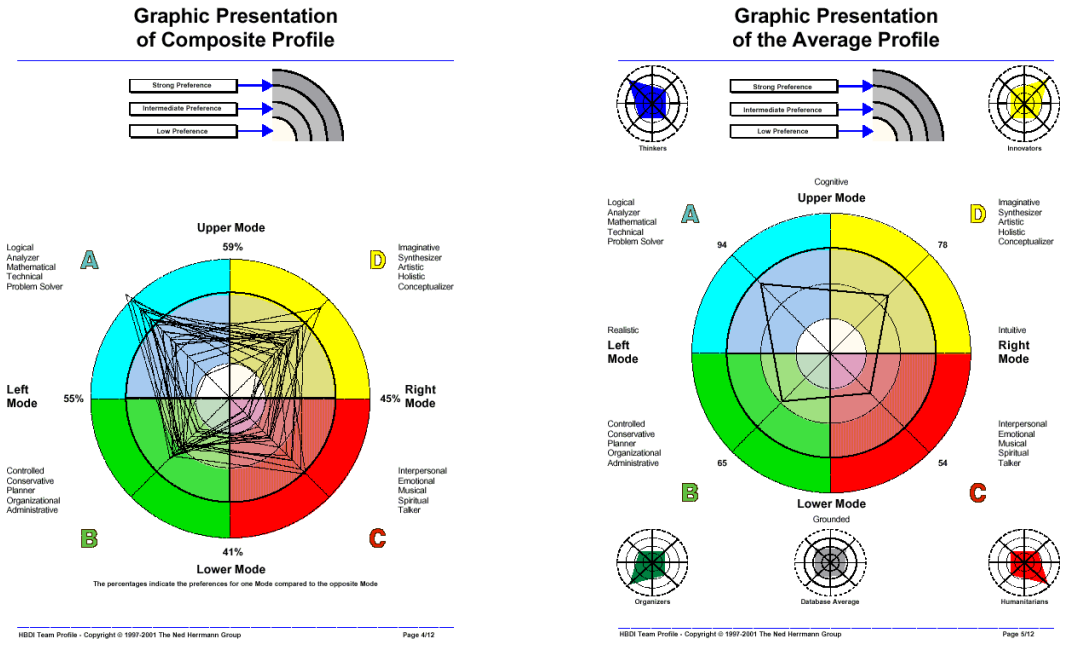


Figure 13. HBDI™ composite and average group profile.

The composite profile is an overlay of all individuals within the research group. It shows clusters of preference concentrations in each quadrant, seen as heavy or dark areas. The score values are also plotted showing the minimum and maximum score values. The data also show an average profile. This data plot is a mean average of the members reached by summing the total scores and dividing by the number of members. It provides a clearer view of the overall tilt of the group and generally the group will act in this

preference. Group data are presented in rank ordering. Rank ordering of preferences shows typical approaches to project-oriented group situations such as communication, decision making, problem solving, and project management.

A complement of this rank ordering process is the preference map, in which the opposite quadrant scores are subtracted from each other, for example, the A-quadrant score is subtracted from the C-quadrant score and the B-quadrant score is subtracted from the D-quadrant score. These scores are then plotted in an X–Y coordinate system to create an epicenter of the scores. The clustering of individual profiles can easily be seen in their primary thinking preference location in comparison to the other members.

The key descriptors can be measured by individual quadrants and displayed in a Pareto bar chart. These data provide a concentration of each key descriptor from the survey instrument. Key descriptors are also rank ordered by quadrant score and level of preference. The work elements can be rank ordered and the strengths identified. This information breaks down the strengths of each work element by individual quadrant.

PLAY Case Study Interview Data Presentation

The case study interview data are organized in both the narrative and the table format. The narrative form includes the exact response to the tape-recorded questions presented to the participants in textual format as a Microsoft Word attachment included in chapter 4. The table format includes the interview responses after they have been coded to identify the major themes or patterns that emerged in three different categories. These categories were interview questions representing (1) individual-, (2) group, and (3) innovation-centered responses. These can be seen in Figure 14, Figure 15, and Figure 16.

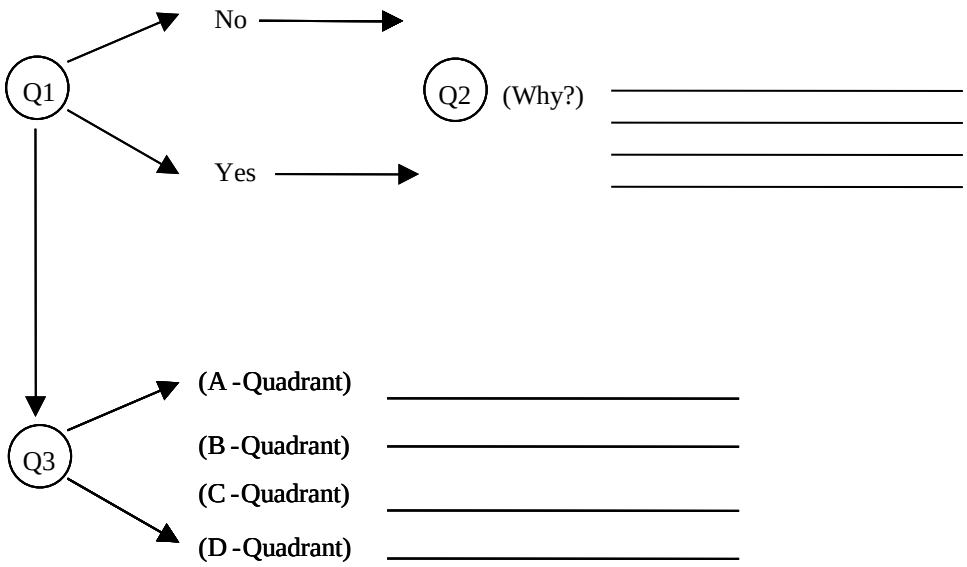


Figure 14. Interview questions: HBDI™ Individual coded logic flow.

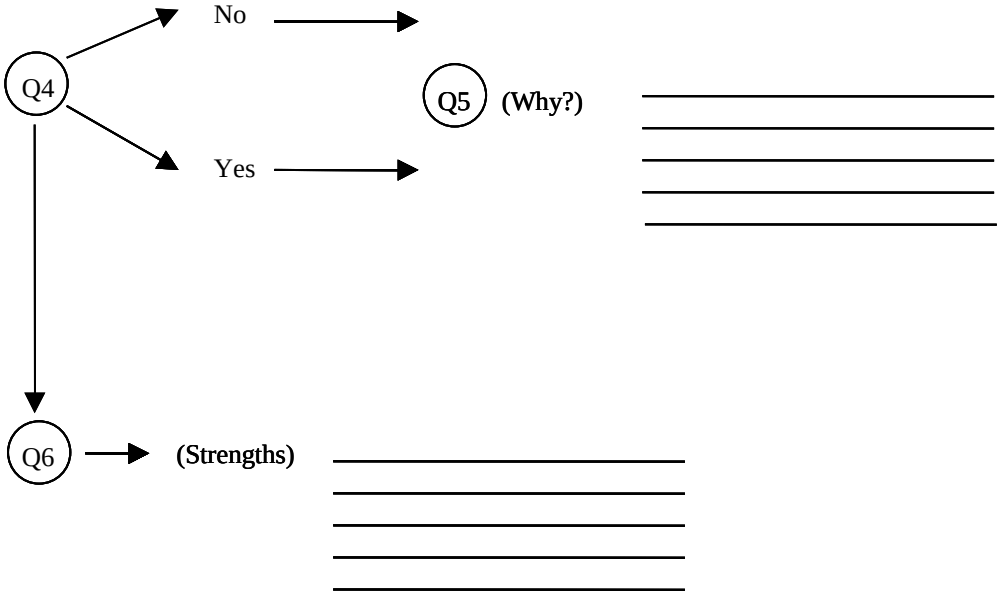


Figure 15. Interview questions: HBDI™ Group coded logic flow.

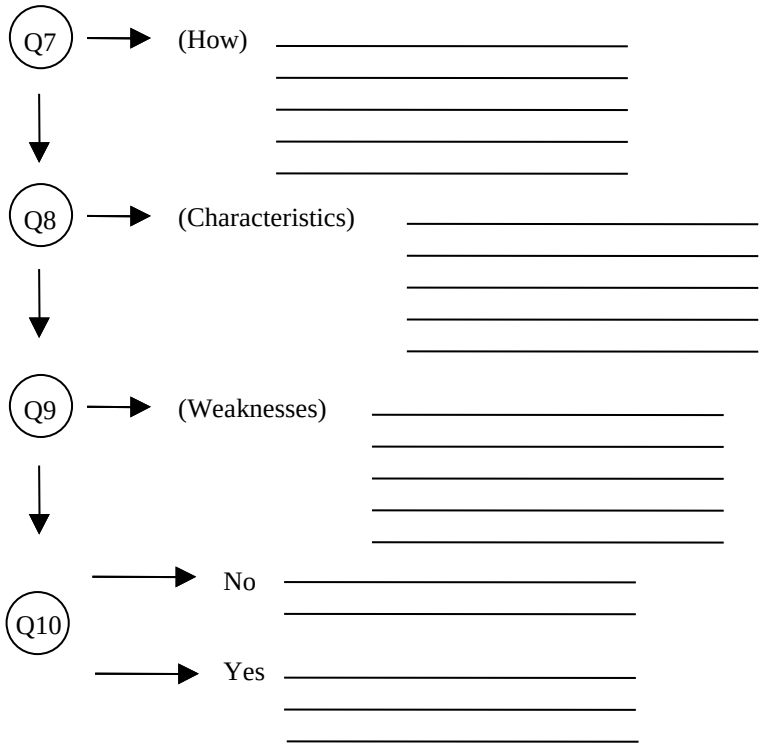


Figure 16. Interview questions HBDI™ Innovation coded logic flow.

Tape recording the interview allowed the researcher to "engage in a lengthy informal and semi-structured interviews without the distraction of manual recording devices" (Bickman & Rog, 1998, p. 491). A separate cassette tape recording of the interview was made for each interview participant. It starts with the participant's name, date, and location of event. This provides an accurate data representation of any tones or inflections in the responses.

Informal Data Presentation

As previously described, informal data were collected in the form of documents. These can be illustrations, diagrams, noninterview notes, and collected interpretations of the research participants or social culture. These data were captured in a primary

researcher journal, presented in chapter 4, to reinforce themes or patterns relevant to the research.

Data Analysis Strategy

The data generated from the initial study HBDI™ and the case study HBDI™ went through separate steps for data analysis since the empirical results were in different databases. With the case study interview questions a master data file was created that synthesizes the research variables, research results, and any significant themes or patterns that emerge from descriptive interpretations. The research analysis began by organizing the data into "generic categories such as interview questions, people and places," as suggested by Glesne (1999, p. 130). Without documentation of these features, a "synthesis will quickly become obsolete if it does not address the variables and relations that are (or will be) important to the area" (Bickman & Rog, 1998, p. 323).

HBDI™ Data Strategy

To analyze the HBDI™ initial study and case study inquiry data, Herrmann International software was available to document, organize, and plot the initial results. When the respondents accurately displayed the thinking preference hypothesized, this data analysis identified with a primary thinking preference in the D-quadrant. Additional trend, cluster preference, and overall tilt of the research group were derived. The HBDI™ software allowed the creation of a composite group data plot of the thinking preferences, which is a four-quadrant scatter plot used to visualize the concentrations of preferences and that creates an average group profile.

PLAY Case Study Interview Data Strategy

Qualitative case study research required the researcher to be completely immersed in the interview transcripts as a primary step in the analysis. The case study data were analyzed in two ways. By using the interview coded logic flow diagrams in Figure 14, Figure 15, and Figure 16, major themes or patterns from the case study participant responses were identified. A second method for coding the textual responses to the interview questions was analyzed using QSR International N6 software. The N6 software provided a verification of the same coded themes and patterns but did not identify any hidden data connections not manually identified. This verification reduced unrecognized bias to help in replicability for future studies.

Summary

The research design used in this qualitative inquiry described for innovation is a triangulation of innovation theory, case study data, and the HBDI™, all of which should provide accurate data. These data have an interconnected series of research variables that were systemically dissected and presented for research analysis. Each step in the research design method was critical to building a strong foundation.

The research analysis provided an acceptable degree of confidence, verification, and validation to maintain the accuracy and consistency of the descriptive methods for research. This led to a successful academic study. The results of the analysis, data coding, and survey results of this academic study are described in chapter 4.

CHAPTER 4: PRESENTATION AND ANALYSIS OF DATA

This introductory section reiterates the case study, research questions, and research goals. A brief description of the purpose of the utilized research instrument is provided. Results and findings are presented as well as a plotting and analysis of the data. Results of a initial study survey and a test–retest report of the data are included, along with case study illustrations, processes, and mental models relevant to the PLAY Company.

The concentration of documentation in this chapter is on research data presentation and analysis. These data are derived from a variety of research paths, which are encompassed under a case study research approach. This approach is illustrated in Figure 17.

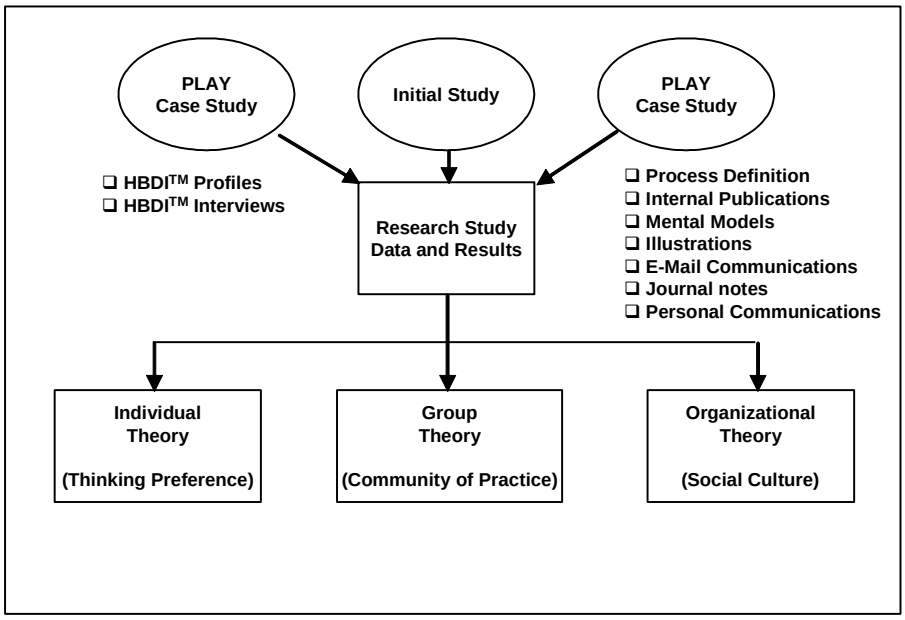


Figure 17. Primary research study results roadmap.

As discussed in chapter 1, the purpose of this qualitative descriptive case study was to explore the extent to which individual thinking preferences impact innovation

inside the PLAY Company's social environment measured by the Herrmann Brain Dominance Instrument™, which espouses the concept of "Whole Brain Technology" (Sheil, 2004, p. 6).

The case study focused on specific innovation attributes as defined by a commercially available survey instrument. The survey instrument was the HBDI™ (Herrmann, 1995), which measured innovation attributes across four quadrant dimensions: analyze mode, organize mode, personalize mode, and synthesize mode. A thinking preferences mapping was created for cerebral (upper brain) versus limbic (lower brain) and left versus right modes.

The specific description of the research questions for this study were as follows:

Research Question 1: How do change agents use different thinking preferences to measure innovation?

Research Question 2: How do change agents use different thinking preferences to measure an innovation culture?

Research Question 3: How do psychometric instruments measure innovation?

Research data are organized into three separate sections: (a) HBDI™ data, (b) case study process and mental models, and (c) case study questionnaire output. The next section describes the HBDI™ initial study survey results that were obtained from a cross section of high-technology companies in the United States, Canada, England, and European members of companies' employees who are self declared change agents and drive innovation.

HBDI™ Research

The HBDI™ research is broken down into three groups: a initial study, a case study, and a test–retest database. Included in the data analysis and results are the HBDI™ thinking preference group profile, composite profile, preference map, and individual profile breakdown.

A initial study database is created that incorporates HBDI™ thinking preferences and data from high-technology companies around the United States, Canada, and Europe captured over a 2- to 3-year period.

A HBDI™ group correlation is created for the case study database, which includes data representing the PLAY Company with 19 members followed by a second set of data representing the PLAY Company approximately 12 months later. The individual HBDI™ profiles are located in Appendix D.

A HBDI™ group correlation is created for the test–retest database that includes CP-01 data representing five individuals. These same five individuals have retaken the HBDI™ and comprise the CP-02 database.

Initial Study HBDI™ Results

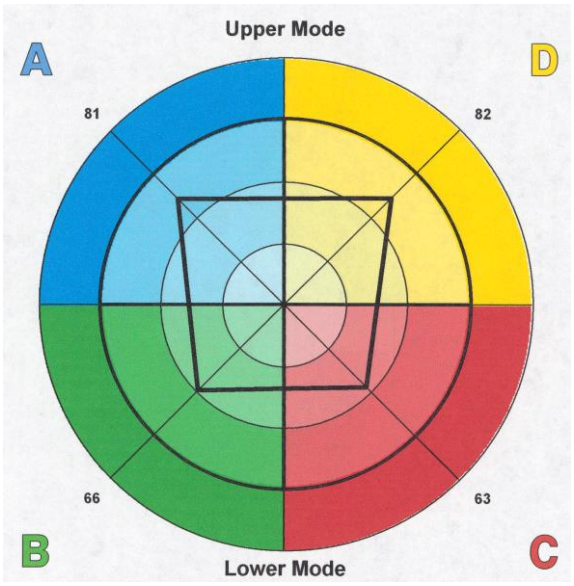


Figure 18. Initial Study HBDI™ group profile (*n* = 151).

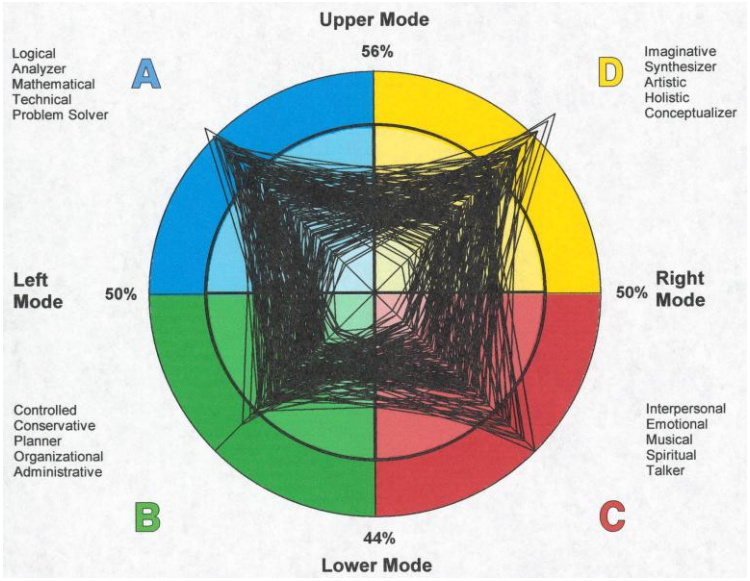


Figure 19. Initial Study (*n* = 151) composite profile.

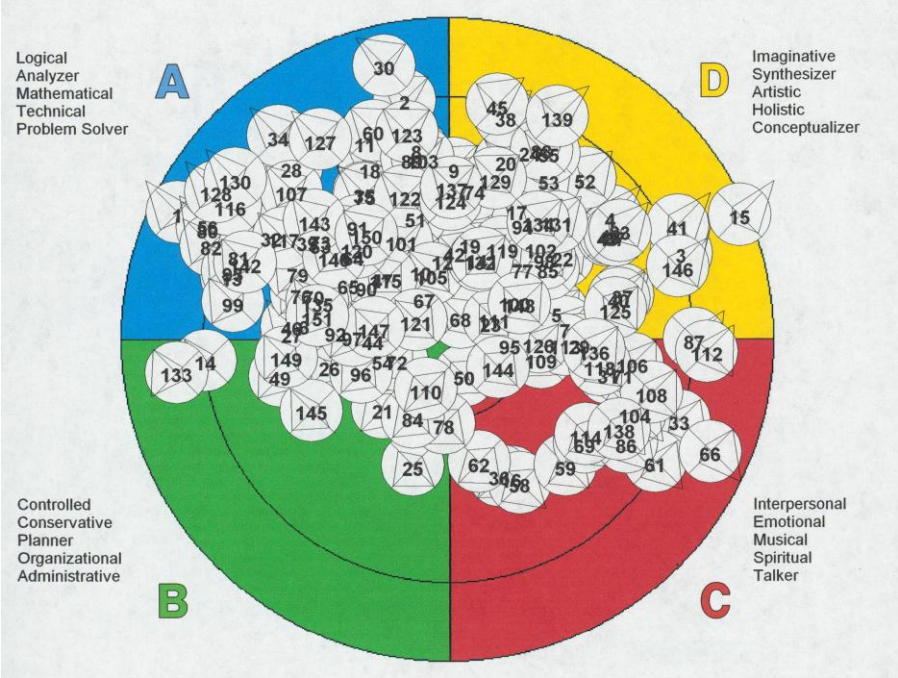


Figure 20. Initial study (*n* = 151) preference map.

Table 8

Summary & Breakdown of Initial Study Group HBDI™ Profile

	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
Primary	103	68	66	99
Secondary	43	77	65	48
Tertiary	5	6	20	4
Total	12258	9922	9959	12423
Average	1	2	2	1

Table 9

Summary & Breakdown of Initial Study Individual HBDI™ Profile (1–30)

	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
Participant 1	141	77	26	36
Participant 2	114	45	32	102
Participant 3	42	45	84	137
Participant 4	48	56	59	138
Participant 5	63	60	86	99
Participant 6	84	96	38	59
Participant 7	51	62	81	99
Participant 8	105	44	41	90
Participant 9	90	53	42	104
Participant 10	72	78	44	90
Participant 11	119	47	38	80
Participant 12	90	59	65	80
Participant 13	116	83	35	39
Participant 14	96	105	32	29
Participant 15	35	32	83	152
Participant 16	50	84	108	62
Participant 17	71	56	53	113
Participant 18	116	42	44	69
Participant 19	78	62	56	96
Participant 20	92	33	57	101
Participant 21	68	101	69	62
Participant 22	69	50	78	107
Participant 23	62	75	69	92
Participant 24	75	44	44	122
Participant 25	66	89	92	42
Participant 26	86	93	59	51
Participant 27	92	96	45	53
Participant 28	122	69	27	74
Participant 29	57	63	96	99
Participant 30	125	32	27	93

Table 10

Summary & Breakdown of Initial Study Individual HBDI™ Profile (31–60)

	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
Participant 31	51	56	107	92
Participant 32	108	84	27	63
Participant 33	33	50	123	93
Participant 34	126	53	18	63
Participant 35	117	56	50	74
Participant 36	39	99	93	74
Participant 37	44	59	81	122
Participant 38	102	33	54	114
Participant 39	98	75	29	63
Participant 40	44	56	81	117
Participant 41	41	47	74	146
Participant 42	68	68	44	95
Participant 43	74	38	90	114
Participant 44	81	84	59	62
Participant 45	93	38	39	120
Participant 46	117	71	68	30
Participant 47	87	75	50	74
Participant 48	59	45	75	122
Participant 49	95	98	57	39
Participant 50	63	80	78	74
Participant 51	90	66	45	92
Participant 52	87	33	80	119
Participant 53	92	29	75	104
Participant 54	75	90	62	65
Participant 55	90	30	65	113
Participant 56	126	83	23	47
Participant 57	72	38	90	116
Participant 58	51	84	113	63
Participant 59	32	78	102	75
Participant 60	105	56	23	95

Table 11

Summary & Breakdown of Initial Study Individual HBDI™ Profile (61–90)

	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
Participant 61	24	68	119	92
Participant 62	51	92	95	65
Participant 63	92	81	27	72
Participant 64	90	77	38	74
Participant 65	107	63	62	50
Participant 66	26	53	134	96
Participant 67	93	63	74	68
Participant 68	92	59	89	69
Participant 69	35	86	104	95
Participant 70	105	80	53	54
Participant 71	36	62	96	102
Participant 72	78	87	69	66
Participant 73	113	65	47	57
Participant 74	87	45	51	96
Participant 75	125	50	59	68
Participant 76	95	89	39	60
Participant 77	65	63	66	105
Participant 78	66	89	89	63
Participant 79	102	86	39	62
Participant 80	117	87	15	50
Participant 81	120	80	35	44
Participant 82	120	83	24	42
Participant 83	56	41	74	122
Participant 84	62	90	74	57
Participant 85	57	59	65	108
Participant 86	44	68	125	89
Participant 87	30	57	101	128
Participant 88	81	41	53	123
Participant 89	117	44	54	86
Participant 90	102	68	63	60

Table 12

Summary & Breakdown of Initial Study Individual HBDI™ Profile (91–120)

	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
Participant 91	98	65	39	72
Participant 92	107	72	72	42
Participant 93	114	98	32	56
Participant 94	81	47	69	102
Participant 95	53	74	72	90
Participant 96	81	89	65	54
Participant 97	77	96	48	69
Participant 98	77	41	81	92
Participant 99	108	96	35	45
Participant 100	69	51	77	81
Participant 101	80	80	38	95
Participant 102	60	63	60	116
Participant 103	104	42	44	87
Participant 104	50	60	125	92
Participant 105	102	51	78	65
Participant 106	42	56	102	102
Participant 107	114	68	26	66
Participant 108	36	62	110	105
Participant 109	42	77	74	98
Participant 110	57	102	65	81
Participant 111	68	65	75	84
Participant 112	35	48	113	119
Participant 113	48	60	83	92
Participant 114	41	77	108	89
Participant 115	102	66	66	66
Participant 116	120	81	18	57
Participant 117	116	74	39	56
Participant 118	45	69	96	105
Participant 119	86	50	75	92
Participant 120	98	69	45	69

Table 13

Summary & Breakdown Initial Study Individual HBDI™ Profile (121–151)

	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
Participant 121	92	69	77	65
Participant 122	108	51	54	80
Participant 123	107	50	35	98
Participant 124	84	57	44	98
Participant 125	54	45	93	102
Participant 126	44	62	71	87
Participant 127	128	56	33	77
Participant 128	134	72	24	48
Participant 129	99	45	66	105
Participant 130	132	66	24	51
Participant 131	72	45	69	110
Participant 132	83	48	69	80
Participant 133	102	111	33	23
Participant 134	71	44	63	104
Participant 135	102	77	53	50
Participant 136	44	63	89	102
Participant 137	87	54	44	99
Participant 138	38	69	113	92
Participant 139	75	42	42	138
Participant 140	107	69	50	60
Participant 141	77	71	63	104
Participant 142	104	96	23	60
Participant 143	102	66	29	62
Participant 144	62	62	84	68
Participant 145	96	89	77	29
Participant 146	44	42	89	129
Participant 147	84	80	59	62
Participant 148	74	62	84	93
Participant 149	99	96	57	44
Participant 150	107	65	53	72
Participant 151	92	90	47	59
Total	12258	9922	9959	12423
Average	81	66	63	82
Minimum	24	29	15	23
Maximum	141	111	134	152

Case Study Results

PLAY (n = 19) HBDI™ Results

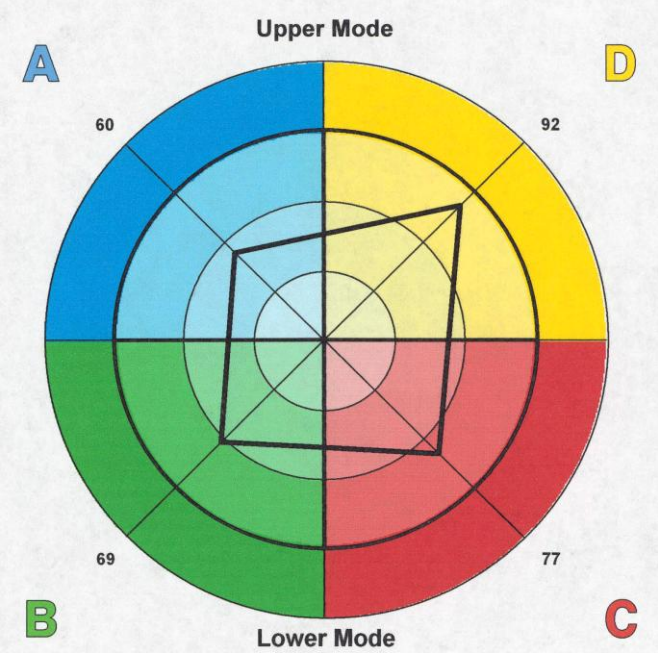


Figure 21. PLAY (*n* = 19) HBDI™ profile.

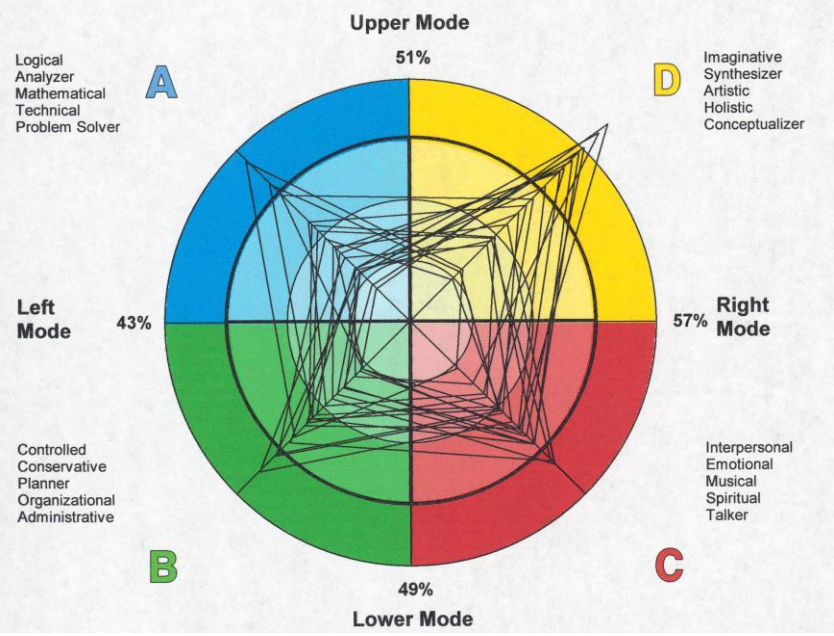


Figure 22. PLAY (*n* = 19) composite profile.

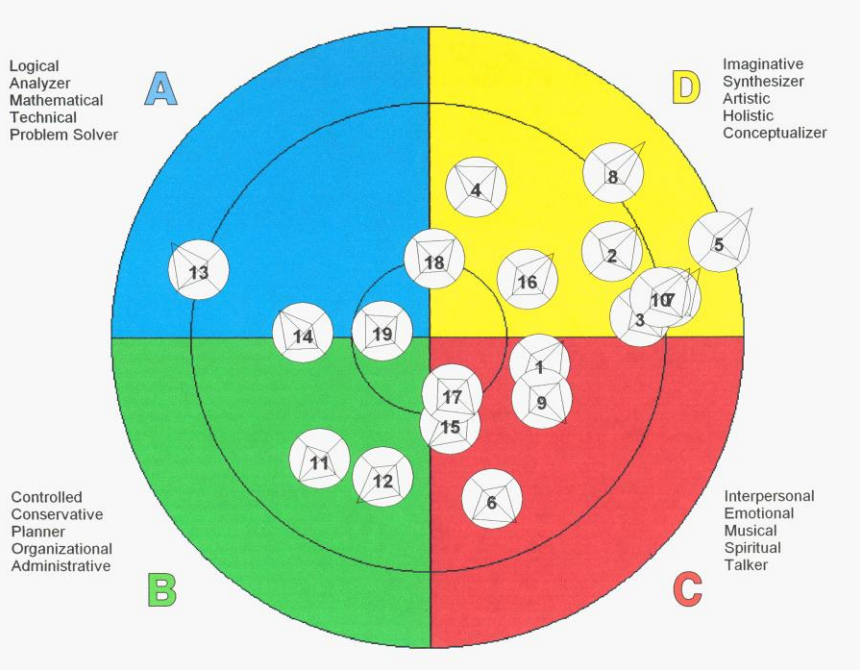


Figure 23. PLAY (*n* = 19) preference map.

Table 14

Summary & Breakdown of PLAY (n = 19) Group HBDI™ Profile

	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
Primary	6	10	14	12
Secondary	11	9	5	6
Tertiary	2	0	0	1
Total	1135	1318	1465	1741
Average	2	1	1	1

Table 15

Summary & Breakdown of PLAY (n = 19) Individual HBDI™ Profile

	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
Participant 1	42	80	83	105
Participant 2	57	36	86	116
Participant 3	38	56	95	125
Participant 4	99	36	68	95
Participant 5	26	38	84	153
Participant 6	42	42	48	146
Participant 7	29	51	89	135
Participant 8	42	42	48	146
Participant 9	59	60	111	75
Participant 10	38	50	95	131
Participant 11	65	102	69	33
Participant 12	50	116	78	60
Participant 13	125	89	36	41
Participant 14	107	75	68	39
Participant 15	39	104	71	84
Participant 16	54	72	66	119
Participant 17	71	75	95	65
Participant 18	78	65	56	90
Participant 19	75	78	59	66
Total	1135	1318	1465	1741
Average	60	69	77	92
Minimum	26	36	36	33
Maximum	125	116	111	153

PLAY (n = 12) HBDITM Results

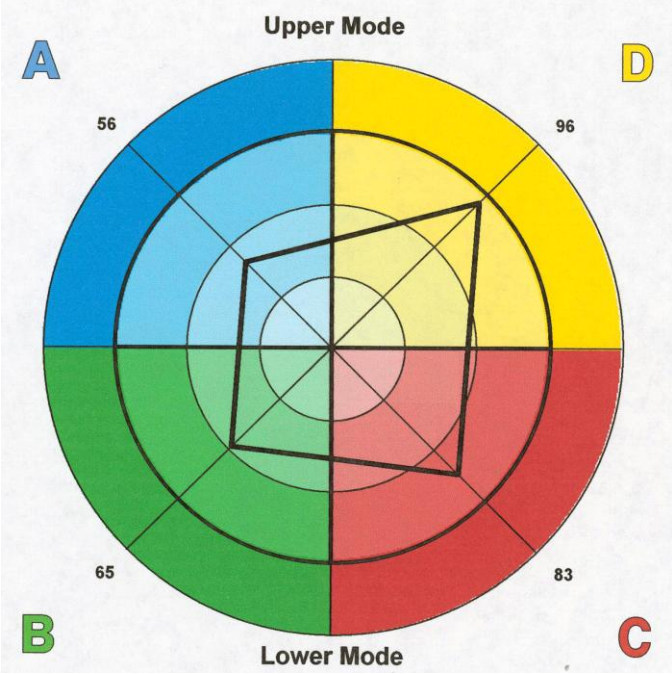


Figure 24. PLAY (*n* = 12) HBDI™ profile.

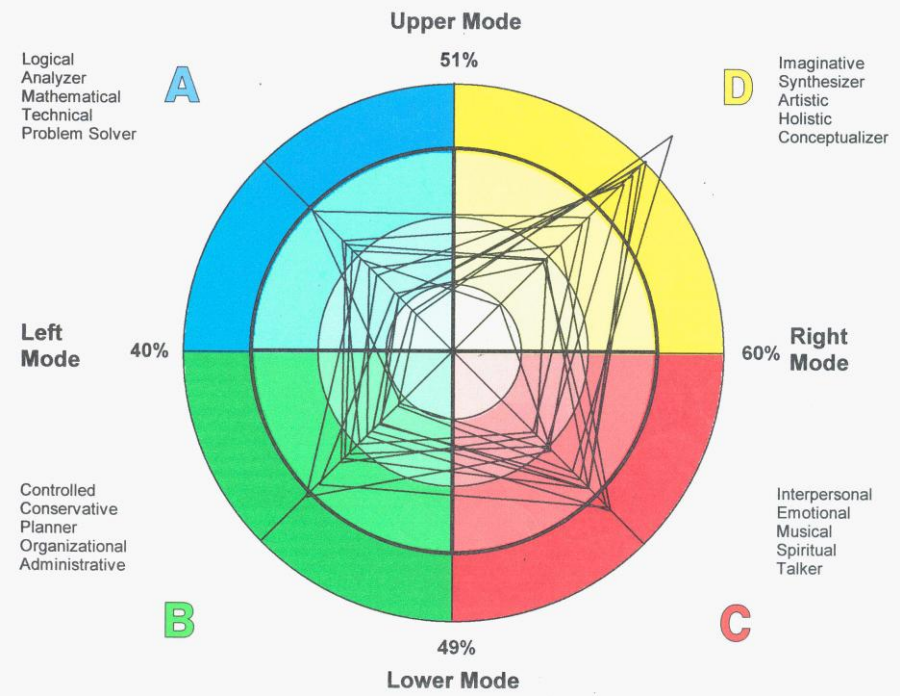


Figure 25. PLAY (*n* = 12) composite profile.

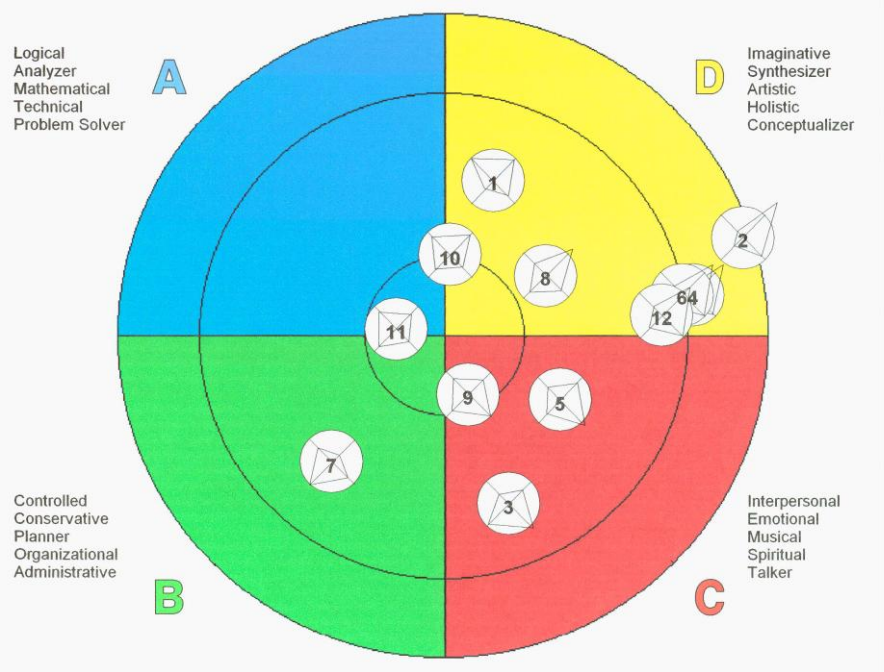


Figure 26. PLAY (*n* = 12) preference map.

Table 16

Summary & Breakdown of PLAY (n = 12) Group HBDI™ Profile

	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
Primary	4	5	8	8
Secondary	6	7	4	4
Tertiary	2	0	0	0
Total	673	776	995	1150
Average	2	2	1	1

Table 17

Summary & Breakdown of PLAY (n = 12) Individual HBDI™ Profile

	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
Participant 1	99	36	68	95
Participant 2	26	38	84	153
Participant 3	41	93	108	63
Participant 4	29	51	89	135
Participant 5	59	60	111	75
Participant 6	38	56	95	125
Participant 7	65	102	69	33
Participant 8	54	72	66	119
Participant 9	71	75	95	65
Participant 10	78	65	56	90
Participant 11	75	78	59	66
Participant 12	38	50	95	131
Total	673	776	995	1150
Average	56	65	83	96
Minimum	26	36	56	33
Maximum	99	102	111	153

Table 18

PLAY 19 versus PLAY 12 HBDI™ Scoring Correlations

	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
PLAY 19	60	69	77	92
PLAY 12	56	65	83	96
Shift	-4	-4	+6	+4

Test–Retest HBDI™ Results

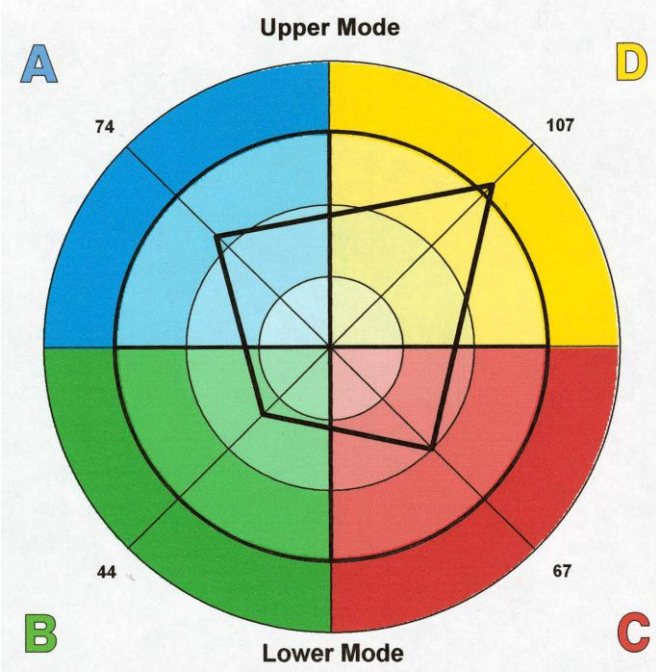


Figure 27. CP-01 HBDI™ profile (*n* = 5).

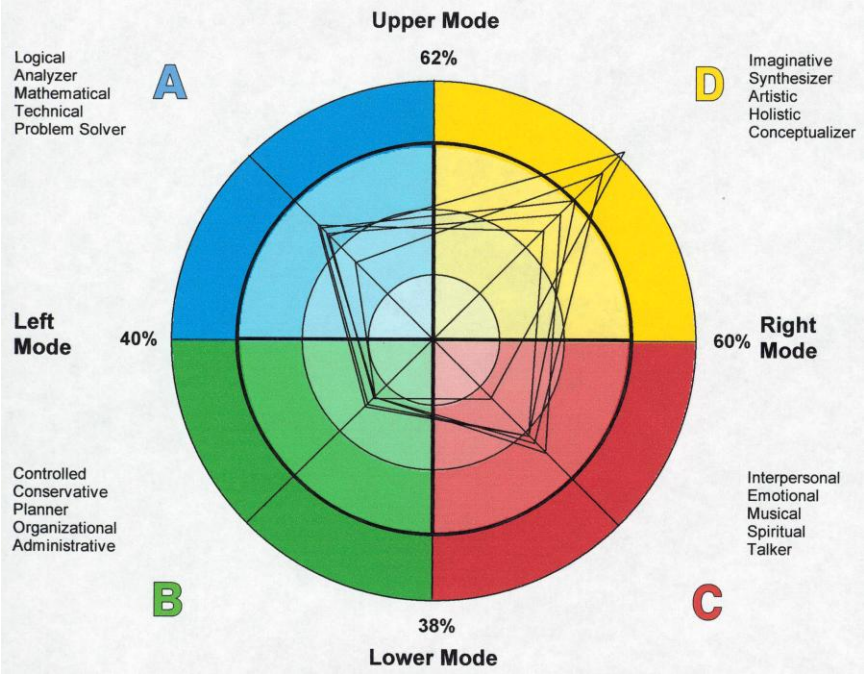


Figure 28. CP-01 (*n* = 5) composite profile.

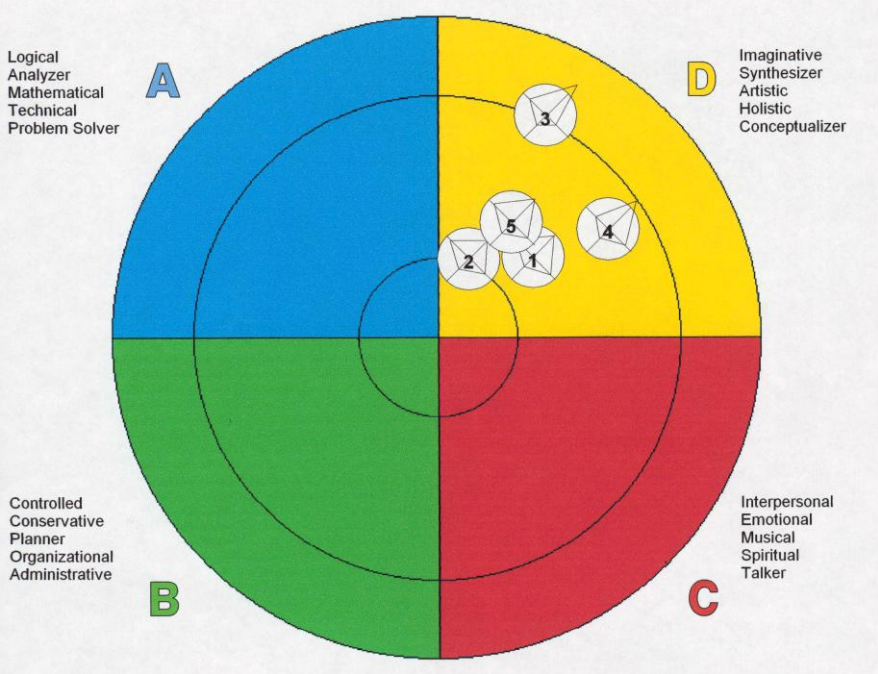


Figure 29. CP-01 (*n* = 5) preference map.

Table 19

Summary & Breakdown of CP-01 Test–Retest Group HBDI™ Profile

	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
Primary	4	0	4	5
Secondary	1	5	1	0
Tertiary	0	0	0	0
Total	372	219	335	534
Average	1	2	1	1

Table 20

Summary & Breakdown of CP-01 Test–Retest Individual HBDI™ Profile

	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
Profile 1	81	47	69	102
Profile 2	77	41	81	92
Profile 3	83	48	69	80
Profile 4	75	42	42	138
Profile 5	56	41	74	122
Total	372	219	335	534
Average	74	44	67	107
Minimum	56	41	42	80
Maximum	83	48	81	138

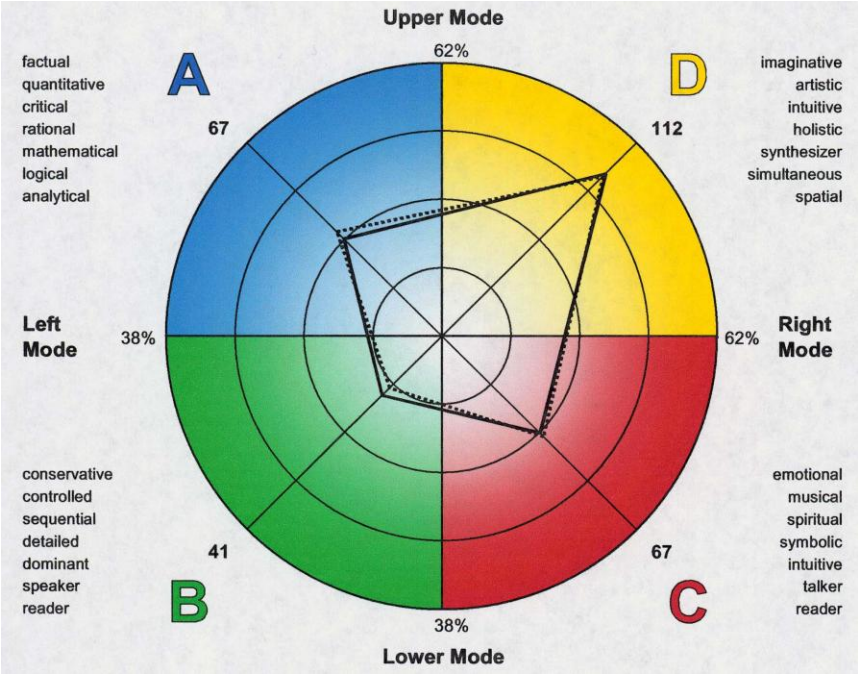


Figure 30. CP-02 test–retest HBDI™ profile (*n* = 5).

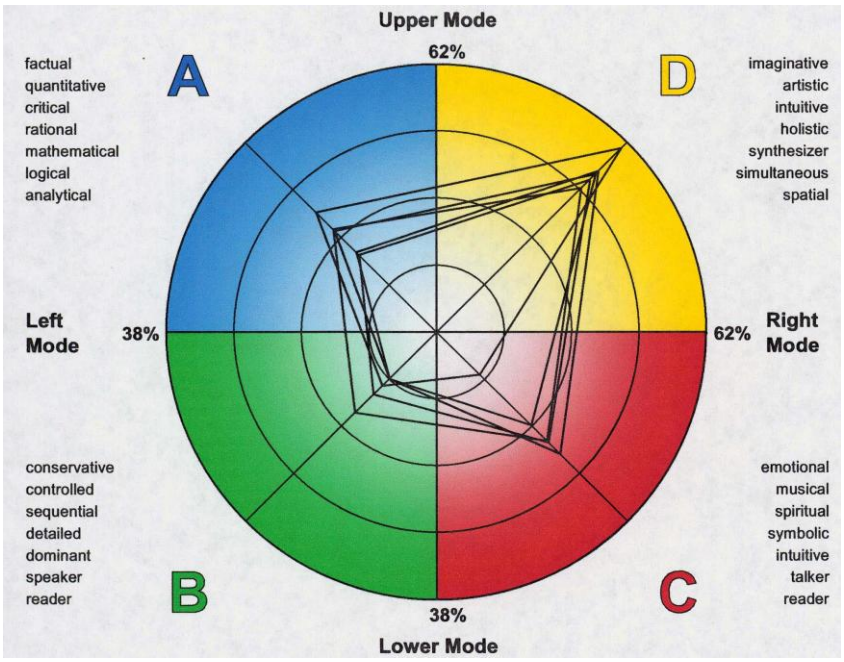


Figure 31. CP-02 (*n* = 5) composite profile.

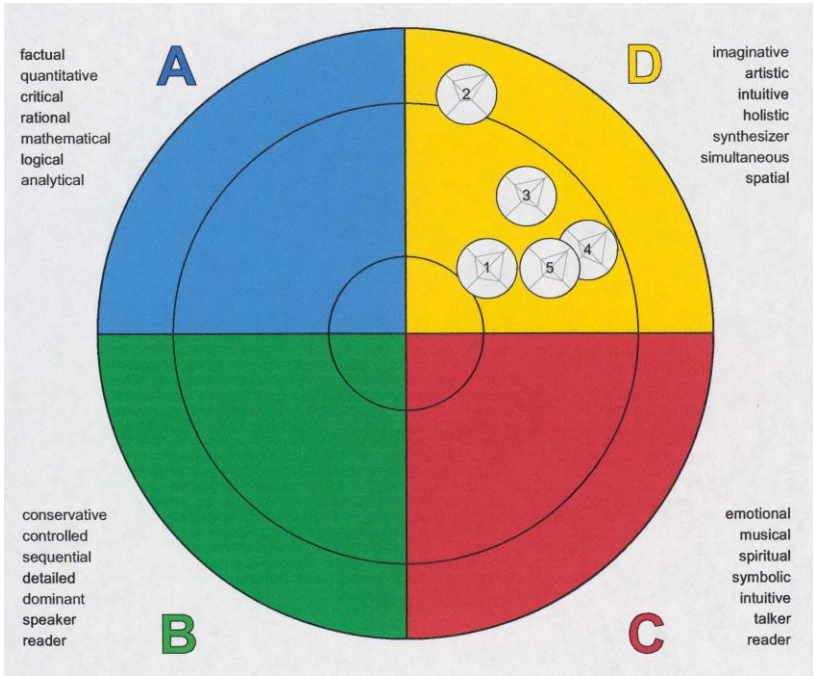


Figure 32. CP-02 (*n* = 5) preference map.

Table 21

Summary & Breakdown of CP-02 Test–Retest Group HBDI™ Profile

	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
Primary	3	0	2	5
Secondary	3	0	2	5
Tertiary	3	0	2	5
Total	337	205	337	561
Average	1	2	1	1

Table 22

Summary & Breakdown of CP-02 Test–Retest Individual HBDI™ Profile

	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
Profile 1	72	57	77	101
Profile 2	84	38	30	129
Profile 3	71	33	66	111
Profile 4	56	33	86	113
Profile 5	54	44	78	107
Total	337	205	337	561
Average	67	41	67	112
Minimum	54	33	30	101
Maximum	84	57	86	129

Test–Retest Correlation Data Analysis

Table 23

CP-01 versus CP-02 HBDI™ Scoring Correlation

Quadrant	A	B	C	D	Profile
CP-01	74	44	67	107	1211
CP-02	67	41	67	112	1211
Shift	-7	-3	0	+5	

HBDI™ Data Analysis

Additional Research Definitions

To better understand the HBDI™ data analysis synopsis requires the creation of two new terms to eliminate prior mental models and bias. Within the standard analysis of psychometric instrument data plots are the terms *loner* and *mini-tribe*. Both of these terms are inaccurate for the research presented. Since the previous traditional definitions of loner and mini-tribe were not useable, new operational definitions were created.

Social Science Definitions

Disconnected. The operating perspective that a given set of elements or parts are discrete rather than joined. Be they elements of a machine, elements of a system, or elements of government, there is no apparent cause and effect relationship between them. As such, they operate independently. (personal communication with B. Bellows, December 5, 2004).

Individuator. Could be viewed as representing differences in how the individual is seen by the group comparing the exaggerated differences against the social network norm (personal communication, K. Stephenson, September 30, 2004).

Mechanistic. Process which operates with the regularity dictated by its internal structure and the causal laws of nature (Ackoff, 2003, p. 3).

Mini-Network. Series of HBDI™ member profiles grouped together or collected in a network plot that shows them centered in the same location (personal communication K. Stephenson, September 30, 2004).

Network. A collection of individuals engaged together who have organized personal patterns and interdependent relationships (Wheatley, 1999, pp. 144–145).

Omniscient Point of View. A third person (God's eye) subjective heteroglossia stance or narrative perspective on a given visual subject or graphical image. (Sanyal, 2000, p. 3).

Organic. An open system of continuous exchange with the environment containing cycles of input, internal transformation, through-put, equifinality, output, and feedback exchange that effect the sustainability of the life and form of the system (G. Morgan, 1998, pp. 40–41).

Process Model. A collection of conceptually related schemas designed to produce a specific ordering of connected work activities across time and place, with rules for a beginning, an end, and a better understand of defined inputs and outputs (Seifert, 1987, pp. 14–37).

Social Network. A structured pattern of relationships typified by reciprocal patterns of communication and exchange. A seamless and often invisible web of

differential and deferential reciprocity achieved largely through face-to-face and frequent interactions that holds these trust-based relationships in place (Stephenson, 1999, pp. 7–41).

Initial Study HBDI™ Data Analysis

1221 Initial study (n = 151) HBDI™ composite profile. The initial study (*n* = 151) group profile seen in Figure 19 shows that, as a group, the research population has primary thinking preferences in all four quadrants. This composite profile shows a strong preference for the analyze and synthesize mode (56%) as it relates to the lower mode (44%). The A- and D-quadrants show extreme scores that are off the charts (A = 141, 132, 134 and D = 152, 137, 138, 146, 138) with a graduated trend from mid-secondary to primary concentrated in a band between scores of 67–100. There are more concentrations of low preferences in the C-quadrant (15, 18) but with a more scattered distribution running from the low to high locations. The split between left mode (50%) and right mode (50%) is equal.

1221 Initial study (n = 151) HBDI™ average profile. The initial study (*n* = 151) group's average profiles seen in Figure 18 identify the most preferred HBDI™ quadrants, which are A and D with an average score of 81 and 82, which places it in the primary zone preferences. The group's next preference is the B- and C-quadrants with an average score of 66 and 63, placing it in the secondary zone preference. The B-quadrant is on the cusp of being a primary preference. No tertiary average scores were present.

The balanced nature of group profiles result in a group average score that is distributed evenly across the A–D and C–B-quadrant pairings. This shows that the group

is evenly split between right mode analytical and left mode synthesizer. The profile is tilted more toward the upper cerebral mode than the lower limbic mode.

1221 Initial study (n = 151) HBDI™ preference map. The initial study (*n* = 151) preference map seen in Figure 20 provides an indication among the team members that a substantial portion of the population exists in the upper cerebral mode rather than the lower limbic mode. The A-quadrant has two members who can be identified as individuators on the outside periphery (Participant 1 and 30). The B-quadrant has the fewest member profiles. It has three individuators (Participants 133, 14, and 25) who exist on the periphery of the samples mapped.

The C-quadrant has a heavy concentration of member profiles in the center and outer profile bands causing a small island of white space. It contains two individuators on the intersection of the C- and D-quadrants (Participants 87 and 112). The C-quadrant contains two mini-networks of participants (Participants 62, 36, 6, and 58; Participants 108, 33, 66, 61, 86, 59, 69, 114, 138, and 104).

The D-quadrant contains the largest number of members compared to the other three quadrants. Within the D-quadrant is one mini-network located on the second periphery ring (Participants 41, 3, and 146). There also is an individuator located on the external band (Participant 15).

PLAY HBDI™ Data Analysis

2111 PLAY (n = 19) HBDI™ composite profile. The PLAY (*n* = 19) group profiles seen in Figure 22 show that, as a group, PLAY has primary thinking preferences in all four quadrants. There are more concentrations of low preferences existing in the A- and B-quadrants. This composite profile shows a strong preference for the right mode

(57%) as it relates to the upper mode (51%). The D-quadrant shows two extreme scores that are off the chart (146, 153) with a graduated trend in scores scaled from intermediate to extreme. The C- and B-quadrants show a trend concentration in the intermediate locations. The A-quadrant shows a concentration at the low position (26, 29) and enough scattering across the quadrant to be recognizable.

2111 PLAY (n = 19) HBDI™ average profile. The PLAY (*n* = 19) group's average profiles seen in Figure 21 identifiy the most preferred HBDI™ quadrants (D, C, and B) with an average score of 92, 77, and 69, which places it in the primary zone preferences. The group's next preference is the A-quadrant with an average score of 60, which places it in the secondary zone preference. No tertiary scores were present.

The balanced nature of the group's profile results in a group average score that is distributed evenly across the D–C- and B–C-quadrant pairings. This shows that the group is more right mode intuitive and lower mode grounded. The profile is tilted more toward the right mode and less toward the left mode.

2111 PLAY (n = 19) HBDI™ preference map. The PLAY (*n* = 19) preference map seen in Figure 23 provides an indication that a substantial portion of the team members are identified in the D- and C-quadrants. Over half of the D-quadrant members are located in the extreme position in this quadrant, which indicates that within the group a very strong sense of D-quadrant characteristics exist. The A-quadrant has only one individuator profile (Participant 13). This individual is located in the cognitive and analytical mode and may seem disconnected from the other team members.

The B- and C-quadrants have a strong balanced positioning of the members and should provide easy access to those skills. In the D-quadrant there is a mini-network

(Participants 3, 10, 7, 5, 8, and 2), or community of profiles, which are upper mode similar thinkers. This homogeneous group of similar thinking preferences could push the team into a groupthink tendency. The rest of the profiles are evenly split and balanced between the cerebral and the limbic thinkers, creating a heterogeneous group. This group does have a right-brain double dominant tilt in the D- and C-quadrants.

2211 PLAY (n = 12) HBDI™ composite profile. The PLAY (*n* = 12) group profiles seen in Figure 25 show that, as a group, PLAY has primary thinking preferences in all four quadrants. There are more concentrations of low preferences existing in the A- and B-quadrants. These composite profiles show a strong preference for the right mode (60%) as it relates to the upper mode (51%). The D-quadrant shows an extreme score that is off the chart (135, 153) with a graduated trend in scores scaled from intermediate to extreme. The C- and B-quadrants show a trend concentration in the intermediate locations. The A-quadrant shows a concentration at the low position (26, 29) but enough scattering across the quadrant to be recognizable.

2211 PLAY (n = 12) HBDI™ average profile. Average profiles of the PLAY (*n* = 12) group seen in Figure 24 identify the most preferred HBDI™ quadrants, D and C, with an average score of 96 and 83 placing it in the primary zone preferences. The group's next preference is the A- and B-quadrant with average scores of 65 and 56, placing it in the secondary zone preference. No tertiary scores were present.

The balanced nature of the group's profile results in a group average score that is distributed evenly across the pairings of the D–C- and B–C-quadrants. This shows that the group is more right mode intuitive and lower mode grounded. The profile is tilted more toward the right modes and less toward the left mode.

2211 PLAY (n = 12) HBDI™ preference map. The PLAY (*n* = 12) preference map seen in Figure 26 provides an indication that among the team members, a substantial portion are identified in the D- and C-quadrants. Over half of the D-quadrant members are located in the extreme position in this quadrant, which indicates that within the group an extremely strong sense of D-quadrant characteristics exists. These group members may bring the conceptual background to the team and are mapped to the extreme position.

The B- and C-quadrants have a strong balanced positioning of the members and should provide easy access to those skills. The group could feel a disconnect in left-mode thinking. In the D-quadrant there is a mini-network (Participants 12, 6, 4, and 2), or community of profiles, which is upper mode and right mode similar thinkers.

There is one individuator in the D-quadrant (profile 2). This D-quadrant homogeneous group of similar thinking preferences could push the team into a groupthink tendency. The rest of the profiles are evenly split and balanced between the cerebral and limbic thinkers, creating a heterogeneous group. This group has a right-brain double dominant tilt in the D- and C-quadrants.

Case study correlation data analysis synopsis. The correlation between PLAY 19 versus PLAY 12 seen in Table 18 shows that the databases are numerically similar. Within an acceptable variance determined by the HBDI™ reliability validation, HBDI™ score validation variance can be as significant as 20 points and still maintain validity. The PLAY 19 versus PLAY 12 database correlation shows a total numerical shift from 0 of 10 points between each other from the positive to negative scoring limits. The HBDI™ score in the B-quadrant for both databases is on the primary threshold score of 67 points.

The PLAY 19 and PLAY 12 database scores are essentially identical within the instrument reliability and validity constraints.

Test–Retest HBDITH Data Analysis

1211 CP-01 (n=5) HBDI^{TM} composite profile. The CP-01 Test (*n* = 5) group profiles seen in Figure 28 show that, as a group, the CP-01 has primary thinking preferences in all four quadrants. There are more concentrations of lower preferences existing in the B-quadrant. This composite profile shows a strong preference for the right mode (60%) as it relates to the left mode (40%). The D-quadrant shows extreme scores that are off the chart (102, 122, and 138) with a graduated trend in scores scaled from intermediate to extreme. The C-quadrant shows a trend concentration in the intermediate to strong positions (69, 74, and 81). The B-quadrant shows a trend concentration in the low to intermediate positions (41, 42, 47, and 48) with enough concentration to be recognizable. The A-quadrant shows a concentration at the intermediate to strong positions (56, 75, 77, 81, 83).

1211 CP-01 (n = 5) HBDI^{TM} average profile. The CP-01 (*n* = 5) group average profiles seen in Figure 27 identify the most preferred HBDI^{TM} quadrants, D, C, and A, with an average score of 107, 67, and 74, which places it in the primary zone preferences. The next preference of the group is the B-quadrant with an average score of 44, which places it in the secondary zone preference. No tertiary scores were present.

The balanced nature of the group profile results in a group average score that is distributed evenly across the pairings of the D–C- and A–D-quadrants. This shows that the group is more right-mode intuitive and upper mode cognitive. The profile is tilted more toward the upper mode and less toward the lower modes.

1211 CP-01 (n = 5) HBDI™ preference map. The CP-01 (*n* = 5) preference map seen in Figure 29 provides indication that all the informal team members, or validation grouping, are identified in the D-quadrant. Over half of the D-quadrant members are located in the intermediate position, which indicates that within the validation group an extreme sense of D-quadrant characteristics exists.

There is a mini-network (Participants 2, 5, and 1), in the D-quadrant or community of profiles, which are upper mode similar thinkers. This homogeneous group of similar thinking preferences could push this informal team, or validation group of members, into groupthink. There are two individuator profiles in the D-quadrant (3, 4).

The C, B, and A-quadrants have no participant profiles centered in that location. All of the profiles are cerebral with no limbic thinkers, which creates an informal homogeneous group. This group has a right-brain double dominant tilt in the D- and C-quadrants and an upper-brain double dominant tilt in the A- and D-quadrants.

1211 CP-02 (n = 5) HBDI™ composite profile. The CP-02 retest (*n* = 5) group profiles seen in Figure 31 show that, as a group, the CP-02 has primary thinking preferences in all four quadrants. There are more concentrations of low preferences existing in the B-quadrant. This composite profile shows a strong preference for the right mode (62%) as it relates to the left mode (38%). The D-quadrant shows high scores (101, 111, 113, and 129) with a graduated trend in scores scaled from intermediate to strong positions. The C-quadrant shows a trend concentration in the intermediate locations (66, 77, 78, 86) with one profile identified as a low preference (30). The B-quadrant shows a trend concentration in the low to intermediate positions (33, 38, 44, and 57) with enough

concentration to be recognizable. The A-quadrant shows a concentration at the intermediate to strong positions (54, 56, 71, 72, 84).

1211 CP-02 (n = 5) HBDI™ average profile. The CP-02 (*n* = 5) group average profiles seen in Figure 20 identify the most preferred HBDI™ quadrants, D, C, and A, with an average score of 112, 67, and 67, which places it in the primary zone preferences. The next preference of the group is the B-quadrant with an average score of 41, which places it in the secondary zone preference. No tertiary scores were present.

The balanced nature of the group's profile results in a group average score that is distributed evenly across the pairings of the D–C- and A–D-quadrants. This shows that the group is more right mode intuitive and upper mode cognitive. The profile is tilted more toward the synthesize and analyze modes and less toward the organize and personalize modes.

1211 CP-02 (n = 5) HBDI™ preference map. The CP-02 (*n* = 5) preference map seen in Figure 32 provides indication that among the informal team members, or validation grouping, all are identified in the D-quadrant. Over half of the D-quadrant members have a secondary preference in the intermediate position in this quadrant, which indicates that within the validation group an extreme sense of D-quadrant characteristics may exist.

In the D-quadrant there is a mini-network (Participants 4, 5, and 1), or community of profiles, which are upper mode similar thinkers. This homogeneous group of similar thinking preferences could push this informal team, or validation group, of members into groupthink. There are two individuator profiles in the D-quadrant (2, 3).

The C-, B-, and A-quadrants have no participant profiles centered in that location. All of the profiles are cerebral with no limbic thinkers, which creates an informal homogeneous group. This group does have a right-brain double dominant tilt in the D- and C-quadrants and an upper-brain double dominant tilt in the A- and D-quadrants.

Test–retest correlation data analysis synopsis. The correlation between CP-01 and CP-02 seen in Table 22 shows that the databases are numerically similar. Within an acceptable variance determined by the HBDI™ reliability validation, HBDI™ score validation variance can be as significant as 20 points and still maintain validity. The CP-01 versus CP-02 database correlation shows a total directional shift of 12 points between each other from the positive to negative scoring limits. The HBDI™ score for both databases exhibits empirical test–retest stability. The CP-01 and CP-02 database scores are essentially identical within the instrument reliability and validity constraints.

Case Study Process Models, Mental Models, Graphics, and Illustrations

Case Study Definitions

To better understand the case study data analysis and results the addition of new PLAY Company definitions was required. These terms are specific to the research document and case study common language used to produce a grounded understanding. This unique terminology is documented verbatim and unveiled during the inquiry.

PLAY Company Definitions

Brilliance. A declarative statement that is the baseline of language at PLAY Company. Its use acknowledges to everyone crystal clarity of an idea or thought that allows the continuation of creative thinking (A. Stefanovich, personal communication, December 15, 2004).

Change Perspective. The comfort and ability to incorporate alternative points of view into generating ideas. The ability to change perspective allows us to remain curious and develop alternative ideas (PLAY, 2003).

Confusion Tolerance. The comfort and tolerance for ambiguity and temporarily sets aside the need for an immediate answer. Maintaining high levels of confusion tolerance allows us to remain curious and develop alternative ideas and solutions (PLAY, 2003).

Creativity (aka Lamstaih). Look at more stuff. Think about it harder (PLAY, 2003).

Creative Collective Consciousness. Consists of any and every idea, notion, theory, practice, person, place, or thing ever conceived throughout history (PLAY, 2003).

Hook. A declarative statement which allows a polite interruption during creativity dialogue. This allows a new person to jump into the conversation allowing everyone to participate (A. Stefanovich, personal communication, December 15, 2004).

Leader$_c$. The ability to encourage divergent thinking and create opportunities to solicit input (perspective) from others when generating ideas. More important, incorporate the thinking from others into the ideas being worked on (PLAY, 2003).

Mindset (a). Intellectual and emotional foundation of creativity unique to every person. It includes the four tenants of thinking creativity: change perspective, confusion tolerance, skinned knees, and passion (PLAY, 2003).

Passion. The comfort and the ability to apply characteristics of passion to work. Passion is the energy behind innovation, allowing individuals to incorporate successful personal attributes (PLAY, 2003).

Skinned Knees. The comfort and willingness to take risks and learn from mistakes. Skinned knees allows us to explore possible innovations by removing the inhibitions of failure (PLAY, 2003).

Case Study Process and Mental Models

The PLAY Company has different process models and mental models that describe creativity and innovation. These models provide a cognitive description of the PLAY philosophy of creativity, the creative mindset, the five steps of creativity, the collective creative consciousness, and the 4M's.

In addition to the models are other illustrations, graphics, and cartoons that create a higher level of understanding into the culture of the PLAY Company. These are the inspiration–creativity–innovation flow illustration, creativity–better business triangulation illustration, 4M's not 4-square illustration, ripple effects illustration, and S.O.S. illustration. To present a fuller meaning of the graphics requires a researcher synopsis that describes the intention of the visual image.

The following synopses and critiques are presented from an omniscient point of view. The models were initially reviewed and the researcher created a synopsis. Every mental model and process model describes an abstract representation of some real world entity that we study, not for that intrinsic interest, but for its formalized or simplified representation of phenomena, which can be easily studied to provide a clear understanding.

Mental models are internal psychological representations of the PLAY member's interactions with the world. One purpose of these representations is they allow PLAY members the conceptual framework to solve problems and use artifacts (Schein, 1992,

p. 17). Process models are a collection of conceptually related schemas designed to produce a specific ordering of connected PLAY Company work activities across time and place with rules for a beginning, an end, and defined inputs and outputs.

After an initial description of the mental models and process models was created, the synopsis was provided to the PLAY Company for review and acknowledgment. Agreement was reached on any unclear or ambiguous areas in the critique, reprint, and duplication of images approved by ©PLAY 2003.

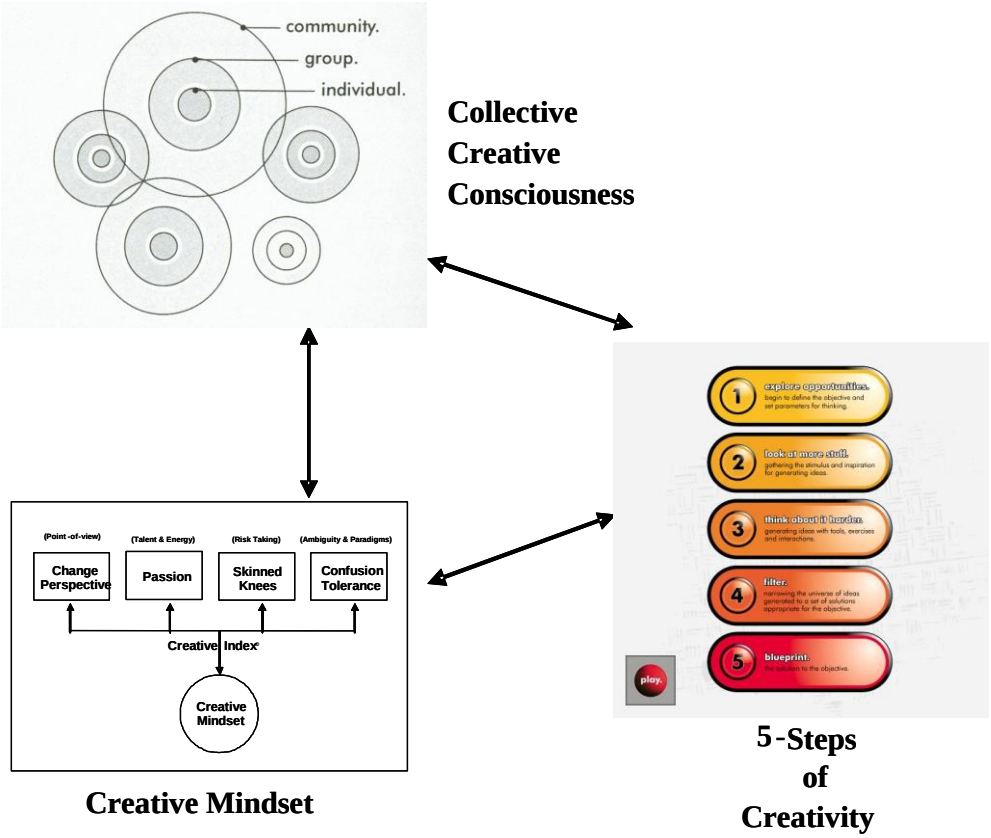


Figure 33. Philosophy of creativity.

PLAY Company philosophy of creativity synopsis. The PLAY Company philosophy of creativity is based upon three elements: collective creative consciousness (CCC), five steps of creativity, and creative mindset. These elements are interconnected and flow between and through each element into each other.

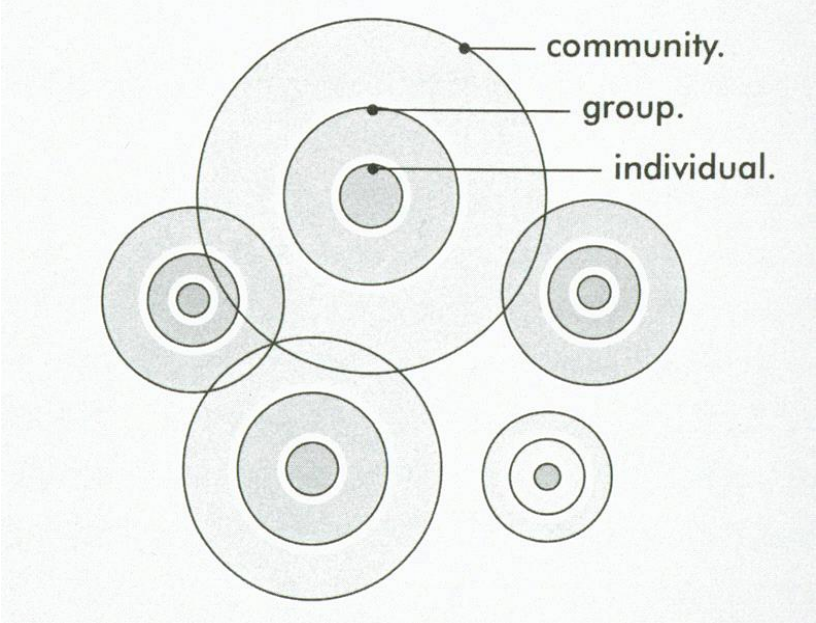


Figure 34. Collective creative consciousness.

PLAY creative collective consciousness synopsis. The CCC encompasses any and every "idea, notion, theory, practice, person, place, or thing ever conceived throughout history" (PLAY, 2003). The CCC model is comprised of a series of concentric circles that have different sizes and overlap containing a ring representing the individual, the group, and the community. The only difference between these items in the CCC is the impact each one may have upon a person who may reside or comes in contact with it. The graphical image of the model symbolically illustrates a series of raindrops in a puddle that creates impact (ripples) regardless of their size.

Figure 35. Five steps of the creativity.

Five steps of creativity synopsis. The PLAY Company creative process is an organic series of mechanistic steps that can be customized by incorporating different stimuli such as tools or exercises. The five-step innovation process is composed of a split of three divergent and two convergent thinking methods.

Step 1: *Explore opportunities*. A divergent thinking method of bringing focus to the objective and planning how to approach the objective.

Step 2: *Look at more stuff*. A divergent thinking method of finding and experiencing the stimuli and inspiration for developing new ideas.

Step 3: *Think about it harder*. A divergent thinking method of synthesizing inspiration into the generation of new ideas.

Step 4: *Filter*. A convergent thinking method of separating the good ideas from the great ideas based on a success criteria.

Step 5: *Blueprint*. A convergent thinking method of transforming the idea into a solution to meet the objective.

The PLAY Company's divergent thinking methods are process steps designed to generate as many ideas as possible. The convergent thinking methods are process steps designed to evaluate, sort, and categorize ideas so they can be narrowed down to identify the most appropriate solutions. This five-step process is the PLAY Company's framework for approaching any objective or problem.

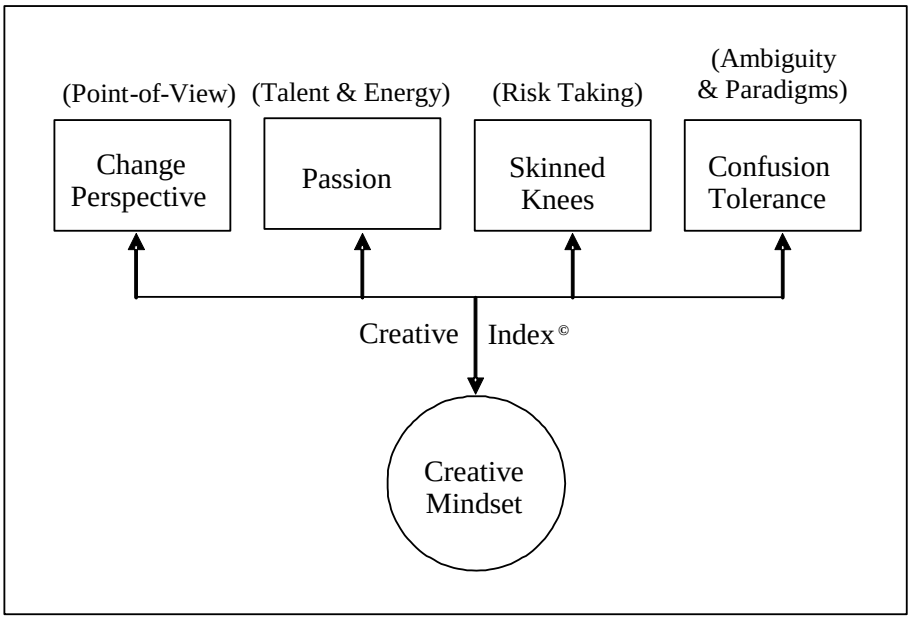


Figure 36. Creative mindset.

Creative mindset synopsis. The creative mindset is comprised of multiple elements that are a subset of the Creative Index^{sw}. It is an individual guide to ability within four different traits for generating ideas. These are centered on inspiration and the ability to develop new ways of thinking. The change perspective, passion, skinned knees, and confusion tolerance mindset guide the individual toward creative action.

Change Perspective: The comfort and ability to incorporate alternative points of view into generating ideas.

Passion: Unique talents and energy characterized in the way we think, feel, and behave demonstrate our passion.

Skinned Knees: The comfort, ability, or willingness to take risks framed in terms of perceived gains or losses around possible outcomes.

Confusion Tolerance: Information based upon a rule of thumb (paradigm) to reach decisions needs to be encouraged to present a systemic and thorough search for ideas.

These elements create tools for ideas representing unique talents and abilities to think in different ways to produce the foundation of the organizational creative process.

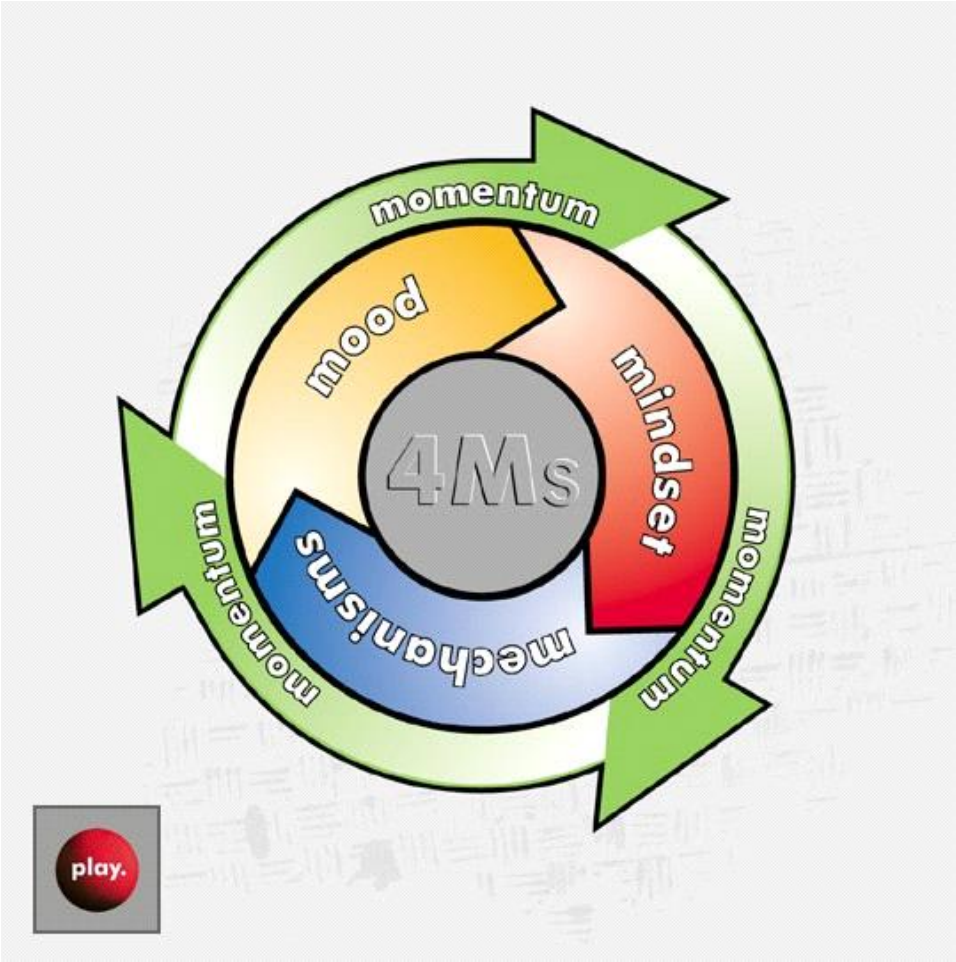


Figure 37. 4M's creative training framework.

4M's creative training framework synopsis. This graphic creates a language behind the sequence of events for creativity. A. Stefanovich, in 2000, originally conceptualized it while sitting on an airplane searching for a way to move from esoteric language to visual with a model. He was able to refine the model with collaborative dialogue and input of other PLAY Company members as they searched for a way to illustrate where individuals fall into the innovation process. The 4M's creativity training

framework includes four specific components that allow some people to individualize it while others apply its influence to the organization. PLAY Company 4M's training framework model elements are described as the mood, mindset, mechanism, and momentum, which allow a process for implementing innovation into a culture.

1. *Mood*: The immersion data point used as an assessment for indexing the strength of the individual creativity baseline.
2. *Mindset* (b): Based on the "why" premise for where you are now and where you want to go.
3. *Mechanism*: Based on the "how" premise with the PLAY processes, tools, and exercises.
4. *Momentum*: Action plan for how to carry this influence and learning forward to integrate it into the organization, group, or culture.

Case Study Graphics and Illustrations and Cartoons

The following synopses and critiques are presented from an omniscient point of view. The graphics were initially reviewed, and the researcher created the synopsis. A cartoon is a humorous, satirical, or nonserious image created to allow a unique perception of the world. An illustration is a visual representation (diagram) used to make the meaning of a subject easier to understand.

Every cartoon or illustration graphic tells a story about the PLAY Company, which the researcher then describes. After an initial description of the illustration was created, the synopsis was provided to the PLAY Company for review and acknowledgment. Agreement was reached on unclear or ambiguous areas in the critique

to provide an accurate representation, reprint, and duplication of images approved by ©PLAY 2003.

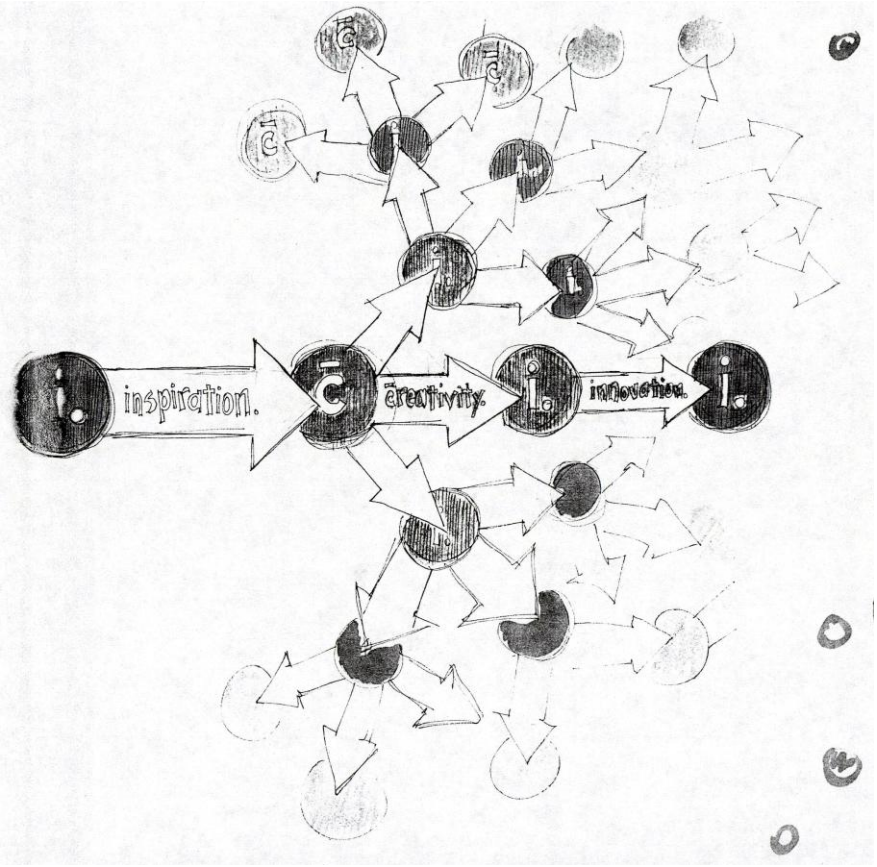


Figure 38. PLAY inspiration–creativity–innovation flow illustration.

PLAY inspiration–creativity–innovation flow illustration synopsis. This illustration describes innovation as a process that includes creativity and inspiration. Inspiration is the start of the innovation process. When creativity occurs, it divides into either a single innovation or multiple innovations points. These "bifurcation points" (G. Morgan, 1998, p. 225) of innovation lead to other creativity offshoots. Creativity increases and expands from a single inspiration ultimately leading to innovation. The unique theme is that innovation and creativity multiply through inspiration.

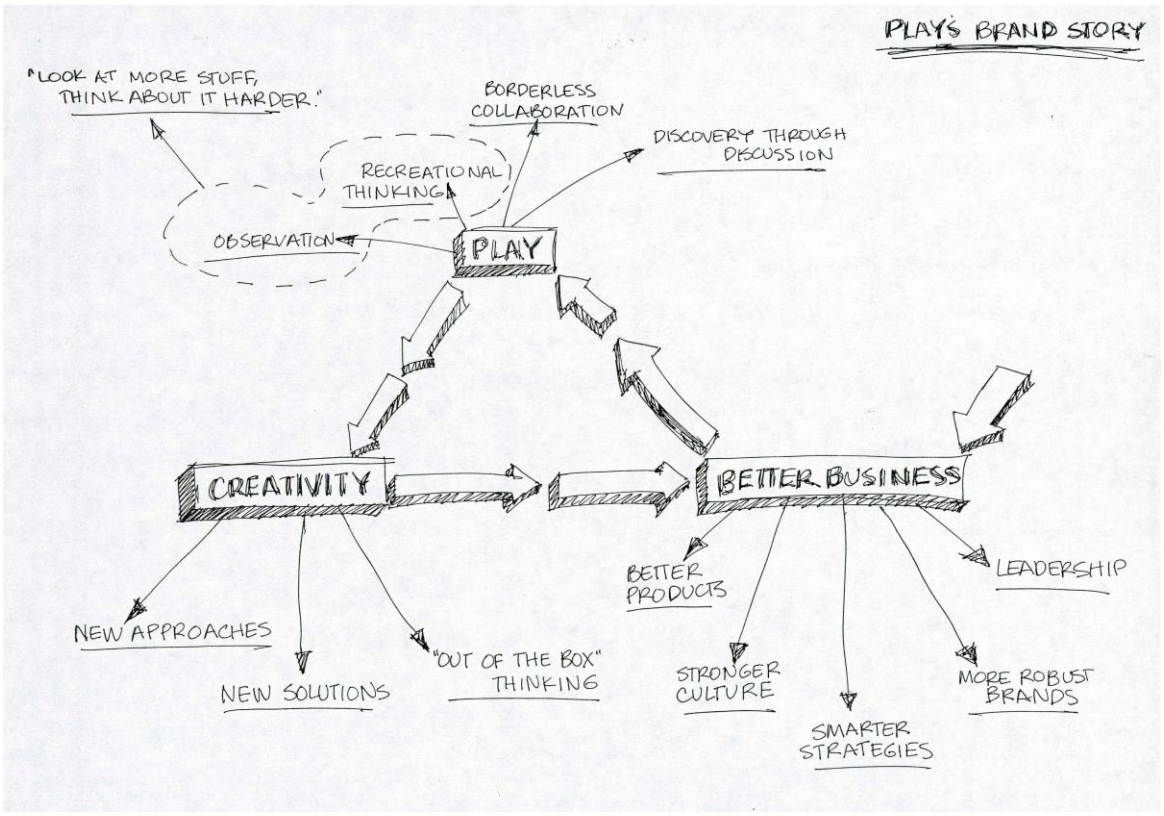


Figure 39. PLAY–creativity–better business triangulation illustration.

PLAY–creativity–better business triangulation illustration synopsis. This illustration describes the *PLAY Brand Story,* which is comprised of three major components: better business, PLAY, and creativity. Better business is the start of a variety of vision–mission goals and objectives. The elements to better business are better products, a stronger culture, smarter strategies, more robust brands, and leadership.

The second component is PLAY, containing five elements, two of which are integrated. The elements are discovery through discussion, borderless collaboration, and the two combined elements of recreational thinking and observations leading to "Looking at more stuff ,and thinking about it harder." The final component is creativity that contains new approaches, new solutions, and out-of-the-box thinking. These three

components are linked in a loop that continuously leads back to better business for PLAY.

The purpose of Figure 39 is to better illustrate an internal company strategy for better business. This opportunity for better business is built upon PLAY observation–looking, teaming with others, and exposure through discussion. These competencies are established through the PLAY creativity process and provide a new unique approach leading to new solutions and original thought. This PLAY by-product is encompassed under a better business strategy leading to better products, a stronger culture, smarter strategies, more robust brands, and leadership. The unique theme is that leadership is a by-product of better business.

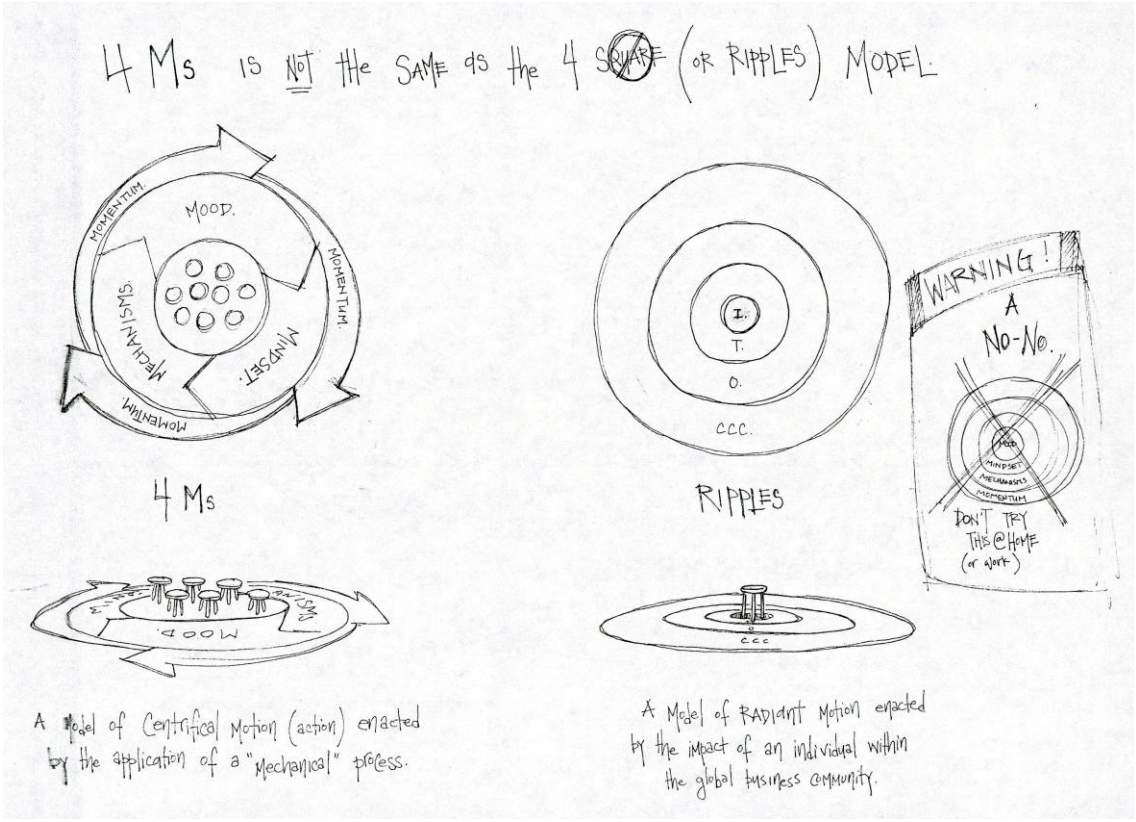


Figure 40. PLAY 4M's not 4-square illustration.

PLAY 4M's not 4-square illustration synopsis. This figure describes three major themes that are graphically separated. The first theme is illustrated as a top and plan view of the 4M's model. It identifies that the purpose of the model is to show circular motion (action) created by the application of a mechanical process. The second illustrated theme is a top and plan view of the ripples model that contains the components of the individual, team, organization, and creative collective consciousness. The graphic image of a three-legged stool is located in the center ring of the model of radiant motion. This proposes the impact of one individual inside the global business community.

The third figure is a warning to people not to attempt to fit the 4M's components of mood, mindset, mechanisms, and momentum into the ripples model. It is a "no-no" to mix the metaphors and mental models together. Text accompanying the image states, "Don't Try This @ Home" (or work). The unique theme is that the 4M's and 4-square (ripples) models have been previously confused.

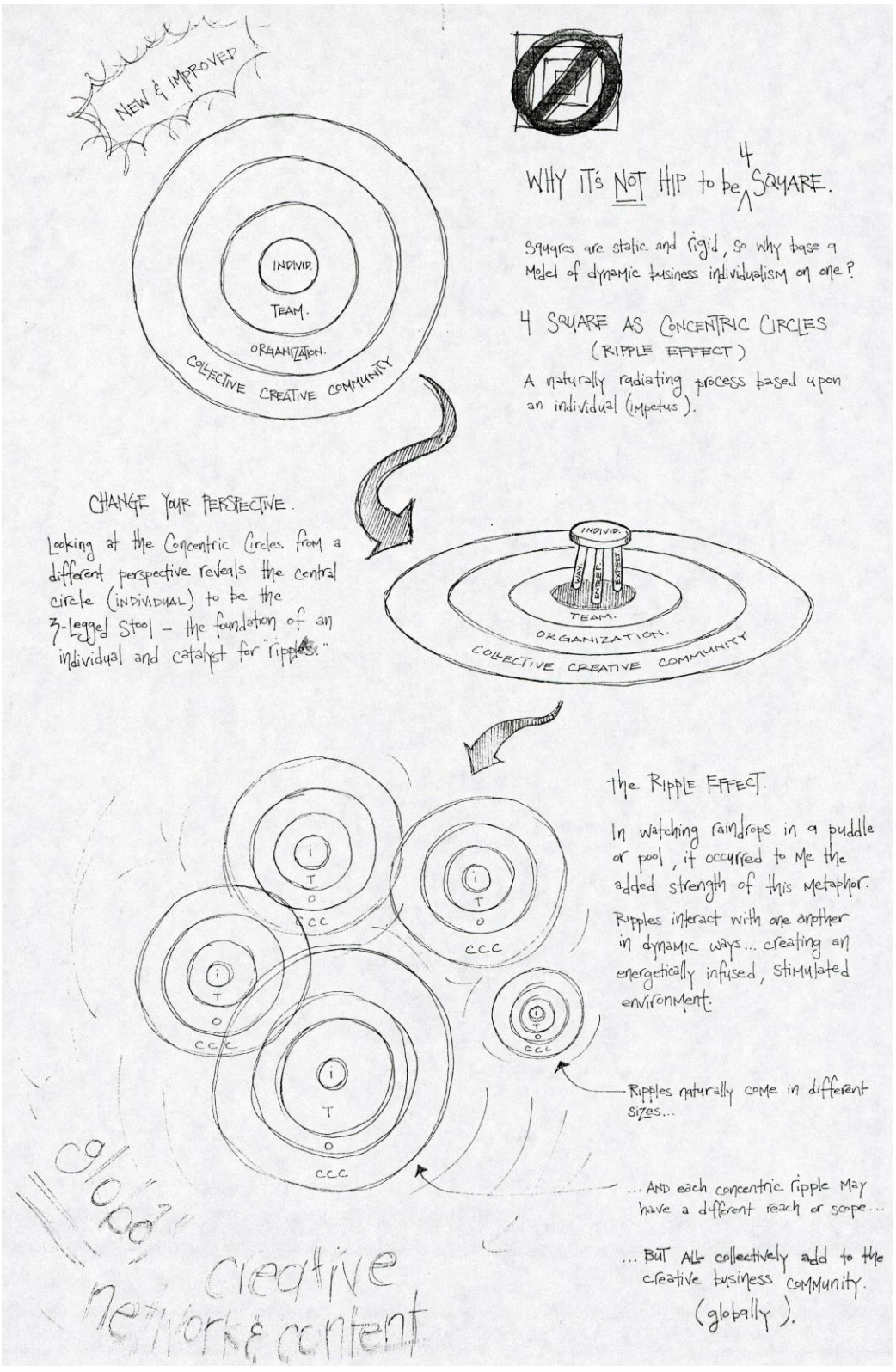


Figure 41. Ripple effect illustration.

Ripple effect illustration synopsis. Figure 41 describes four major themes that are integrated with a flow running through three of them. The first image is a duplication of the 4-square graphic with a statement that outlines the difference between a business model for innovation and a model of dynamic individualism. It displays the premise that the individual impetus should be based upon a naturally radiating series of concentric circles known as the ripple effect.

The second image is a banner illustrating the term *new and improved* with a graphic of three concentric circles with labels identified in each section. The graphic contains text: *Individual* is located in the center, *Organization* is located in the next ring, *Collective Creative Community* is located in the outside ring.

A freehand flowing arrow moves to the next graphic, which is the same set of concentric circles and labels laid flat to the horizon with a three-legged stool in the center labeled "Individ(ual)" on the seat. Each of the three legs has a text label with a PLAY Company known meaning behind them. The first leg says "Way," which means "your style in which you bring yourself." The second leg says "Entrep(renurial Spirit)," which means "your appetite to create new things, and move forward." The third leg says "Expert(ise)," which means "your knowledge and skills."

An additional freehand flowing arrow moves to a final graphic, which is a collection of five different concentric circles of various sizes overlapping each other, and spinning, all with the symbols I, T, O, and CCC inside them. The banner *Global Creative Network Content* is placed below the image, and text statements for "The Ripple Effect" are adjacent to the image on the right side.

The text describes the correlation of the graphic to “watching raindrops in a puddle, or pool” that interact with one another in dynamic ways, creating an “energetically infused, stimulated environment.” These ripples “naturally come in different sizes,” and “each concentric ripple may have a different reach, or scope,” but “all collectively add to the creative business community (globally).”

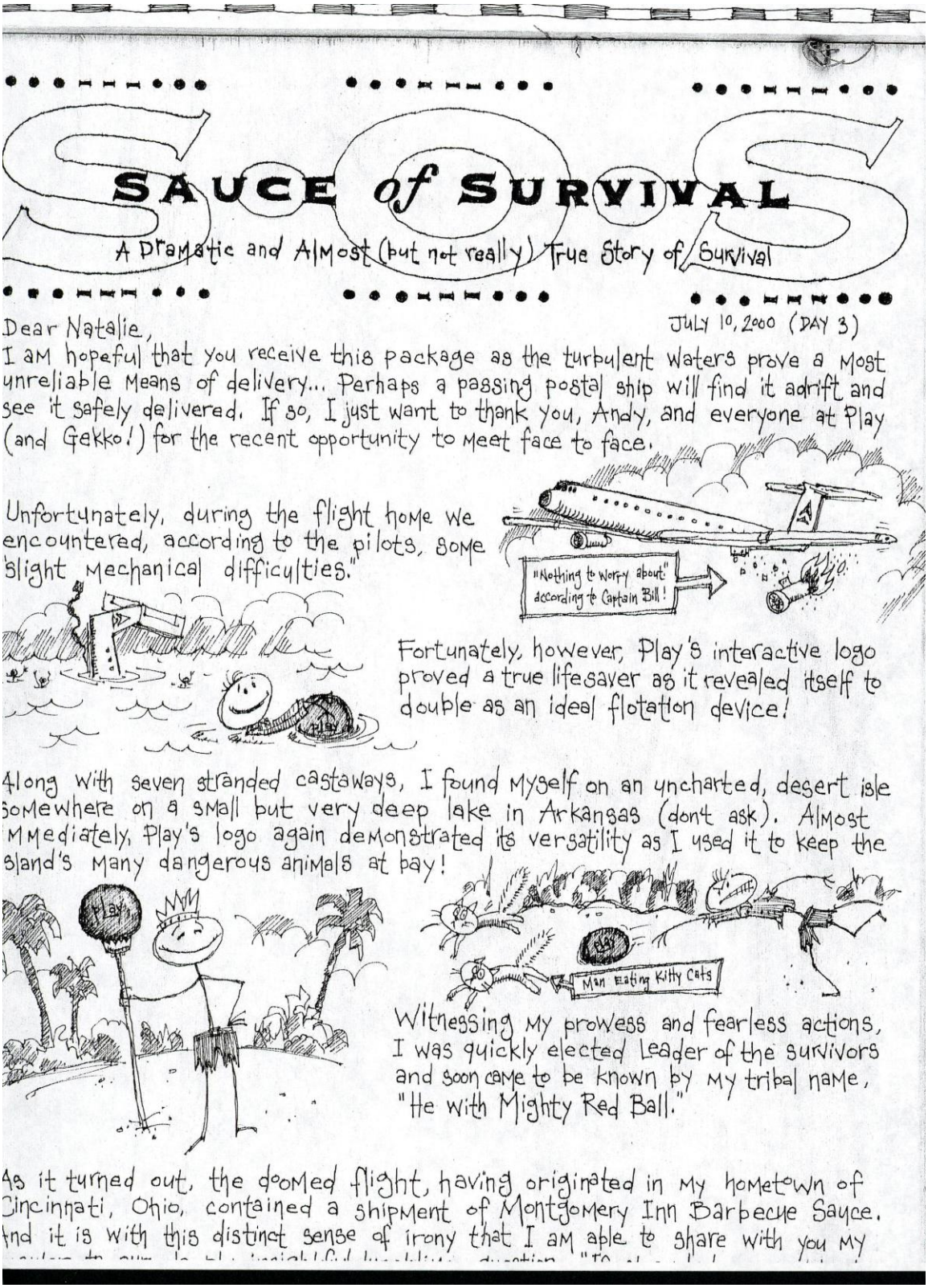


Figure 42. PLAY S.O.S. illustration.

S.O.S. illustration synopsis. A candidate for employment who was later hired at PLAY submitted this cartoon after a personal interview. The premise behind the communication with PLAY was a humorous attempt to reinforce the author's understanding of the PLAY 4-square red ball metaphor and mental model when applied to an external emergency situation, that is, a plane crash over a deep lake in Arkansas where they ultimately end up on an island.

The story illustrates the use of the PLAY 4-square red ball as a flotation device, a weapon to scare away dangerous animals, and a symbol for a new tribal name, "he with mighty red ball." The graphical image was created and placed on the cover of a barbeque sauce gift box sent to PLAY as a thank-you to the primary leader, PLAY team members, creative consultants, and the primary leader's dog (considered a company mascot). The purpose of the graphic is to provide strong thanks for the PLAY creativity training received and demonstrate humor expressed through double-loop learning. This learning is exhibited by the author's possible use of the PLAY training in everyday situations. The unique theme of the graphic is a proclamation that the use of PLAY creativity, innovation tools, and processes should be fun.

Case Study HBDI™ Survey Question Results

PLAY Organizational Results

The case study survey questions Q2, Q5–Q9 (Tables 25, 28–32) response data went through a primary and secondary decoding process to expose themes and textual trends that were valid responses organized into three major philosophies. These responses were naturally distributed within the philosophies of the individual, group, and organization. The individual case study interview responses are in Appendix E.

Q1 and Q4 (Tables 24 and 27 were true–false questions, and the responses were organized into percentages associated with one of those two responses or an indication of no response was identified. Q3 (Table 26) required the participants to recognize and identify an HBDI™ primary thinking preference by quadrant. The data are presented in a simple checklist method. Q10 (Table 33) was submitted to elicit any remaining ideas, themes, or responses not captured in Q1–Q9.

The major leader of the PLAY organization was provided three additional questions, Q10–Q12, for response. These questions were presented in a question–answer format and contain an immediately recognizable theme or series of themes in the responses. The coded and decoded responses are matrixed (see Appendix F).

Table 24

Individual Thinking Preference Validation: Arranged by Participant Number

Question # 1	Yes	No	No Response
Participant 1	Yes		
Participant 2	Yes		
Participant 3	Yes		
Participant 4	Yes		
Participant 5	Yes		
Participant 6	Yes		
Participant 7	Yes		
Participant 8	Yes		
Participant 9	Yes		
Participant 10	Yes		
Participant 11	Yes		
Participant 12	Yes		
Total	12	0	0
Percent	100 %	0 %	0 %

Note. Q1: Does the individual HBDI™ personal thinking preference report seem to be valid?

Table 25

Why: Arranged by Theme Percentage of Total Response Text Units

Theme	Individual Theory	Group Theory	Organization Theory	Non Correlated
Validation Recognition	14	0	0	0
Personality Strength	11	0	0	0
C Quadrant Recognition	7	0	0	0
D Quadrant Recognition	5	0	0	0
A Quadrant Recognition	4	0	0	0
B Quadrant Recognition	5	0	0	0
Thinking Weakness	3	0	0	0
Thinking Strength	3	0	0	0
Preference Identification	2	0	0	0
Extrinsic Value	0	1	0	0
Total	54	1	0	0
Percent	98.2 %	1.8 %	0 %	0 %

Note. Q2: Why does the individual HBDI™ report seem that way?

Table 26

HBDI™ Quadrants Primary Thinking Preference: Arranged by Participant Number

Survey Question # 3				
Response	A-Quadrant	B-Quadrant	C-Quadrant	D-Quadrant
Participant 1	X	X	X	X
Participant 2			X	X
Participant 3		X	X	
Participant 4				X
Participant 5	X	X	X	X
Participant 6			X	X
Participant 7		X	X	
Participant 8	X	X		X
Participant 9			X	
Participant 10	X			
Participant 11				
Participant 12			X	X
	Yes	Yes	Yes	Yes

Note. Q3: What HBDI™ quadrants do you personally have as your primary thinking preference?

Table 27

HBDI™ Composite Average Group Plot Profile Arranged by Participant Number

Question # 4	Yes	No	No Response
Participant 1	Yes		
Participant 2	Yes		
Participant 3	Yes		
Participant 4	Yes		
Participant 5	Yes		
Participant 6	Yes		
Participant 7	Yes		
Participant 8	Yes		
Participant 9	Yes		
Participant 10			Unresponsive
Participant 11	Yes		
Participant 12	Yes		
Total	11	0	1
Percent	91.6 %	0 %	8.3 %

Note. Q4: Does the HBDI™ composite average group plot profile for the PLAY Company seem to be valid?

Table 28

Why: Arranged by Theme Percentage of Total Response Text Units

Theme	Individual Theory	Group Theory	Organization Theory	Non Correlated
Validation Recognition	1	13	2	0
Group Composite	1	10	1	0
D Quadrant Recognition	1	9	2	0
A Quadrant Recognition	2	8	0	0
Thinking Flow	1	8	1	0
B Quadrant Recognition	1	6	0	0
C Quadrant Recognition	0	5	1	0
Process Model	0	4	0	0
Mental Model	0	4	0	0
Group Strength	0	2	1	0
Group Weakness	0	1	1	0
Total	7	70	9	0
Percent	8.1 %	81.4 %	10.5 %	0 %

Note. Q5: Why Does the HBDI™ composite average group plot profile seem that way?

Table 29

What Is Strength: Arranged by Theme Percentage of Total Response Text Units

Theme	Individual Theory	Group Theory	Organization Theory	Non Correlated
Thinking Flow	1	10	0	0
A Quadrant Recognition	0	9	1	0
Group Composite	0	9	0	0
B Quadrant Recognition	0	8	0	0
Group Strength	0	7	6	0
Group Weakness	0	5	5	0
D Quadrant Recognition	0	5	0	0
C Quadrant Recognition	0	3	0	0
Bi-Polar Awareness	0	3	0	0
Validation Recognition	0	3	0	0
Process Model	0	1	0	0
Total	1	63	12	0
Percent	1.3 %	82.9 %	15.8 %	0 %

Note. Q6: What is the strength in knowing what other members of PLAY HBDI™ individual thinking preferences are?

Table 30

Tool Identity Innovation: Arranged by Theme Percentage of Total Response Text Units

Theme	Individual Theory	Group Theory	Organization Theory	Non Correlated
D Quadrant Recognition	1	16	0	0
Innovation Skill Set	1	13	4	0
Group Strength	1	6	1	0
B Quadrant Recognition	2	5	0	0
A Quadrant Recognition	1	2	0	0
Mental Model	0	2	1	0
Bi-Polar Awareness	0	2	0	0
Inspiration	0	2	0	0
Divergent Thinking	0	2	0	0
Whole Brain	0	2	0	0
Group Weakness	0	2	0	0
C Quadrant Recognition	1	1	0	0
Passion	0	1	0	0
Total	7	53	6	0
Percent	10.6 %	80.3 %	9.1 %	0 %

Note. Q7: How does the HBDI™ tool identify innovation at PLAY?

Table 31

Indicators of Innovation: Arranged by Theme Percentage of Total Response Text Units

Theme	Individual Theory	Group Theory	Organization Theory	Non Correlated
Positive Energy	0	11	0	0
D Quadrant Recognition	0	9	0	0
Possibility Thinking	0	8	8	0
Systems Thinking	0	6	5	0
Imagination	5	6	0	0
Convergent Thinking	0	6	1	0
B Quadrant Recognition	0	5	0	0
Paradigm Shift	4	4	3	0
Communication	3	4	4	0
A Quadrant Recognition	0	4	0	0
Shared Learning	0	3	3	0
Serendipity	0	3	0	0
C Quadrant Recognition	0	1	0	0
Divergent Thinking	0	1	0	0
Total	12	69	24	0
Percent	11.4 %	65.7 %	22.9 %	0 %

Note. Q8: What are the HBDI™ indicators of innovation at PLAY?

Table 32

Weaknesses of HBDI™: Arranged by Theme Percentage of Total Response Text Units

Theme	Individual Theory	Group Theory	Organization Theory	Non Correlated
Personal Diversity	8	11	1	0
Innovation Process	4	7	4	0
Operational Definition	6	6	0	0
Instrument Clarity	3	4	0	0
Interconnections	1	4	1	0
Individual Capability	2	4	0	0
Dynamic Output	1	3	1	0
Mental Models	1	1	0	0
Synergy	0	1	1	0
Cross Correlation	0	1	1	0
Total	26	42	9	0
Percent	33.8 %	54.5 %	11.7 %	0 %

Note. Q9: What are the weaknesses of the HBDI™ individual thinking preference tool for identifying innovation?

Table 33

Additional Comments about HBDI™ Tool: Arranged by Participant Number

Question # 10	Response
Participant 1	Upper/Lower and Left/Right helps see
Participant 2	Great tool
Participant 3	Validating for me–aren't to many surprises
Participant 4	None provided
Participant 5	Accurate reflection of individual and group
Participant 6	None provided
Participant 7	Right on target
Participant 8	None provided
Participant 9	Would like a copy spouses profile results
Participant 10	Would like greater detail in certain characteristics
Participant 11	More depth than other personality models
Participant 12	None provided

Note. Q10: Is there anything else you would like to comment on about the HBDI™ tool?

PLAY Leadership Results

Q10: From a leader's perspective, did the HBDI™ tool identify any organizational weaknesses at PLAY?

A1: The HBDI™ tool helped in identifying certain characteristics that should be formally woven into our organizational design.

Q11: What changes, if any, were made at PLAY due to the HBDI™ profile?

A1: Having become more aware of these characteristics, PLAY's executive team built a short-, mid-, and long-term hiring strategy. Specifically, individuals who possessed characteristics in quadrants A and B were hired within the past 9 months, which has significantly improved our bottom line as well as our maturity as a business model.

Q12: If organizational changes were made due to the HBDI™ profiles, were they initiated by you or the individuals?

A1: The changes were ultimately made by me as the leader, yet our informal hierarchy drove the decisions as a result.

Summary

In summary, chapter 4 is separated into three unique sections: HBDI™ research; a descriptive case study evaluation of PLAY Company process models, mental models, illustrations, and graphics; and case study interview responses to a research survey containing questionnaire responses.

One purpose of this chapter was to present the qualitative results of three HBDI™ databases and to offer analysis of those results. The initial study database contains no correlation. The descriptive case study database contains a correlation between the PLAY 19 and the PLAY 12 databases. The test–retest database contains a correlation between the CP-01 and CP-02 databases. Second, this chapter presented a descriptive case study series of PLAY Company process models, mental models, illustrations, and graphics accompanied by a synopsis of the meaning presented from an omniscient point of view.

Finally, this chapter presented qualitative analysis and the results of a descriptive case study survey questionnaire. These responses were analyzed and decoded to produce invariant themes documented and reinforced through individual textual and structural descriptions. The results of the combination of this qualitative data are presented in chapter 5 and ultimately referenced back to the original three research questions. Chapter 5 enumerates limitations of the study and shares lessons learned for future studies.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

The issue of innovation and the creation of novel ideas has been described as one of the most critical issues facing leaders[a,b,c] and organizations today. The problem this research study sought to explore was whether leaders[a,b,c] could benefit from a comprehensive and interconnected process for innovation and its components, which comprise individual thinking preferences, new operational definitions, mental models, and the social context used to create novel ideas. Leadership and organizational measurements available for analyzing innovation tended to concentrate on the individual person rather than the organization and social environment or a balanced mixture of all components.

The case study revealed that at PLAY Company the process model that is used internally for individual innovation and taught externally to clients and customers is a blend of both algorithmic (e.g., TRIZ, USIT, SIMPLEX) and heuristic (parallel, lateral thinking) innovation processes. This blend provides a stronger innovation process for individuals to follow because it adds to the innovation tools that comprise an innovation skill set.

In addition, a major premise of this study was that the connection between the thinking preferences or thinking styles that lead human cognition and the behaviors linked to innovation. These lacked a clear understanding when looking at the individuals contribution to innovation . This lack of understanding was compounded by the confusion between the terms *creativity* and *innovation*, which can mean different things to different people. In the case study interview responses, Participants 6, 7, and 9 used both terms interchangeably.

The literature review exposed that the terms are fused together and are considered an "overlapping concept of innovation, creativity and change" (West & Farr, 1990, p.10). The term *change* was used in chapter 1 as a substitute for *innovation* by M. Kirton (personal communication, October 19, 2001). The research in chapter 2 and in almost all current publications indicates a distinct difference between the two terms.

Change is a process of incremental or deep "transformation" (O'Toole, 1996, p. 158) from one mindset to another, whereas *innovation* is typically seen as a "social process" (West & Farr, 1990, p. 11). Amabile (1983, 1984) described the social psychological model containing components of motivation that comprise the "intrinsic-extrinsic dichotomy" (West & Farr, 1996, p. 21). In the empirical results of Amabile's field study (1984), she identified a pattern that "extrinsic factors inhibited and intrinsic factors facilitated creativity" (as cited in West & Farr, 1996, p. 21). The extrinsic motivators described in her research were described as (a) challenge as a stimulus, (b) pressure, and (c) recognition.

This social psychological process was visible at the PLAY Company and was represented as a series of positive organizational transformations. These transformations ultimately provided learning and thinking that created the multidisciplinary capacity for incremental or discontinuous change. This *change* as described helps produce organizational metamorphosis, strategies, and structures built upon inner shifts in people's beliefs, values, aspirations, and patterns of behavior.

Themes were introduced into the research by the coding and decoding process associated with the interview data. New terminology or phrases comprise these themes and provide the connection to new features of innovation descriptions, including

(a) passion, (b) inspiration, (c) bipolar awareness, (d) possibility thinking, (e) positive energy, (f) imagination, (g) shared learning, (h) serendipity, (i) synergy, (j) interconnections, (k) systems thinking, and (l) personal diversity.

Myths were presented in the research connected to the impact of the PLAY Company stories. These stories personalize a message into a form that everyone can understand in relation to his or her own position in a company. An example was the S.O.S. graphic, which, 5 years after its creation, still clearly articulates the message of innovation training and the tools available to a user.

Finally, *paradigms* were exposed in the initial study and then in the case study. In the initial study, the researcher attempted to determine whether a linkage existed between change agents and the HBDI™ thinking preference quadrants. Initially the researcher believed there would be a natural D-quadrant thinking preference because the thinking preference model descriptions of (a) imaginative, (b) synthesizer, (c) artistic, (d) holistic, and (e) conceptualizer seemed accurate.

In actuality, the initial study HBDI™ research data and analysis presented an A/D-quadrant split, which indicates that change agents are utilizing thinking preferences in upper-brain functionality and balancing it between right- and left-brain modes. This balance is a mixture of analysis and synthesis thinking.

In the case study, the researcher sought to determine if a linkage between innovation and the HBDI™ thinking preference quadrants exists. Initially the researcher believed there would be a natural D-quadrant thinking preference, again because the thinking preference model descriptions of (a) imaginative, (b) synthesizer, (c) artistic, (d) holistic, and (e) conceptualizer seemed accurate. In actuality, the HBDI™ research

presented an A/C-quadrant split, which indicates that innovation utilizes thinking preferences in upper- and lower-brain functionality and concentrates on the right-brain mode. This balance is a mixture of synthesis and passion.

This study revealed numerous insights important to leadership, innovation, and thinking preferences. These insights are linked to a proposed interconnection to the individual, the group, and organization theories.

Significance of the Study to Leadership

The significance of this study was based on the premise that within the study of innovation, leadership, and change there exists a new and practical knowledge of communication creating collaboration and synergies that can create a positive organizational transformation (Flamholtz & Randle, 1998; Galliers & Baets, 1998; Nadler et al., 1998; Senge, 1999). This research also addresses the necessity for the re-creation of "paradigms, myths, scripts, or frameworks" (Quinn, 1996, p. 46) that can define new innovation paths that successfully realign leaders$_{a,b,c}$ and change agents (Ulrich, 1997). The participant responses from survey question 8 revealed the need for (a) positive energy, (b) possibility thinking, (c) systems thinking, (d) imagination, (e) convergent thinking, (f) paradigm shift, and (g) communication as indicators of innovation.

Research Question 1

The first research question explored was, How do change agents use different thinking preferences to measure innovation? In this research project a *change agent* is someone who can determine, describe, and use innovation to create novel ideas. Responses from survey question 7 acknowledge that the measurement of innovation is

recognizable in the HBDI™ D-quadrant and through an innovation skill set. Over 80% of the respondents confirmed they believed this recognition to be a group theory. Just over 10% believed it was an individual theory, and 9% believed it was an organizational theory. Three major themes were characterized as weaknesses for identifying innovation: personal diversity, the innovation process, and the operational definition of innovation. Over 50% of these weaknesses were characterized as group theory, whereas 33% believed it was an individual theory.

Research Question 2

The second research question explored was, How do change agents use different thinking preferences to measure an innovation culture? Responses from survey question 8 acknowledge that the use of HBDI™ thinking preferences can measure an innovation culture through the recognition of many different characteristics, but the strongest were in positive energy, the HBDI™ D-quadrant, and possibility thinking. Additional responses were provided for systems thinking, imagination, and convergent thinking. Over 65% of these responses were seen as group theory, 22% were seen as organizational theory, and 11% were seen as individual theory.

Research Question 3

The third research question explored was, How do psychometric instruments measure innovation? Responses from survey question 1 through survey question 3 acknowledge that 100% of the research participants found the HBDI™ a valid instrument to measure individual thinking preferences. This validation recognition was seen in the respective A-, B-, C-, and D-quadrants and participant personality strength. Over 98% of the respondents saw this as individual theory, 1.8% as group theory, and 0% as

organizational theory. Over 82% of the survey participants recognized strengths in knowing what other members' individual thinking preferences were associated with the team members' thinking flow.

Responses from survey question 4 through survey question 6 acknowledge that over 91% of the respondents found the HBDI™ a valid instrument to measure group-thinking preferences. This validation was seen in the respective group composition, thinking flow, and A-, B-, C-, and D-quadrants. Over 81% saw this as group theory, 10% as organizational theory, and 8% as individual theory.

Critique of the Methodology and Study

Any research methodology will have disadvantages and advantages that are recognizable after the study has been completed. A qualitative descriptive case study methodology was used to examine leadership influences on an innovative culture. The decision to utilize this method was originally challenged by the consideration of a phenomenological study, which was rejected due to many incompatible research parameters. The immersion required of the researcher by a phenomenological methodology (Moustakas, 1994) was not possible. The most compelling point for using a descriptive research method was that innovation could be replicated at any moment through established heuristic (e.g., parallel, lateral thinking) or algorithmic (TRIZ, USIT, SIMPLEX) systemic and process-based methods.

The choice made for a descriptive study was appropriate for this type of research. In addition, the HBDI™ components of the initial study, case study, and test–retest database provided a numerically quantifiable method for the correlation of research data. Each scoring protocol provides a quantified measure of the participants' thinking

preferences for each mental quadrant "expressed in a four digit numerical code" (Herrmann, 1995, p. 70) that assigns a primary, secondary, or tertiary indication of preference strength.

The descriptive methodology as an inquiry process was helpful in finding invariant themes. The coding and decoding approach of giving each statement equal value and eliminating those not pertinent to the research provides a roadmap to textual and structural descriptions not initially apparent from the interview data presented as viable themes.

Scope and Limitations of the Study

A challenge of the study, which may have been a limitation of the inquiry, is the number of case study members in the coresearchers' company. Because the researcher only included interviews from 12 members of the original 19-member organization, some of the interview response themes may have been eliminated.

The time spent with each coresearcher was adequate to answer all the survey questions and provide an additional open-ended survey question for any additional comments. Many of the additional comments were directed toward general and future research, but none was directly pertinent to the current survey questions. Although none of the interviews were stopped prior to their natural ending, a follow-up interview or dialogue may have provided additional clarity.

Finally, there were limitations in the review and validity of the interview data. Although all 12 members reviewed each textual transcript, minor grammatical changes or nuance clarifications were provided by only two coresearchers. An additional

coresearcher was unable to provide a follow-up check after moving to a different organization in Virginia.

A limitation of the HBDI™ is the inability to measure the known variation from one profile thinking preference over time. Many factors may cause a rubber-banding effect within a profile. Thinking preference variation is not a design construct of the HBDI™. The instrument measures specific modes of thinking preference and provides one backup mode, which is created with adjective pairs in a stress-induced situation. The tool does not create a correlation or thinking preference from behavioral situations that may be encountered daily.

Conclusion

Multidimensional thought creates a problem with the current operational definition of innovation available to leaders. This lack translates into the need for new cognitive models. These models need to be more complex and should combine organizational change, innovation, and personal thinking preferences into a new, useful, and valid view of current social and cultural environments in innovative organizations.

There was a difference in the way people saw the HBDI™ thinking preference mapping. This difference was conceptualized as either color quadrant assignments or alphanumeric quadrant assignments. In other words, some participants understand the HBDI™ thinking preference as the blue quadrant whereas others translate it as the A-quadrant, which causes potential cognitive confusion and leads to misunderstanding and miscommunication. This confusion is generated by a cognitive lack of appropriate knowledge in a learning system that focuses on a single dimensional input. Through the survey question responses, this research has exposed the need for multidimensional

models, information, and learning that are interconnected in the individual, group, and organizational theory.

The process of innovation identified within chapter 2 has been described as falling into one of two categories, either heuristic (e.g., parallel, lateral thinking) innovation or algorithmic (TRIZ, USIT, SIMPLEX) innovation. The PLAY Company case study has presented an innovation process and toolset that allows for both the heuristic and the algorithmic boundaries to be successfully crossed and mixed. This success is measured through the ability to create new and novel ideas. With an innovation process and with practice, anyone can be successful in creating new and novel ideas, but innovation occurs as a result of the "passion" (Collins, 2001, p. 109) of individuals. The case study identified that at the PLAY Company, the creative mindset is composed of four traits for generating ideas: a change perspective, passion, skinned knees, and confusion tolerance.

Future Research and Implications

The implications derived from this research run deeply through the results presented. The *social context* (Amabile, 1983, 1989) and *process-based* (de bono, 1999b) theories of innovation may be enhanced through the use of HBDI^{TM} (Herrmann, 1995) psychometric analysis (Plutchik & Conte, 1997), which can allow the construction of a new dynamic and an evolutionary model of innovation. These new models and theories can be based upon the construction of new methodologies and constructive research and survey questions to explore what seem to be "randomly patterned" (Wheatley, 1999, pp. 125–127) examples of operation terms around change, creativity, and innovation.

Future Research

Because this study was a descriptive exploration in innovation, additional replications are necessary across individual, group, and organizational settings; case study contexts; and psychometric analysis for continued empirical elaboration. As in the current study, replications should continue to focus on the use of the HBDI™ to create validity, efficiency, and effectiveness of thinking preferences, which support innovation based on social context rather than process-based innovation. Interview responses from case study participants identified *imagination* and *the ability to make an analogy or drop something else and apply it* as important areas to understand as indicators of innovation.

In addition, several other implications for future research should be considered. First, the multiple psychometric instrument topographies of thinking preferences included in the current study may be maintained by cross-referencing results against additional instruments (KAI©, LEAF) that focus on the consequence and acceptance of change and personal risk. Future studies should continue to employ qualitative or mixed-method data collection and to use additional case study organizations that have sophisticated procedures. These studies should concentrate on systemic and process-based innovation methods to provide more detailed data results of descriptive research events, which would allow researchers to obtain more rigorous results.

Second, assessment should be expanded to include an interconnected theory of individual, group, and organizational theory conditions to detect innovation "communities of practice" (Wenger, 1999, p. 45). Third, procedural integrity of case study intervention implementation should be included to eliminate rival research and survey questions regarding change. Finally, future research should provide information

about functional assessments conducted solely by innovation consultants and should address issues of (a) the amount of organizational energy necessary to create synergy, (b) the optimal or least number of members required to create new ideas, and (c) the feasibility and efficiency of process-based innovation methods.

Implications for Leadership

The implications for leadership are directly derived from survey responses from survey question 10 through survey question 12. In these responses, the primary leader at the case study company acknowledged that the creation of short-, mid-, and long-term strategies supports the re-creation of leadership "paradigms, myths, scripts, or frameworks" (Quinn, 1996, p. 46). Additionally, strategies that identify left-brain thinking preferences can significantly improve "the bottom line as well as our maturity as a business model" (A. Stephonovich, Research Survey Results, 2004). HBDI^{TM} can help to identify certain characteristics that should be "formally woven into organizational designs" (Stephonovich).

Leaders are called upon to "confront the basic reality of transformation" because "what may have been a premise for successful management in the past is no longer viable" (Imparato & Harari, 1994, p. 4). This dissertation required three independent definitions of leader ($leader_{a,b,c}$) to accurately describe the functions and expectations of the term. These definitions bridge the linkage between a person ($leader_a$), a process ($leader_b$), and an activity ($leader_c$). As defined in the research, these definitions are as follows:

> $Leader_a$ is directly linked to the premise of change as a change agent and is related to the research from the initial study described in chapter 1.

Leader$_b$, called a *systems leader*, describes the leadership process and is used more globally to describe the leading of purpose, technology, relationships, interactions, teamwork, and community related to the research from the literature review in chapter 2.

Leader$_c$ describes the ability to encourage divergent thinking and create opportunities to solicit input (perspective) from others when generating ideas. More important, it describes the ability to incorporate the thinking from others into the ideas actively being worked on. This definition is related to the case study analysis described in chapter 4.

Without all three definitions the inquiry would have been incomplete due to a lack of understanding about whether the research was focused around a person, process, or activity which can all be called leader$_{a,b,c}$.

One feature of the research that was repeated was the need for leaders$_{a,b,c}$ to help create and foster double-loop learning. The PLAY Company innovation graphic illustrates learning in the S.O.S. image and it is reinforced throughout this research. The type of double-loop learning required to support innovation unveiled by the researcher was (a) shared learning, (b) learning forward, (c) learning from lead users, (d) learning more rapidly, (e) and synectics, which introduces prior learning and symbolic representation (Stein, 1974).

Implications of Initial Study

The implications from the initial study are derived directly from the HBDI^{TM} scores. The initial study was constructed to collect personal thinking preferences from a select group of innovation change agents (Ulrich, 1997). These 151 research participants

were self-declared change agents within their organizations from the United States, Canada, and England. Self-declaration meant that the participants acknowledged that they determine, describe, and use innovation to create novel ideas. The anticipated result was that a primary thinking preference would exist in the D-quadrant. The results produced a double-dominant 1221 team member profile. Two primary thinking preferences exist in the A- and D-quadrants, which created an upper cerebral mode preference.

This profile is described as the "ability to switch back and forth between the two cerebral quadrants, as the situation demands" (Herrmann, 1995, p. 386). The instrument successfully identified participants with typical occupations in design engineering, as development scientists, and in strategic positions within technical organizations.

Implications for Individual Innovation

The implications that this research exposed for individual innovation are centered on the use of the terms *creativity* and *innovation*. Innovation requires a series of operational definitions because the term is naturally translated across individual, group, and organizational theory into personal paradigms. It is a complex term that needs additional definition through conceptually flexible and collaborative mental models.

As demonstrated in the case study analysis, self-declared change agents are able to reinforce and share recognition of personal diversity, which is articulated through the common communication method of thinking preferences. The use of a psychometric instrument to measure innovation is possible through thinking preferences but not through personality measurements of circumplex bipolarity. At an individual level, the acknowledgment of full participation in the HBDI^{TM} D-quadrant establishes a valid

baseline to measure individual innovation, sometimes described as imagination and divergent thinking.

The HBDI™ C-quadrant provides a common communication platform that embraces "passion" (Herrmann, 1996, p. 199). Together this HBDI™ D- and C-quadrant validation demonstrates the recognition that a right-brain innovation model for the individual is necessary.

In addition to thinking preferences are innovation processes containing thinking toolsets that should be available for individuals. The research pointed to the PLAY Company and identified a series of skills that individuals bring to an innovation environment referred to as their *way*. The case study revealed that the blend of the traditional algorithmic- and heuristic-based innovation tools into a process for innovation gave an individual a deeper skill set and therefore a stronger *way* as described by PLAY case study process models.

Implications for Group Innovation

Once a "community of practice" (Wenger, 1999, p. 45) is established from the formation of a group, formal or informal specific concerns for innovation exist that are not present with the individual or organizational theory. When this group functions, its members actively search for an innovation skill set that (a) understands the differences between creativity and innovation; (b) contains innovation technical specific knowledge; (c) understands the organizational culture of innovation; (d) understands the organizational structure of innovation; (e) understands the innovation team member structure; (f) understands the use of radical and adaptive innovation; (g) contains

innovation processes, skills, and resources; and (h) understands the innovation value for new ideas.

The case study innovation training for individual innovation experienced by the researcher at the PLAY Company provided a blend of both algorithmic (e.g., TRIZ, USIT, SIMPLEX) and heuristic (parallel, lateral thinking) innovation processes. This blend provides a process methodology and common language for individuals to share with each other to create a community of practice that has more connectivity in a group innovation skill set. Within this skill set is the expectation of an interconnected understanding of systems and possibility thinking. As stated in chapter 2, de bono (1992) described the necessity to create possibility thinking by creating new cognitive patterns by asking *why* questions rather than *why not* or *because*.

The group members rely on each other through innovation process models, shared learning, and positive energy to create synergy, which ultimately leads to inspiration. T. Kelly from IDEO (2001, p. 297) stated, "Innovation isn't about perfection," which implies that failure opens the way to success. Researchers who viewed group innovation as a property of cognitive processing focused on the process steps in creative thinking or cognition and dismissed social implications.

Innovation may depend upon unstructured spontaneity, which functions differently from the traditional group structure. This means a new definition and understanding of the term *group* needs to be created. Its new replacement should be a "social network" (K. Stephenson, personal communication, September 30, 2004). In the analysis in chapter 4 of the HBDI^{TM} preference map, two situations occurred in which traditional terminology did not correctly describe a group situation:

Loner: This term has negative connotations for an individual within a group and implies a person who avoids the company or assistance of others. *Individuator* was substituted due to its neutral implication for an individual thinking preference situated away from a group of other profiles.

Mini-tribe: This term has negative connotations for a small group that shift away from the traditional thinking in a negative way. *Mini-network* was substituted due to its neutral implication and connection to the other profiles within the social network.

These new definitions are a movement toward defining, clarifying, and providing the understanding of social environments through traditional social network analysis.

Implications for Organization Innovation

A positive organizational transformation (Flamholtz & Randle, 1998; Galliers & Baets, 1998; Nadler et al., 1998; Senge, 1999) requires an understanding of the contribution of the HBDI™ A- and B-quadrants thinking preferences. The HBDI™ A-quadrant provides an analytical baseline and paradigm that models logic. The HBDI™ B-quadrant provides a planning and organizing capability. Together, the HBDI™ D- and C-quadrant validation demonstrates the recognition that a left-brain analytical and organizing model for the individual is necessary. Ultimately, a "whole-brained" (Herrmann, 1999, p. 218) approach to innovation is necessary that requires thinking preferences in all four HBDI™ quadrants.

Operational definitions were required for several new terms within the construct of this study. The creation of two key terms was required for describing individuals mapped against other members in an organization. The addition of these definitions for

individuator and *mini-network* provided a neutral balance and accurate vocabulary that was mapped within the HBDI™.

Sternberg (1999) proposed that studies of innovation for the organization require the understanding of an interconnected balance of multidimensional approaches. Six methods are proposed to correctly interpret innovation:

1. *Psychometric*: Instruments that measure an individual's amount of innovation ability, viewed as a mental capability. These are linked from the analysis report in chapter 4 that maps thinking preference to innovation ability measurable in the HBDI™ D-quadrant.
2. *Experimental*: Cognitive models, mental models, process models, and paradigm shifts. These are linked from the synopsis in chapter 4 of the PLAY Company case study on *collective creative consciousness*, *creative mindset, creative index,* and the *5 steps of creativity*.
3. *Biographical*: Qualitative case studies that explore innovation specialty companies and organizations providing richness and authenticity in the results. This is linked from the case study survey interview responses in chapter 4 that are coded and decoded into themes.
4. *Biological*: A focus on formal psychological measures such as EEG to correlate the thinking preference against the premise that all cognitive behavior can be reduced to physiological activity. This is linked from the initial study and case study HBDI™ data files in chapter 4 that map cognitive behavior for change agents and innovation specialists.

5. *Computational*: Techniques for network analysis modeling that are based on current organizational structure including logic statements and rules from shared basic assumptions and anticipatory predictions. This is linked from the HBDI™ data synopsis for group preference mapping in chapter 4 that required new terminology to describe individuators and mini-networks.
6. *Contextual*: New operational definitions that provide a clearer understanding and reframing of key terms, which allows the field to move forward in an organizational transformation. This is linked to the operational definitions in chapter 1 and chapter 4 that are required to accurately interpret multidimensional terminology (e.g., $leader_a$, $leader_b$, and $leader_c$).

The implementation of these methods are organizational specific and nonsequential. They are presented in a chronological sequence that has a conditional and adaptive logic flow unique to every situation. Utilization of these innovation methods provides a baseline organization that is continually optimizing opportunities available as it moves forward in time.

The previous approaches become the start of a roadmap to interpret innovation, but require grounding within the organizational construct of an innovation community of practice to become the locus. According to the research, accomplishing this requires new definitions and an understanding of the social science of innovation that will provide additional awareness in (a) social values, (b) the social context or setting, (c) social implications, (d) a social network, (e) and the social and physical environment called culture. Adding to these approaches is the need for "the organization to continually innovate, create, and even reinvent itself" (Imparato & Harari, 1994, p. 130).

Recommendations and Summary

In summary, chapter 1 provided insights into the problem and issue of innovation and the creation of novel ideas was described as one of the most critical issues facing organizations today. It is strongly suggested that leaders$_{a,b,c}$ could benefit from a comprehensive and interconnected process for innovation and its components, which comprise individual thinking preference, social context, and the mental processes used to create novel ideas.

In chapter 2, the complex and multidimensional aspects of innovation theory were explored and the extensive literature from three primary elements of innovation were introduced and investigated: the individual, group, and organizational theory. The literature review unveiled the complexity of thinking preferences and described the foundation and development of the HBDI™, circumplex models, and other historical innovation mental models through the present. Finally, it explored the development of the social science of innovation that described new avenues of awareness in innovation for current organizations.

In chapter 3, the methodology to explore three research questions was illustrated and the structure of the inquiry was described in detail: (a) the nature and source of data, (b) the research design, (c) validity and method appropriateness, (d) qualitative approaches, (e) the research process, (f) the study instruments, (g) the use of research tools, and (h) the study's feasibility and appropriateness.

In chapter 4, the results and findings, plotting, and analysis of the HBDI™ thinking preference data were provided. The results of an initial survey and a test–retest report of the data were included, as well as case study illustrations, processes, and mental

models relevant to the PLAY Company. Additionally, themes produced from case study interview survey questions 1–12 were correlated to the three primary elements of innovation: the individual, group, and organizational theory.

A description of the significance of the study to leadership was provided in chapter 5. Conclusions and implications for leadership, individual innovation, group innovation, and organizational innovation were presented. Research questions RQ1, RQ2, and RQ3 were answered from the results of the coded and decoded responses and themes were derived from survey questions 1–12 from the case study interviews. Finally, a critique of the methodology of the study, scope, limitations of the study, and implications for future research were presented.

Leaders, theorists, change agents, and practitioners of innovation should understand that there is always more than a single answer and that limiting one's view to a single paradigm can prevent a required cognitive transformation. This dissertation has provided several examples of how leaders can develop this process by following the case study illustrations in chapter 4 for the collective creative consciousness and ripple effect. These illustrations identify an interconnected flow from the individual, group, and community that describes the impacts, small or large, that can be gained toward creating a better business strategy, better products, a stronger culture, smarter strategies, and more robust brands.

Practitioners of idea creation may be challenged to provide an interconnected blend of both radical and adaptive innovation to support the requirements of new business demands. This future for innovation requires leaders who can embrace all members in an organization regardless of their thinking style or preference. A final wish

and challenge for all who read this dissertation is to walk away with additional insight about innovation and change that will allow them to energize their "passion" (Leonard & Swap, 1999b, p. 165) and move themselves and others forward in a positive organizational transformation. The researcher has strongly recommended specific techniques through psychometric, experimental, biographical, biological, computational, and contextual innovation methods that may be used to benefit organizations, leaders, and groups in their challenge to create new ideas. The critical efforts necessary to establish processes, build cognitive and mental models for heuristic (e.g., parallel, lateral thinking) and algorithmic (TRIZ, USIT, SIMPLEX) innovation, problem solve, make decisions, and design new products drove this dissertation and remained instrumental throughout the research and analytical work.

References

Aaronson, B. S. (1968). Hypnotic alterations of space and time. In R. Cavanna & M. Ullman (Eds.), *Psi and altered states of consciousness: Hypnosis, drugs, dreams & psi* (pp. 42–54). New York: Parapsychology Foundation.

Ackoff, R. (1999a). *Ackoff's best*. New York: Wiley.

Ackoff, R. (1999b). *Re-creating the organization*. New York: Oxford University Press.

Ackoff, R. (2003). *Redesigning Society*. Stanford, CA: Stanford University Press.

Alreck, P., & Settle, R. (1995). *The survey research handbook* (2nd ed.). New York: McGraw-Hill.

Amabile, T. M. (1983). *The social psychology of creativity*. New York: Springer-Verlag.

Amabile, T. M. (1988). *A model of creativity and innovation in organizations*. Greenwich, CT: JAI Press.

Banga, J. R., Versyck, K. J., & Van impe, J. F. (2000, May 7-10). *Numerical strategies for optimal experimental design for parameter identification of non-linear dynamic bio-chemical processes*. Paper presented at ESCAPE-10, Firenze, Italy.

Basadur, M. (1998). *Simplex: A flight to creativity*. Ancaster, Ontario, Canada: Creative Education Foundation Press.

Bass, B. M. (1990). *Bass and Stogdill's handbook of leadership: Theory, research, & managerial applications* (3rd ed.). New York: Free Press.

Bayley, N. (1968). Behavioral correlations of mental growth: Birth to thirty-six years. *American Psychologist, 23*, 1–17.

Bentley, J. P. (2000). *Learning Orientation Questionnaire correlation with the Herrmann Brain Dominance Instrument*. Unpublished doctoral dissertation, Brigham Young University, Provo, UT.

Bergquist, W. (1993). *The post-modern organization: Mastering the art of irreversible change*. San Francisco: Jossey-Bass.

Bertanlanffy, L. V. (1969). *General system theory*. New York: George Brazillier.

Best, S., & Kellner, D. (1997). *The postmodern turn*. New York: Guilford Press.

Bickman, L., & Rog, D. (1998). *Handbook of applied social research methods*. Thousand Oaks, CA: Sage.

Bizzell, P. (1994) *Academic discourse and critical consciousness*. Pittsburgh, PA: University of Pittsburgh Press.

Bollman, L., & Deal, T. (1997). *Reframing organizations*. San Francisco: Jossey-Bass.

Borgman, A. (1993). *Crossing the postmodern divide*. Chicago: University of Chicago Press.

Branscomb, L., & Keller, J. (1999). *Investing in innovation: Creating a research and innovation policy that works*. Cambridge, MA: MIT Press.

Braud, W., & Anderson, R. (1998). *Transpersonal research methods for social sciences*. Thousand Oaks, CA: Sage.

Broadbent, D. E., & Broadbent, M. H. P. (1987). From detection to identification: Response to multiple targets in rapid serial visual presentation. *Perception and Psychophysics, 42*, 433–458.

Bunderson, C. V. (1988). Validation of the Herrmann Brain Dominance Instrument. In N. Herrmann (Ed.), *The creative brain.* Lake Lure, NC: Brain Books.

Bunderson, C. V., & Olsen, J. B. (1980). *A factor analysis of personal profile measures related to cerebral hemisphere specialization* (Special Report No. 4). Unknown Location: Learning Design Laboratories WICAT, Inc.

Bunderson, C. V., & Olsen, J. B. (1981, March). *A preliminary report of the findings of the validation of the participant survey and twenty questions.* Report submitted to N. Herrmann, Management Development Institute, General Electric.

Bunderson, C. V., Olsen, J. B., & Herrmann, W. E. (1982). *A four-fold model of multiple brain dominance and its validation through correlational research.* Unpublished manuscript.

Carten, C. L. (2002*). Organizational transformation and community building: An exploration in the field*. Unpublished doctoral dissertation, Case Western Reserve University, Cleveland, OH.

Cassidy, J. E. (1998). From "half-brain" to "whole-brain": Learn to create high performing teams. *Annual Quality Congress Proceedings*, p. 725.

Cattell, R. B. (1946). *The description and measurement of personality*. New York: Harcourt Brace.

Cattell, R. B. (1971). *Abilities: Their structure, growth and action*. Boston: Houghton Mifflin.

Checkland, P. (2000). *Systems thinking, systems practice*. Chichester, England: Wiley.

Christensen, C., & Overdorf, M. (2001). *Meeting the challenge of disruptive change*. In *Harvard Business Review* on Innovation. Boston: Harvard Business School Press.

Clandinin, D. J., & Connelly, F. M. (1990). Stories of experience and narrative inquiry. *Educational Researcher,* 19(5), 2–14.

Coetzee, H. S., & De Boer, A. L. (2000). *Thinking styles and their role in teaching and learning*. University of Pretoria, Pretoria, South Africa.

Collins, J. (2001). *Good to great*. New York: HarperPerennial.

Connor, S. (1989). *Postmodern culture*. Oxford: Basil Blackwell.

Cousier, K. J. (2001). *From the outside, in: An ethnographic case study of an art classroom in an alternative high school for at-risk students*. Unpublished doctoral dissertation, Indiana University, South Bend.

Cramer, P. (1968). *Word associations*. New York: Academic Press.

Creswell, J. W. (1994). *Research design: Qualitative and quantitative approaches*. Thousand Oaks, CA: Sage.

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage.

Creswell, J. W. (2002). *Educational research: Planning, conducting and evaluating quantitative and qualitative research*. Upper Saddle River, NJ: Prentice Hall.

Crocker, L. M., & Algina, J. (1986). *Introduction to classical and modern test theory*. New York: Holt, Rinehart & Winston.

de Bono, E. (1999a). *Lateral thinking: Creativity step by step.* New York: Harper & Row.

de Bono, E. (1992). *Serious creativity*. New York: Harper Business.

de Bono, E. (1993). *Edward de bono: Water logic*. Canada: APT Advanced Practical Thinking Training.

de Bono, E. (1994). *deBono's thinking course*. New York: MICA Management, Facts on File.

de Bono, E. (1999b). *Six thinking hats*. London: Penguin Books.

Deming, W. E. (1994). *The new economics*. Boston: Massachusetts Institute of Technology Center for Advanced Educational Services.

Drucker, P. F. (1985). *Innovation and entrepreneurship: Practice and principles*. London: Heinemann.

Duncan, R. (1973). Multiple decision making structures in adapting to environmental uncertainty: The impact on organizational effectiveness. *Human Relations, 26,* 273–291.

Eisbach, A. O. (2001). *Children's developing knowledge about diversity in thought*. Unpublished doctoral dissertation, Stanford University, Stanford, CA.

Flamaholtz, E. G., & Randle, Y. (1998). *Changing the game: Organizational transformations of the first, second, and third kinds*. New York: Oxford University Press.

Ford, C. M., & Gioia, D. A. (1995). *Creative action in organizations*. Thousand Oaks, CA: Sage.

Frankl, V. (1984). *Man's search for meaning.* New York: Washington Square Press.

Freedland, K. E., & Carney, R. M. (1992). Data management and accountability in behavioral and biomedical research. *American Psychologist, 47,* 640–645.

Gall, M. D., Borg, W. R., & Gall, J. P. (1996). *Educational research: An introduction*. White Plains, NY: Longman.

Galliers, R. D., & Baets, R. J. (1998). *Information technology and organizational transformation: Innovation for the 21st century organization*. Chichester, England: Wiley.

Galton, F. (1870). *Hereditary genius*. New York: Appleton.

Gay, L. R., & Airasian, P. (2003). *Educational research: Competencies for analysis and applications* (7th ed). Upper Saddle River, NJ: Prentice Hall.

Gazzaniga, M. S. (1998). *The mind's past*. Berkeley: University of California Press.

Glesne, C. (1999). *Becoming qualitative researchers: An introduction*. New York: Longman.

Gordon, W. J. J. (1961). *Synectics*. New York: Collier.

Guilford, J. P. (1950). Creativity. *American Psychologist, 5*, 444–454.

Guilford, J. P. (1967). *The nature of human intelligence*. New York: McGraw-Hill.

Guilford, J. P., & Guilford, R. R. (1936). Personality factors: S, E, and M and their measurement. *Journal of Psychology, 2*, 109–217.

Gundling, E. (2000). *The 3M way to innovation*. New York: Kodansha.

Guttman, L. (1954). *A new approach to factor analysis: The radix*. In P. F. Lazarsfeld (Ed.), *Mathematical thinking in the social sciences* (pp. 258–348). Glencoe, IL: Free Press.

Handy, C. (1998). *Beyond certainty*. Boston: Harvard School Press.

Handy, C. (1999). *The new alchemists*. London: Trafalgar Square.

Henry, G. T. (1990). Practical Sampling. Newbury Park, CA: Sage Publications.

Herrmann, N. (1995). *The creative brain*. Kingsport, TN: Quebecor.

Herrmann, N. (1996). *The whole brain business book*. New York: McGraw-Hill.

Hesselbein, F., Goldsmith, M., & Beckhard, R. (1997). *The organization of the future*. San Francisco: Jossey-Bass.

Hillman, J. (1996). *The soul's code: In search of character and calling*. New York: Random House.

Hippel, E.V., Thomke, S., & Sonnack, M. (2001). *Creating breakthroughs at 3M*. Harvard Business Review on Innovation. Cambridge, MA: Harvard Business School Press.

Hitchcock, J. H. (2003). *Identifying and validating cultural specific, emic factors relevant to self-concept: Methodological considerations*. Unpublished doctoral dissertation, University of New York at Albany.

Ho, K. (1987). *Dimensionality and occupational discriminating power of the Herrmann Brain Dominance Instrument*. Unpublished doctoral dissertation, Brigham Young University.

Hughes, G. D. (2003). Add creativity to your decision process. *Journal for Quality and Participation*, *26*(2), 5–13.

Ideation International. (1999). *Tools of classical TRIZ*. Southfield, MI: Author.

Imparato, N., & Harari, O. (1994). *Jumping the curve: Innovation and strategic choice in an age of transition*. San Francisco: Jossey-Bass.

Janis, I. (1973). *Victims of group think.* Boston: Houghton Mifflin.

Jung, C. G. (1971a). *Psychological types or the psychology of the individual*. New York: Pantheon Books. (Original work published in 1921)

Jung, C. G. (1971b). *Psychological types*. Princeton, NJ: Princeton University Press. (Original work published in 1923).

Jung, C. G. (1990). *Man and his symbols*. New York: Penguin Arkana. (Originally published by Dell, New York in 1964)

Kanter, R. M. (1988). When a thousand flowers bloom: Structural, collective, and social conditions for innovation in organizations. In B. M. Staw & L. L. Cummings

(Eds.), *Research in organizational behavior* (Vol. 10, pp. 123–167). London, JAI Press.

Kanter, R. M., Kao, J., & Wiersema, F. (1997). *Breakthrough ideas at 3M, Dupont, GE, Pfizer, and Rubbermaid*. New York: HarperPerennial.

Kelley, T., & Littman, J. (2001). *The art of innovation*. New York: Doubleday.

King, I. T. (1994). *Explorations beyond the machine: A philosophy of social science for the post-Newtonian age*. New York: NOVA Science.

Knisbacher, A. M. (1999). *Learning and thinking styles as a guide for mapping skill gaps to efficient learning solutions and career choice*. Unpublished doctoral dissertation, Walden University.

Koa, J. (1991). *Managing creativity*. Englewood Cliffs, NJ: Prentice Hall.

Kris, E. (1953). Psychoanalysis and the study of creative imagination. *Bulletin of the New York Academy of Medicine, 29*, 334–351.

Kuhn, T. (1996) *The structure of scientific revolutions* (5th ed.). Chicago: University of Chicago Press.

Leifer, R., McDermott, C., O'Connor, G., Peters, L., Rice, M., & Veryzer, R. (2000). *Radical innovation*. Boston: Harvard Business School Press.

Leonard, D., & Straus, S. (1997a). Identifying how we think: The Myers-Briggs type. *Harvard Business Review, 75*(4), 114.

Leonard, D., & Straus, S. (1997b). Putting your company's whole brain to work. *Harvard Business Review, 75*(4), 110.

Leonard, D., & Swap, W. (1999). *When sparks fly: Igniting creativity in groups*. Boston: Harvard Business School Press.

Lincoln, Y. S., & Guda, E. G. (1985). *Naturalistic inquiry*. Thousand Oaks, CA: Sage.

Locke, L., Silverman, S., & Spirduso, W. (1998). *Reading and understanding research*. Thousand Oaks, CA: Sage.

Maher, A. R. (1970). *New approaches to personality classification*. New York: Columbia University Press.

Maslow, A. H. (1963). The creative attitude. *Structuralist, 3*, 4–10.

McKay, D. (1998). *Tensions between the rational and the conventional: Critical reflections on the methodology of sociological inquiry*. Unpublished doctoral dissertation, University of Western Ontario, London, Ontario, Canada.

Merriam, S. B. (1988). *Qualitative research and case study application in education*. San Francisco: Jossey-Bass.

Michael, J. (2003). Using the Myers Briggs Type Indicator as a Tool for Leadership Development? Apply with Caution. *Journal of Leadership and Organizational Studies*. Vol. 10, Number 1, p.68.

Morgan, A. (1999). *Eating the big fish*. New York: Wiley.

Morgan, G. (1998). *Images of organization*. San Francisco: Berrett-Koehler.

Moustakas, C. (1994). *Phenomenological research methods*. Thousand Oaks, CA: Sage.

Mumford, M., & Gustafson, S. (1988). Creativity syndrome: Integration, application and innovation. *Psychology Bulletin, 103*, 27–43.

Myerson, R. B. (2001, Winter). *Advanced game theory, Part I, equilibrium refinements*. Paper presented at GPEM.

Nadler, D. A., Shaw, R. B., & Walton, E. A. (1995). *Discontinuous change: Leading organizational transformation*. San Francisco: Jossey-Bass.

Nemeth, C. J., & Staw, B. M. (1989). The tradeoffs of social control and innovation within groups and organizations. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 22, pp. 175–210). New York: Academic Press.

Nibler,R., & Harris, K. L. (2003). The effects of culture and cohesiveness on intragroup conflict and effectiveness. *Journal of Social Psychology*, *143*, 613–631.

Nicholson, N. & West, M.A. (1988). *Managerial Job Change: Men and Woman in Transition*. Cambridge: Cambridge University Press.

O'Brian, H. (1990). *Visionary leadership: A guide to making a difference*. Los Angeles: Hugh O'Brian Youth Foundation.

Osborn, A. F. (1953) (Rev. 1957, 1963). *Applied imagination: Principles and procedures of creative problem-solving*. New York: Charles Scribner's Sons.

Oshry, B. (1996). *Seeing systems*. San Francisco: Berrett-Koehler.

O'Toole, J. (1996). *Leading change: The argument for values-based leadership*. New York: Jossey-Bass.

Parkes, K. R., & Sparkes, T. J. (1998). *Organizational interventions to reduce work-related stress: Are they effective?* Sudbury, Suffolk, England: HSE Books. Found in Mikkelsen, A., & Gundersen, M. (2003). The effect of a participatory organizational intervention on work environment, job stress, and subjective health complaints. *International Journal of Stress Management*, 10(2), 91–110.

Parloff, M. D., & Handlon, J. H. (1964). The influences of criticalness on creative problem solving. *Psychiatry*, *27*, 17–27.

Patton, M. (1990). *Qualitative education and research methods*. Thousand Oaks, CA: Sage.

Pfeffer, J. (1982). Management as a symbolic action: The creation and maintenance of organizational paradigms. In L. L. Cummings & B. M. Staw (Eds.), *Research in organizational behavior, Vol. 3*. Greenwich, CT: JAI Press.

Piantanida, M., & Garman, N. (1999). *The qualitative dissertation*. Thousand Oaks, CA: Corwin Press.

PLAY Company. (2002). *PLAY creativity training handbook*. Richmond, VA: No Author.

Plsek, P. E. (1997). *Creativity, innovation and quality*. Milwaukee, WI: ASQ Quality Press.

Plutchik, R., & Conte, H. R. (1997). *Circumplex models of personality and emotions*. Washington, DC: American Psychological Association.

Polit, D. F, & Hungler, B. P. (1997). *Nursing research: Method appraisal and utilization* (4th ed.). Philadelphia: Lippincott.

Poole, M., Van de Ven, A., Dooley, K., & Holmes, M. (2000). *Organizational change and innovation processes*. New York: Oxford University Press.

Pye, D. (1983). *The nature and aesthetics of design*. London: Herbert Press.

Quinn, R. (1996). *Deep change*. San Francisco: Jossey-Bass.

Rasiel, E., & Friga, P. (2002). *The McKinsey mind*. New York: McGraw Hill.

Rea, L. M., & Parker, R. A. (1997). *Designing and conducting survey research*. San Francisco: Jossey-Bass.

Rimmer, A. (1924). Radex of the language emotion. *Israel Annals of Psychiatry and Related Disciplines, 12*, 238–241.

Rinn, J. L. (1965). Structure of phenomenal domains. *Psychological Review, 72*, 445–466.

Rogers, E. M. (1995). *Diffusion of innovations* (4th ed.) New York: Free Press.

Rowe, F. A., & Waters, M. L. (1992). Can personality type instruments profile majors in management programs? *Journal of Education Business, 68*, 10.

Rudestam, K. E., & Newton, R. R. (2001). *Surviving your dissertation* (2nd ed.). Thousand Oaks, CA: Sage.

Sanyal, A. M. (2000). *Narrator-narratee relationship in the major novels of George Elliot*. Unpublished doctorate dissertation, University of New York.

Savransky, S. (2000). *Engineering of creativity: Introduction to TRIZ methodology of inventive problem solving*. Boca Raton, FL: CRC Press.

Schaefer, E. S., & Edgerton, M. (1982). *Circimplex and spherical model for child school adjustment and competence*. Paper presented at the annual meeting of the American Psychological Association, Washington, DC.

Schein, E. (1992). *Organizational culture and leadership* (2nd ed.). San Francisco: Jossey-Bass.

Scholtes, P. R. (1998). *The leader's handbook*. New York: McGraw Hill.

Seifert, C. M. (1987). *Mental representations of social knowledge: A conceptual approach to reasoning about relationships*. Unpublished doctoral dissertation, Yale University, New Haven, CT.

Senge, P. (1990). *The fifth discipline: The art and practice of the learning company*. New York: Currency Doubleday.

Senge, P. (1999). *The dance of change*. New York: Doubleday.

Sheil, A. (2004). *The structuration of brain dominance on organizational communication: A correlational study*. Unpublished doctoral dissertation, University of Tennessee.

Shulyak, L., & Fedoseev, U. (1998). *40 principles, TRIZ keys to technical innovation*. Worchester, MA: Technical Innovation Center.

Sickafus, E. N. (1997). *Unified structured inventive thinking: How to invent*. Grosse Ile, MI: Ntelleck.

Simon, H. A. (1986). How managers express their creativity. *Across the Board, 23*(3), 11–16.

Simonton, D. K. (1992). Leaders in psychology, 1979-1967: Career development, creative output, and professional achievement. *Journal of Personality and Social Psychology, 62*, 5–17.

Skinner, N. F, & Drake, J. M. (2003). Behavioral implications of Adaption-Innovation: III. Adaption-innovation, achievement motivation, and academic performance. *Social Behavior and Personality, 31*, 101–105.

Sperry, P. A., & Sperry, R. W. (1982). *Science and moral priority, merging mind, brain, and human values*. New York: Columbia University Press.

Sperry, R. W. (1973). Lateral specialization of cerebral function in the surgically separated hemispheres. In: J. B. McGuigan and R. A. Schoonover (Eds.), Psychophysiology of Thinking, Chapter 6, pp. 5-19, NY: Academic Press.

Staw, B. M. (1984). Organizational behavior: A review and reformulation of the field's outcome variables. In M. A. West & J. L. Farr (1990), *Innovation and creativity*

at work: Psychological and organizational strategies. Annual Review of Psychology (Vol. 35, pp. 627–666). Chichester, England: Wiley.

Stein, M. I. (1974). *Stimulating creativity*. New York: Academic Press.

Stein, M. I., Heinze, S. J., & Rodgers, R. R. (1957). *Creativity and/or success* (2nd ed.). In C. W. Taylor (Ed.), University of Utah Research Conference on the Identification of Creative Scientific Talent. Salt Lake City: University of Utah Press.

Stephenson, K. (1999). *Networks: The deep structure of organization*. CRC Handbook of Chemistry and Physics. Boca Raton, LA: CRC Press.

Stephenson, K. (n.d.). *Network management*. Reprinted from Focus no. 20. Zurich: Zurich Insurance Group.

Stern, G. G. (1958). *Activities index*. Syracuse, NY: Syracuse University Psychological Research Center.

Sternberg, R. J. (1988). Mental self-government: A theory of intellectual styles and their development. *Human development and book of creativity, 31*, 197–224.

Sternberg, R. J. (1997). *Thinking styles*. Cambridge, MA: Cambridge University Press.

Sternberg, R. J. (1999). *Handbook of creativity*. Cambridge, UK: Cambridge University Press.

Strocchia, M. (2003). *Innovation and learning in three small entrepreneurial firms in Venezuela*. Unpublished doctoral dissertation, Columbia University, New York.

Syer, J., & Connolly, C. (1996). *How teamwork works: The dynamics of effective team development*. New York: McGraw Hill.

Ulrich, D. (1997). *Human resource champions*. Boston: Harvard Business School Press.

UMCP. (1995). *Diversity at UMCP: Moving toward community plan*. College Park: University of Maryland.

Van Maanen, J. (1982). *Tales of the field, on writing ethnography*. Chicago: University of Chicago Press.

Von Oech, R. (1998). *A whack on the side of the head*. New York: Warner Books.

Wallas, G. (1926). *The art of thought*. New York: Harcourt.

Weick, K. (1960). *The social psychology of organizing*. Reading, MA: Addison-Wesley.

Wenger, E. (1999). *Communities of practice learning, meaning, and identity*. Cambridge, UK: Cambridge University Press.

West, M. A., & Farr, J. L. (1990). *Innovation and creativity at work: Psychological and organizational strategies*. Chichester, England: Wiley.

Wheatley, M. J. (1999). *Leadership and the new science* (2nd ed.). San Francisco: Berrett-Kohler.

Wiggins, J. S. (1979). A psychological taxonomy of trait-descriptive terms: The interpersonal domain. *Journal of Personality and Social Psychology, 37*, 395–412.

Wilson, R. G., Pilgrim, D. H., & Tashjian, D. (2001). *The machine-age in America: 1918-1941*. New York: Harry N. Abrams.

Yin, R. K. (1993). *Applications of case study research*. Thousand Oaks, CA: Sage.

Yin, R. K. (1994). *Case study research: Design and methods* (2nd ed.). Thousand Oaks, CA: Sage.

APPENDIX A: Case Study HBDI™ Interview Questions

Individual Centered

1) Does the Individual HBDI™ personal thinking preference report seem to be valid? (Yes-No)

2) Why does the Individual HBDI™ report seem that way?

3) What HBDI™ quadrants do you personally have as your primary thinking preferences?

Group Centered

4) Does the HBDI™ composite average group plot profile for the PLAY Company seem to be valid (Yes-No)

5) Why does the HBDI™ composite average group plot profile seem that way?

6) What is the strength in knowing what others members of PLAY HBDI™ individual thinking preference is?

Innovation Centered

7) How does the HBDI™ tool identify "Innovation" at PLAY? "?

8) What are the HBDI™ indicators of "Innovation" at PLAY?

9) What are the weaknesses of the HBDI™ individual thinking preference tool for identifying "Innovation"?

APPENDIX B: Case Study HBDI™ Interview Leadership Questions

Individual Centered

1) Does the Individual HBDI™ personal thinking preference report seem to be valid? (Yes-No)

2) Why does the Individual HBDI™ report seem that way?

3) What HBDI™ quadrants do you personally have as your primary thinking preferences?

Group Centered

4) Does the HBDI™ composite average group plot profile for the PLAY Company seem to be valid (Yes-No)

5) Why does the HBDI™ composite average group plot profile seem that way?

6) What is the strength in knowing what others members of PLAY HBDI™ individual thinking preference is?

Innovation Centered

7) How does the HBDI™ tool identify "Innovation" at PLAY? "?

8) What are the HBDI™ indicators of "Innovation" at PLAY?

9) What are the weaknesses of the HBDI™ individual thinking preference tool for identifying "Innovation"?

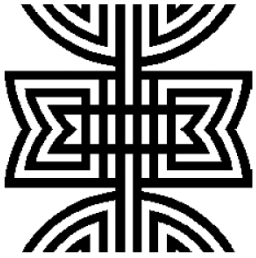
Leadership Centered

10) From a leaders perspective did the HBDI™ tool identify any organizational weaknesses at PLAY?

11) What changes if any were made at PLAY due to the HBDI™ profiles?

12) If organizational changes were made due to the HBDI profiles were they initiated by you or the individuals?

APPENDIX C: HBDI™



HBDI

Herrmann Brain Dominance Instrument

Thinking Styles Assessment

This 120-question survey form results in a profile of your preferred thinking styles. By understanding your thinking style preferences you can achieve greater appreciation for how you learn, make decisions, solve problems, and communicate, and why you do these things—and others—the way you do. The survey measures preferences rather than skills. It is not a test; there are no wrong answers. You will gain the greatest understanding by answering the questions frankly and sincerely.

Herrmann International

794 Buffalo Creek Road, Lake Lure, NC 28746
(828) 625-9153 or (800) 432-HBDI
Fax: (828) 625-1402
E-mail: thinking@hbdi.com

INSTRUCTIONS

A profile of your mental preferences will be determined by your responses to the following 120 questions. Answer each question by writing in the appropriate words or numbers, or checking the boxes provided. **This is not a test**, and there are no right or wrong answers. You are only indicating your preferences. Please respond to questions as authentically as possible, keeping in mind your **total self, at work and at home**. When you have completed the survey form, confirm that you have answered every question. Then complete the name and address information on the back of the form, and send or fax pages 2 through 5 to the Ned Herrmann Group at the address on the cover.

Refer to the glossary of terms for clarification of the terms used. Save the glossary page for reference when you receive your profile results.

GLOSSARY OF TERMS

analytic • Breaking up things or ideas into parts and examining them to see how they fit together.

artistic • Taking enjoyment from or skillful in painting, drawing, music, or sculpture. Able to coordinate color, design, and texture for pleasing effects.

conceptual • Able to conceive thoughts and ideas; to generalize abstract ideas from specific instances.

controlled • Restrained, holding back, in charge of one's emotions.

conservative • Tending toward maintaining traditional and proven views, conditions, and institutions.

creative • Having unusual ideas and innovative thoughts. Able to put things together in new and imaginative ways.

critical • Exercising or involving careful judgement or evaluation, e.g., judging the feasibility of an idea or product.

detailed • Paying attention to the small items or parts of an idea or project.

dominant • Ruling or controlling; having strong impact on others.

emotional • Having feelings that are easily stirred; displaying those feelings.

empathetic • Able to understand how another person feels, and able to communicate that feeling.

extrovert • More interested in people and things outside of self than internal thoughts and feelings. Quickly and easily exposes thoughts, reactions, feelings, etc. to others.

financial • Competent in monitoring and handling of quantitative issues related to costs, budgets, and investments.

holistic • Able to perceive and understand the "big picture" without dwelling on individual elements of an idea, concepts, or situation. Can see the forest as contrasted with the trees.

imaginative • Able to form mental images of things not immediately available to the senses or never wholly perceived in reality; able to confront and deal with a problem in a new way.

implementation • Able to carry out an activity and ensure fulfillment by concrete measures and results.

innovating • Able to introduce new or novel ideas, methods, or devices.

integration • The ability to combine pieces, parts and elements of ideas, concepts and situations into a unified whole.

intellectual • Having superior reasoning powers; able to acquire and retain knowledge.

interpersonal • Easily able to develop and maintain meaningful and pleasant relationships with many different kinds of people.

introvert • Directed more toward inward reflection and understanding than toward people and things outside of self. Slow to expose reactions, feelings, and thoughts to others.

intuitive • Knowing something without thinking it out - having instant understanding without need for facts or proof.

logical • Able to reason deductively from what has gone before.

mathematical • Perceiving and understanding numbers and being able to manipulate them to a desired end.

metaphorical • Able to understand and make use of visual and verbal figures of speech to suggest a likeness or an analogy in place of literal descriptions, e.g., "heart of gold."

musical • Having an interest in or talent for music and/or dance.

organized • Able to arrange people, concepts, objects, elements, etc. into coherent relationships with each other.

planning • Formulating methods or means to achieve a desired end in advance of taking actions to implement.

problem solving • Able to find solutions to difficult problems by reasoning.

quantitative • Oriented toward numerical relationships; inclined to know or seek exact measures.

rational • Making choices on the basis of reason as opposed to emotion.

reader • One who reads often and enjoys it.

rigorous thinking • Having a thorough, detailed approach to problem-solving.

sequential • Dealing with things and ideas one after another or in order.

simultaneous • Able to process more than one type of mental input at a time, e.g. visual, verbal, and musical; able to attend to more than one activity at a time.

spatial • Able to perceive, understand and manipulate the relative positions of objects in space.

spiritual • Having to do with spirit or soul as apart from the body or material things.

symbolic • Able to use and understand objects, marks, and signs as representative of facts and ideas.

synthesizer • One who unites separate ideas, elements, or concepts into something new.

technical • Able to understand and apply engineering and scientific knowledge.

teaching/training • Able to explain ideas and procedures in a way that people can understand and apply them.

verbal • Having good speaking skills; clear and effective with words.

writer • One who communicates clearly with the written word and enjoys it.

Page 2

BIOGRAPHICAL INFORMATION

Please complete **every** question according to the directions given. Each response, including your answers to questions 2, 3 and 4, provide important data. When directions are not followed or data is incomplete we are unable to process your survey, and must return it to you.

1. Name _____ 2. Sex: M ❑ F ❑

3. Educational focus or major _____

4. Occupation or job title _____

Describe your work (please be as specific as possible) _____

HANDEDNESS

5. Which picture most closely resembles the way you hold a pencil?

A ❑  B ❑  C ❑  D ❑ 

6. What is the strength and direction of your handedness?

A ❑ Primary left B ❑ Primary left, some right C ❑ Both hands equal D ❑ Primary right, some left E ❑ Primary right

SCHOOL SUBJECTS

Think back to your performance in the elementary and/or secondary school subjects identified below. Rank order all three subjects on the basis of how well you did: **1** = best; **2** = second best; **3** = third best.

7. _____ Math 8. _____ Foreign language 9. _____ Native language or mother tongue

Please check that no number is duplicated: The numbers **1**, **2**, and **3 must be used once** and **only once**. Correct if necessary.

WORK ELEMENTS

Rate each of the work elements below according to your strength in that activity, using the following scale: **5** = work I do best; **4** = work I do well; **3** = neutral; **2** = work I do less well; **1** = work I do least well. Enter the appropriate number next to each element. **Do not use any number more than four times.**

10. _____ Analytical
11. _____ Administrative
12. _____ Conceptualizing
13. _____ Expressing Ideas
14. _____ Integration
15. _____ Writing
16. _____ Technical Aspects
17. _____ Implementation
18. _____ Planning
19. _____ Interpersonal Aspects
20. _____ Problem Solving
21. _____ Innovating
22. _____ Teaching/Training
23. _____ Organization
24. _____ Creative Aspects
25. _____ Financial Aspects

Please tally: Number of 5's_____, **4's**_____, **3's**_____, **2's**_____, **1's**_____. If there are more than **four** for any category, please redistribute.

KEY DESCRIPTORS

Select **eight adjectives** which best describe the way you see yourself. Enter a **2** next to each of your **eight** selections. Then change one **2** to a **3** for the adjective which **best** describes you.

26. _____ Logical
27. _____ Creative
28. _____ Musical
29. _____ Sequential
30. _____ Synthesizer
31. _____ Verbal
32. _____ Conservative
33. _____ Analytical
34. _____ Detailed
35. _____ Emotional
36. _____ Spatial
37. _____ Critical
38. _____ Artistic
39. _____ Spiritual
40. _____ Rational
41. _____ Controlled
42. _____ Mathematical
43. _____ Symbolic
44. _____ Dominant
45. _____ Holistic
46. _____ Intuitive
47. _____ Quantitative
48. _____ Reader
49. _____ Simultaneous
50. _____ Factual

Please count: seven 2's and one 3? Correct if necessary.

HBDI • Herrmann International • 794 Buffalo Creek Rd. • Lake Lure, NC 28746 • (828) 625-9153 • fax (828) 625-1402

HOBBIES

Indicate a **maximum of six** hobbies you are actively engaged in. Enter a **3** next to your major hobby, a **2** next to each primary hobby, and a **1** next to each secondary hobby. Enter only **one 3**.

51. _____ Arts/Crafts
52. _____ Boating
53. _____ Camping/Hiking
54. _____ Cards
55. _____ Collecting
56. _____ Cooking
57. _____ Creative Writing
58. _____ Fishing
59. _____ Gardening/Plants
60. _____ Golf
61. _____ Home Improvements
62. _____ Music Listening
63. _____ Music Playing
64. _____ Photography
65. _____ Reading
66. _____ Sailing
67. ____ Sewing
68. ____ Spectator Sports
69. ____ Swimming/Diving
70. ____ Tennis
71. ____ Travel
72. ____ Woodworking
_____ Other_____
_____

Please review: Only one **3** and **no more than six hobbies**. Correct if necessary.

ENERGY LEVEL

73. Thinking about your energy level or "drive," select the one that best represents you. Check box **A**, **B**, or **C**.

a. ☐ Day person b. ☐ Day/night person equally c. ☐ Night person

MOTION SICKNESS

74. Have you ever experienced motion sickness (nausea, vomiting) in response to vehicular motion (while in a car, boat, plane, bus, train, amusement ride)? Check box **A**, **B**, **C**, or **D** to indicate the number of times.

a. ☐ None b. ☐ 1-2 c. ☐ 3-10 d. ☐ More than 10

75. Can you read while traveling in a car without stomach awareness, nausea, or vomiting?

a. ☐ Yes b. ☐ No

ADJECTIVE PAIRS

For **each paired item** below, check the word or phrase which is more descriptive of yourself. Check box **A** or **B** for **each** pair, even if the choice is a difficult one. **Do not omit any pairs**.

76. ..... Conservative ☐ / ☐ Empathetic
77 ..... Analyst ☐ / ☐ Synthesizer
78. ..... Quantitative ☐ / ☐ Musical
79 ... Problem-solver ☐ / ☐ Planner
80 ..... Controlled ☐ / ☐ Creative
81. .....Original ☐ / ☐ Emotional
82. ..... Feeling ☐ / ☐ Thinking
83 .....Interpersonal ☐ / ☐ Organizer
84. ..... Spiritual ☐ / ☐ Creative
85. ..... Detailed ☐ / ☐ Holistic
86. ..Originate Ideas ☐ / ☐ Test and Prove Ideas
87 ... Warm, Friendly ☐ / ☐ Analytical
88 ..... Imaginative ☐ / ☐ Sequential
89. ..... Original ☐ / ☐ Reliable
90. .....Creative ☐ / ☐ Logical
91. ..... Controlled ☐ / ☐ Emotional
92 .....Musical ☐ / ☐ Detailed
93. ..... Simultaneous ☐ / ☐ Empathetic
94. ..... Communicator ☐ / ☐ Conceptualizer
95. ..... Technical Things ☐ / ☐ People-oriented
96. ..... Well-organized ☐ / ☐ Logical
97. ... Rigorous Thinking ☐ / ☐ Metaphorical Thinking
98. Like Things Planned ☐ / ☐ Like Things Mathematical
99. ..... Technical ☐ / ☐ Dominant

Please review: Did you mark one and only one of each pair? Correct if necessary.

APPENDIX D: Case Study Individual HBDI™ Profile Reports

PLAY Participant 1 HBDI™ Profile

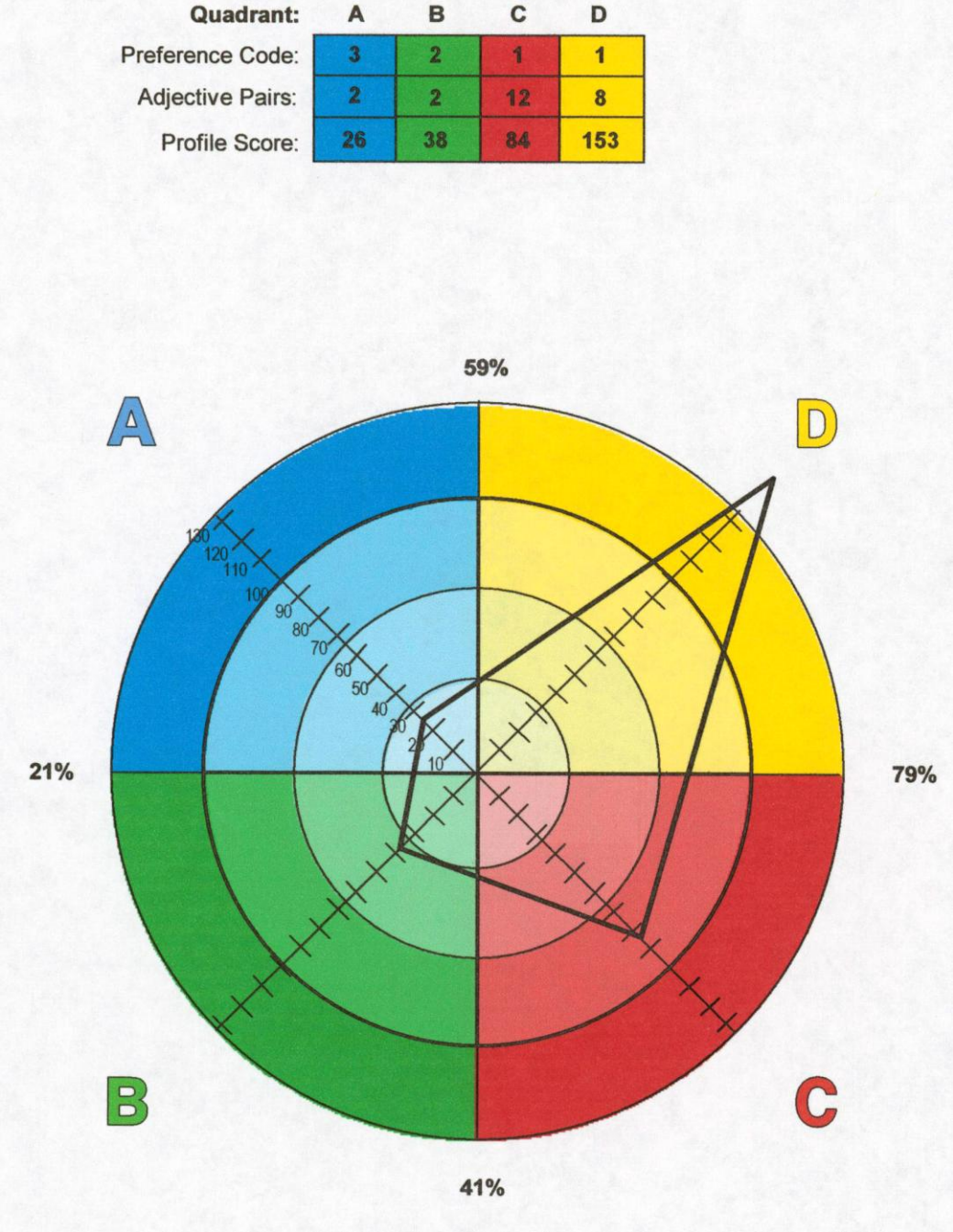


Figure 43. PLAY Participant 1 HBDI™ profile.

PLAY Participant 2 HBDI™ Profile

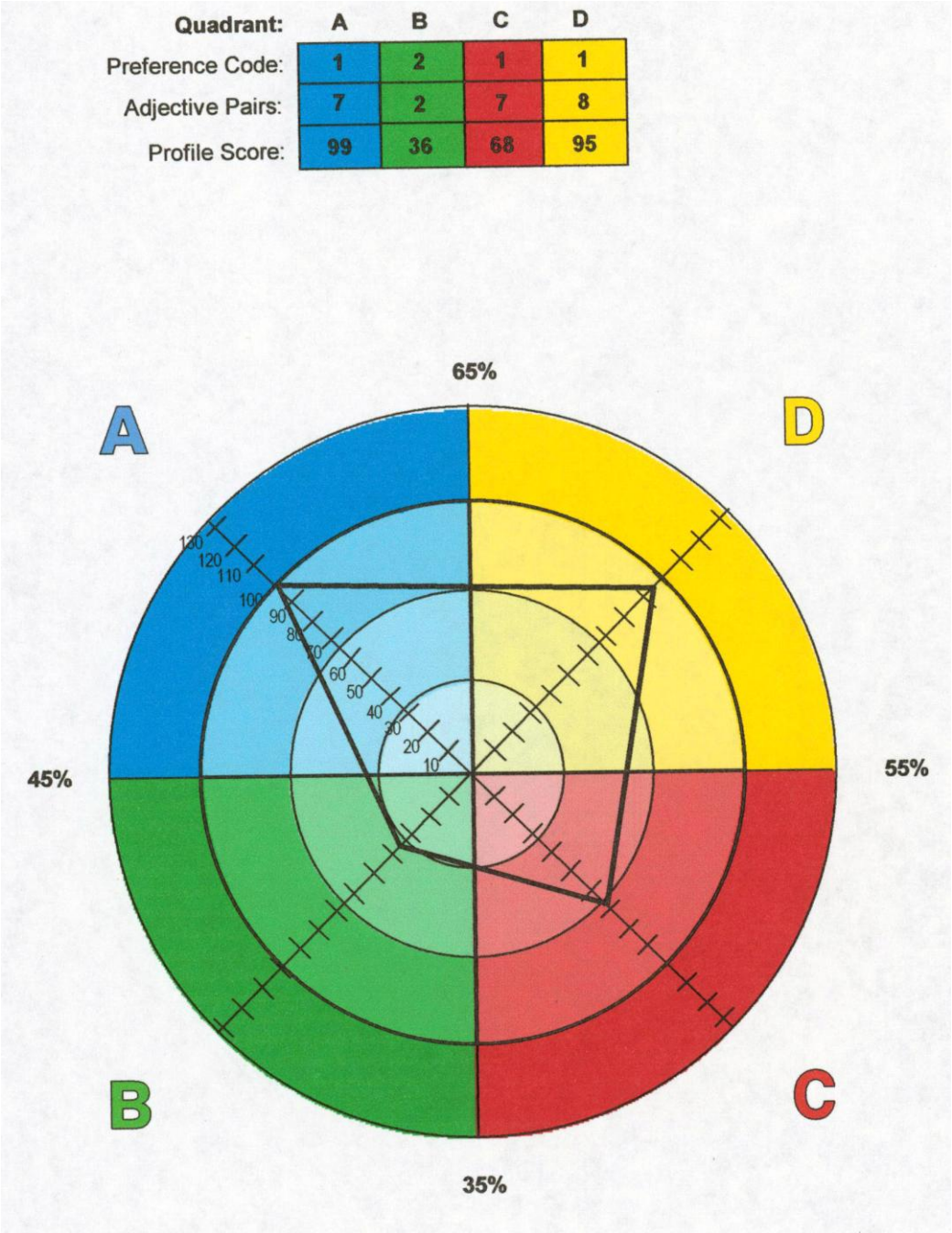


Figure 44. PLAY Participant 2 HBDI™ profile.

PLAY Participant 3 HBDI™ Profile

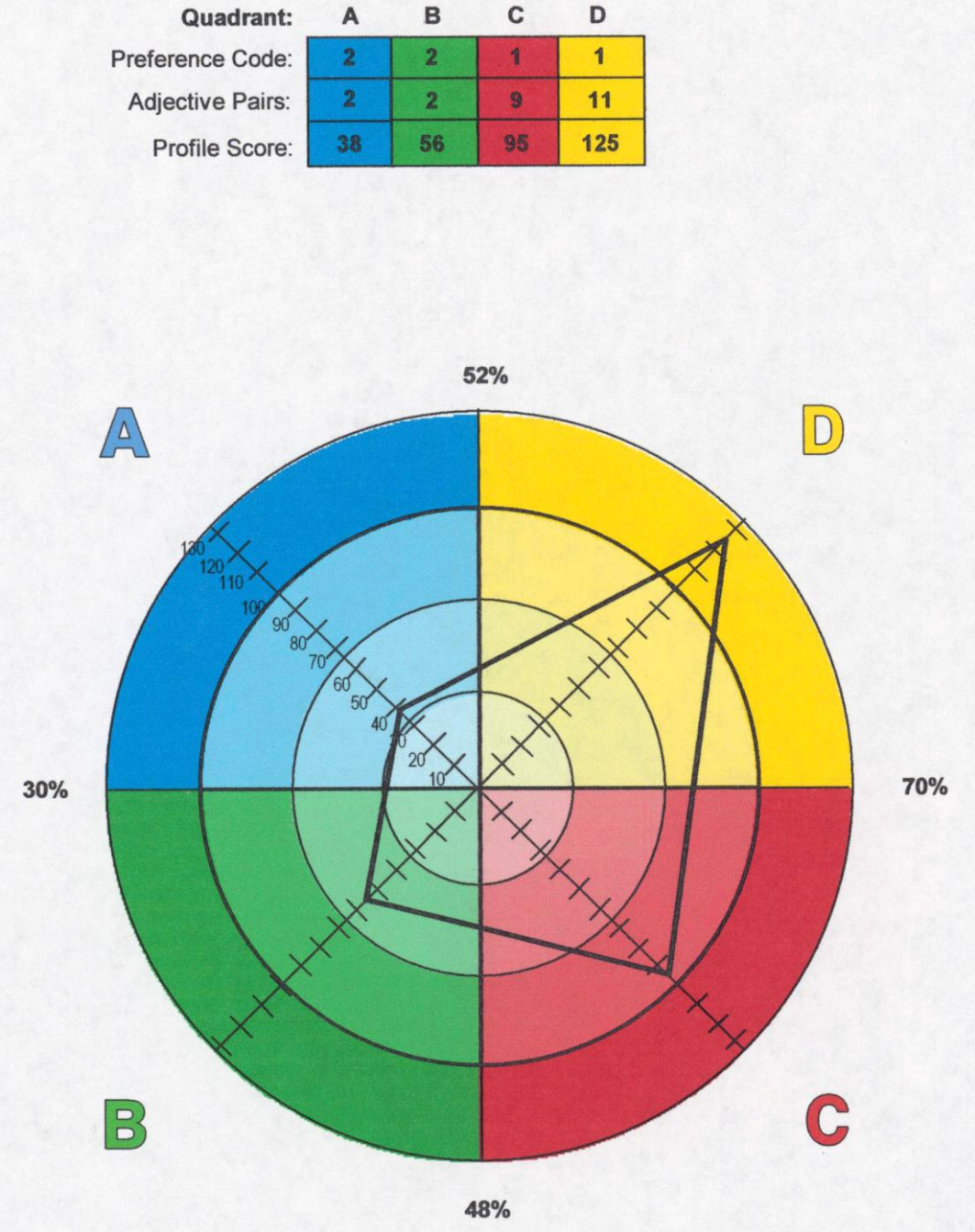


Figure 45. PLAY Participant 3 HBDI™ profile.

PLAY Participant 4 HBDI™ Profile

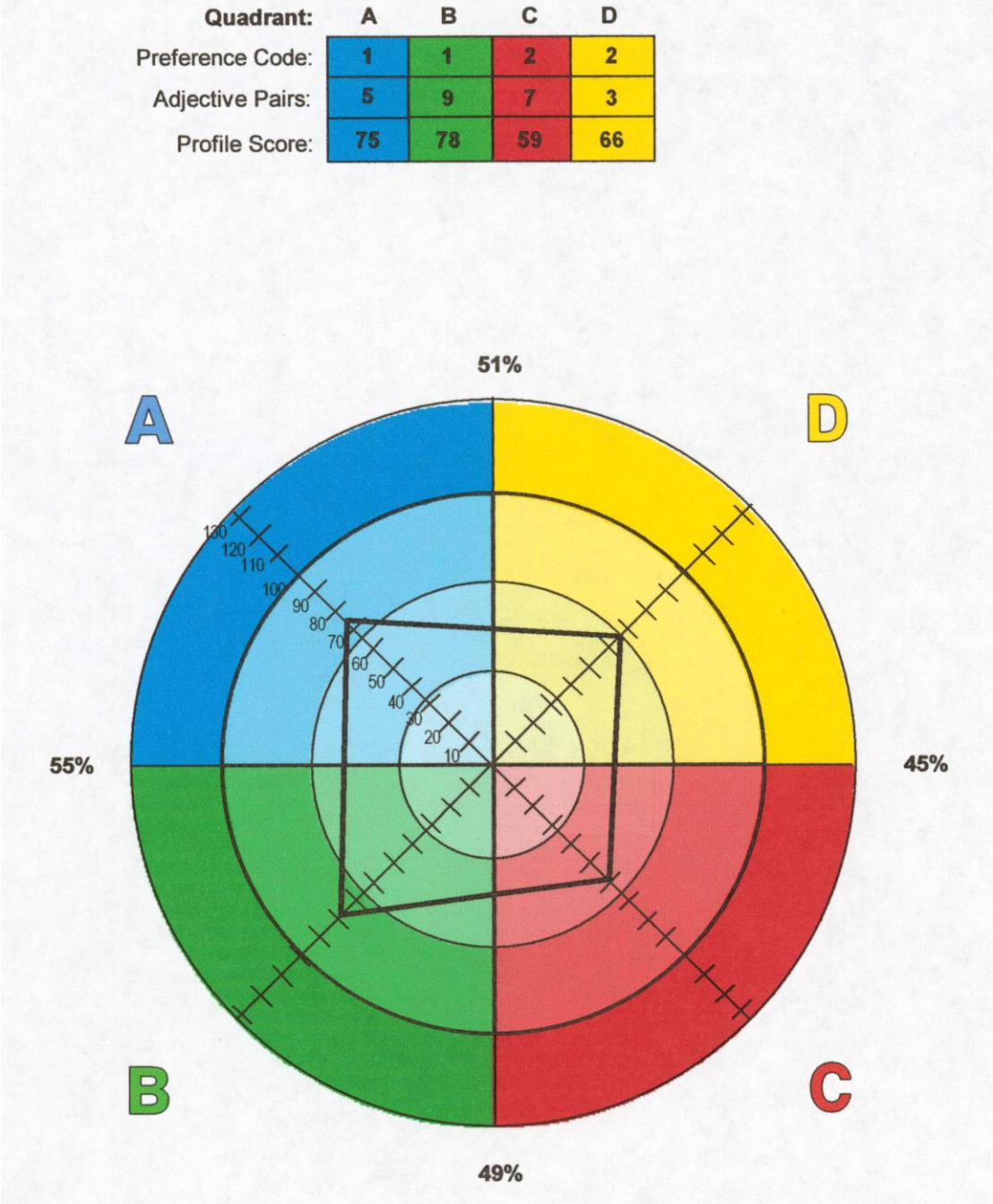


Figure 46. PLAY Participant 4 HBDI™ profile.

PLAY Participant 5 HBDI™ Profile

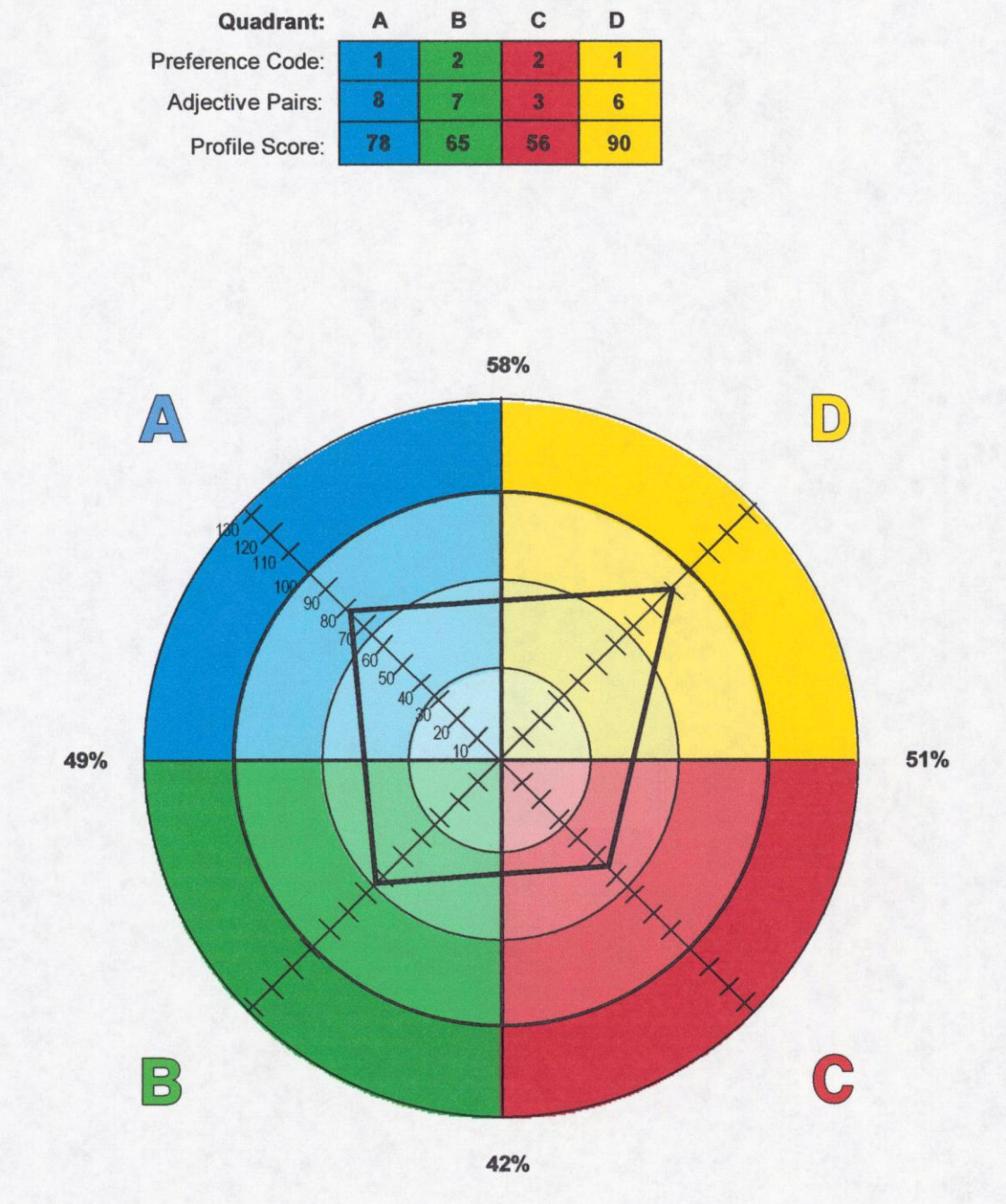


Figure 47. PLAY Participant 5 HBDI™ profile.

PLAY Participant 6 HBDI™ Profile

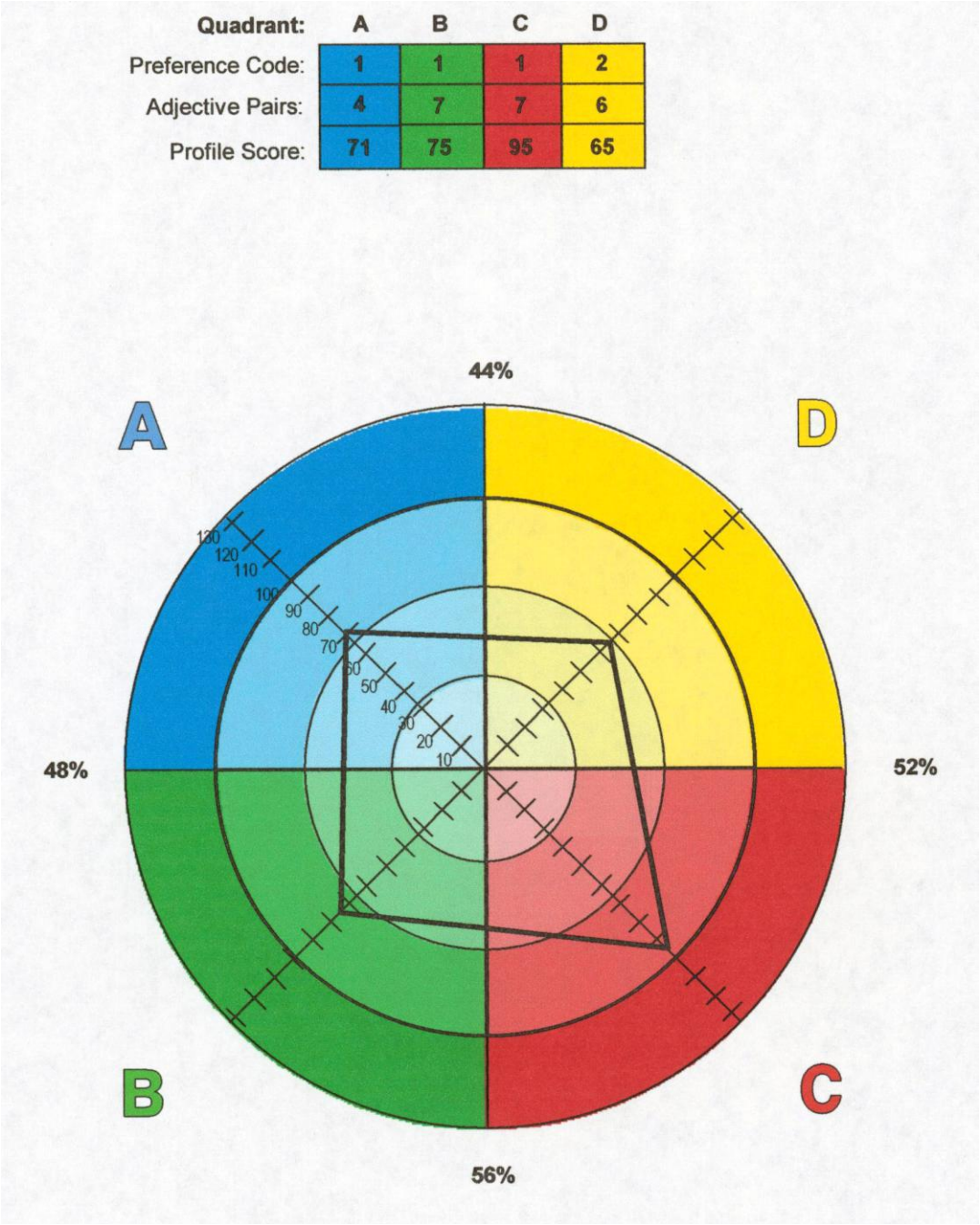


Figure 48. PLAY Participant 6 HBDI™ profile.

PLAY Participant 7 HBDI™ Profile

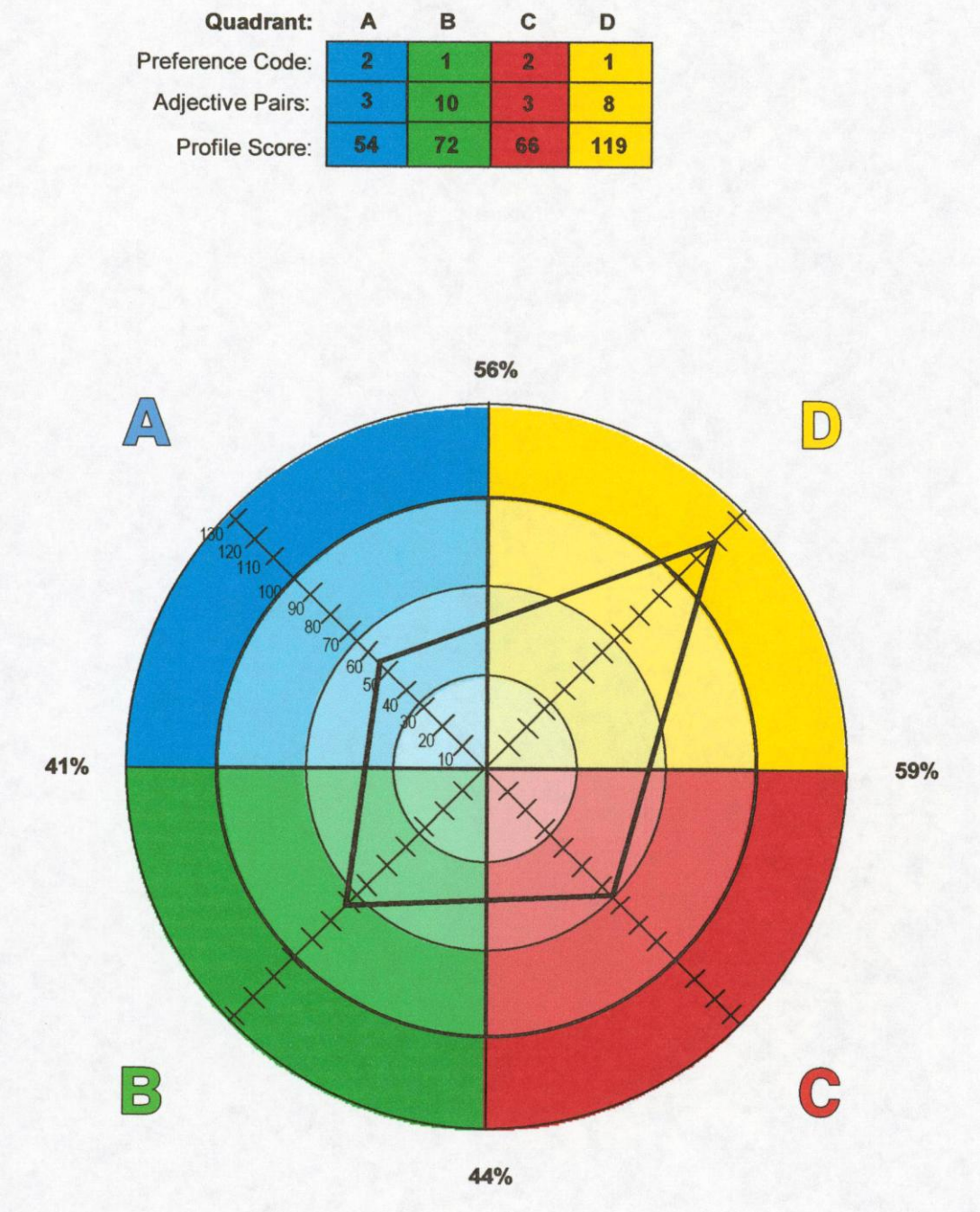


Figure 49. PLAY Participant 7 HBDI™ profile.

PLAY Participant 8 HBDI™ Profile

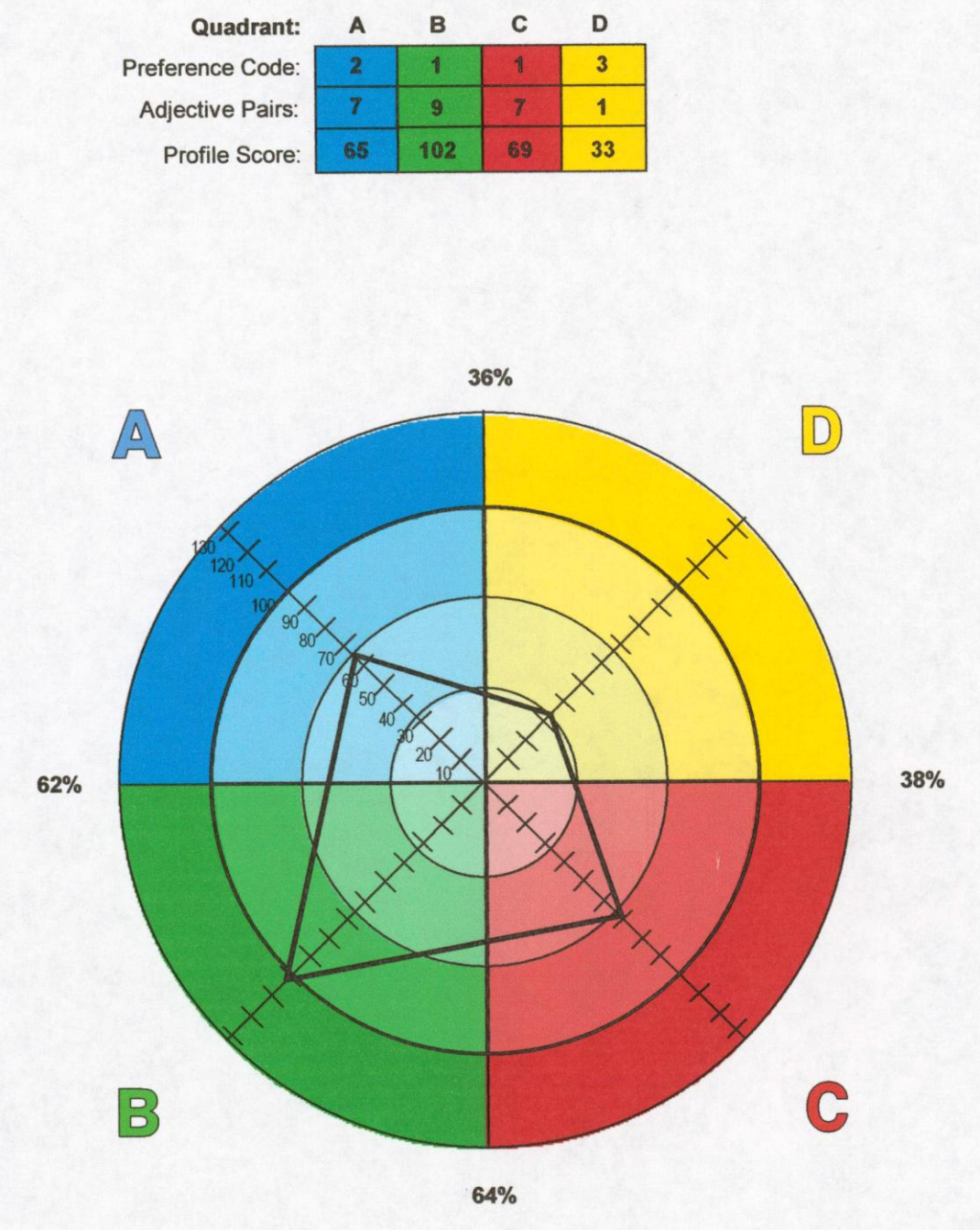


Figure 50. PLAY Participant 8 HBDI™ profile.

PLAY Participant 9 HBDI™ Profile

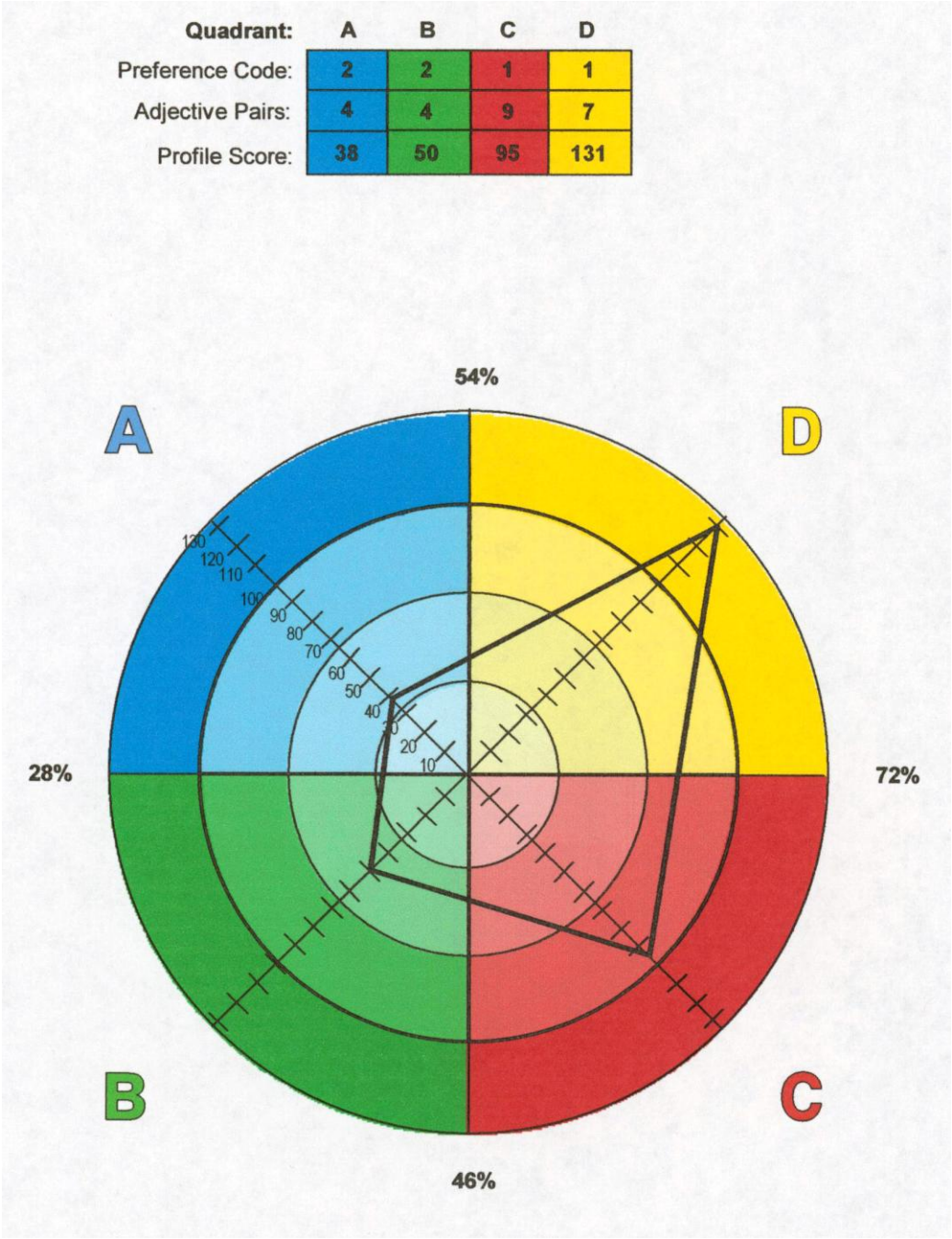


Figure 51. PLAY Participant 9 HBDI™ profile.

PLAY Participant 10 HBDI™ Profile

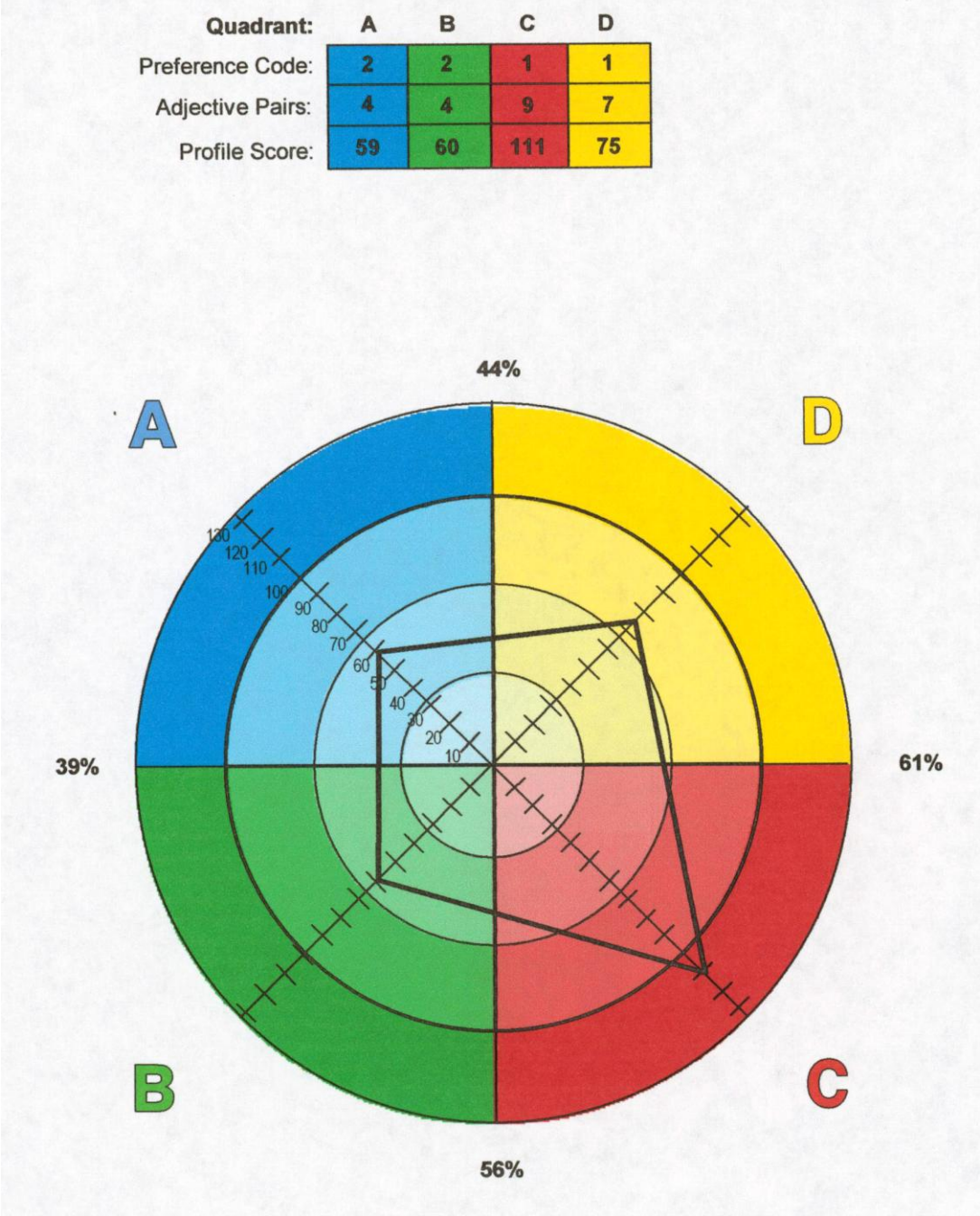


Figure 52. PLAY Participant 10 HBDI™ profile.

PLAY Participant 11 HBDI™ Profile

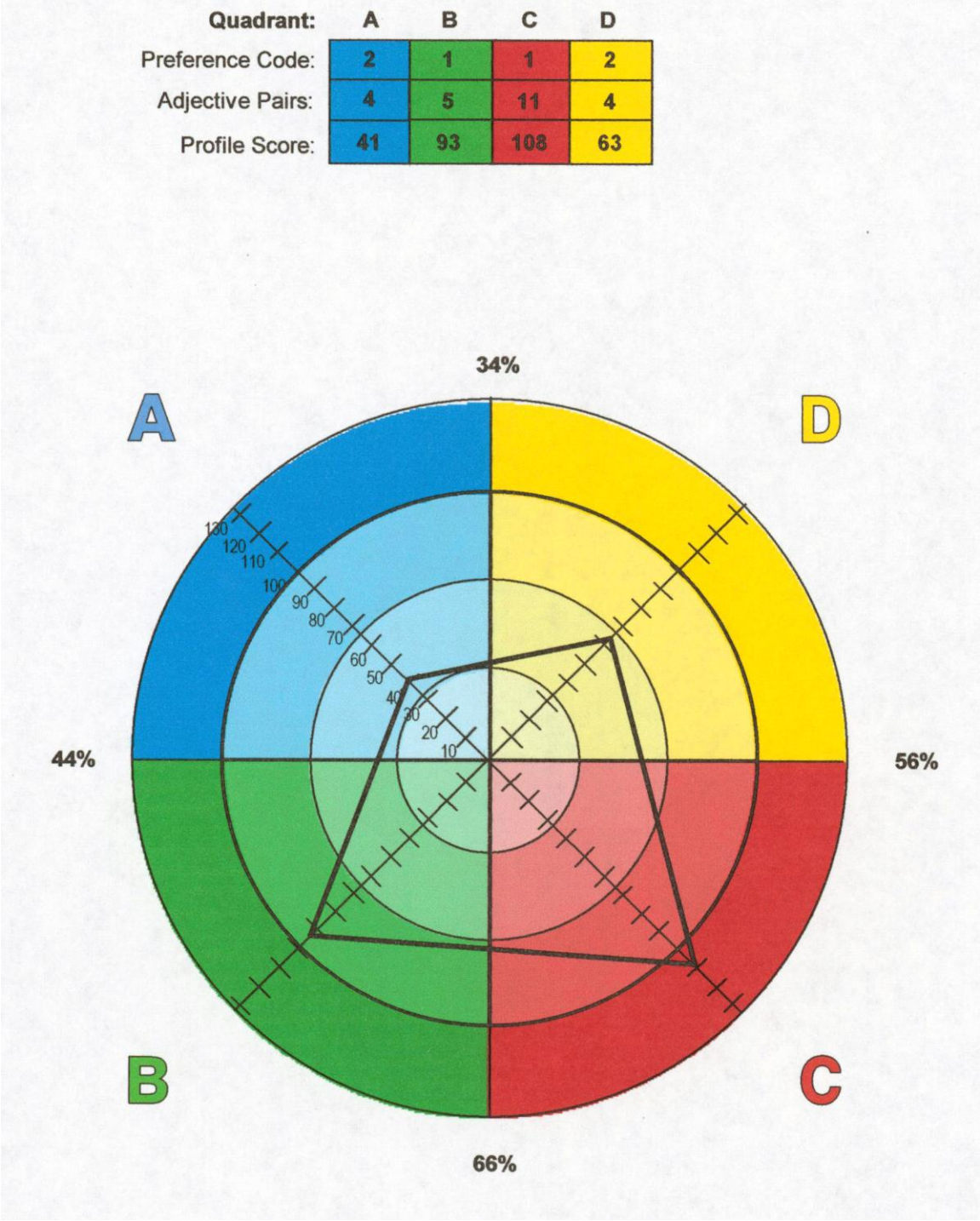


Figure 53. PLAY Participant 11 HBDI™ profile.

PLAY Participant 12 HBDI™ Profile

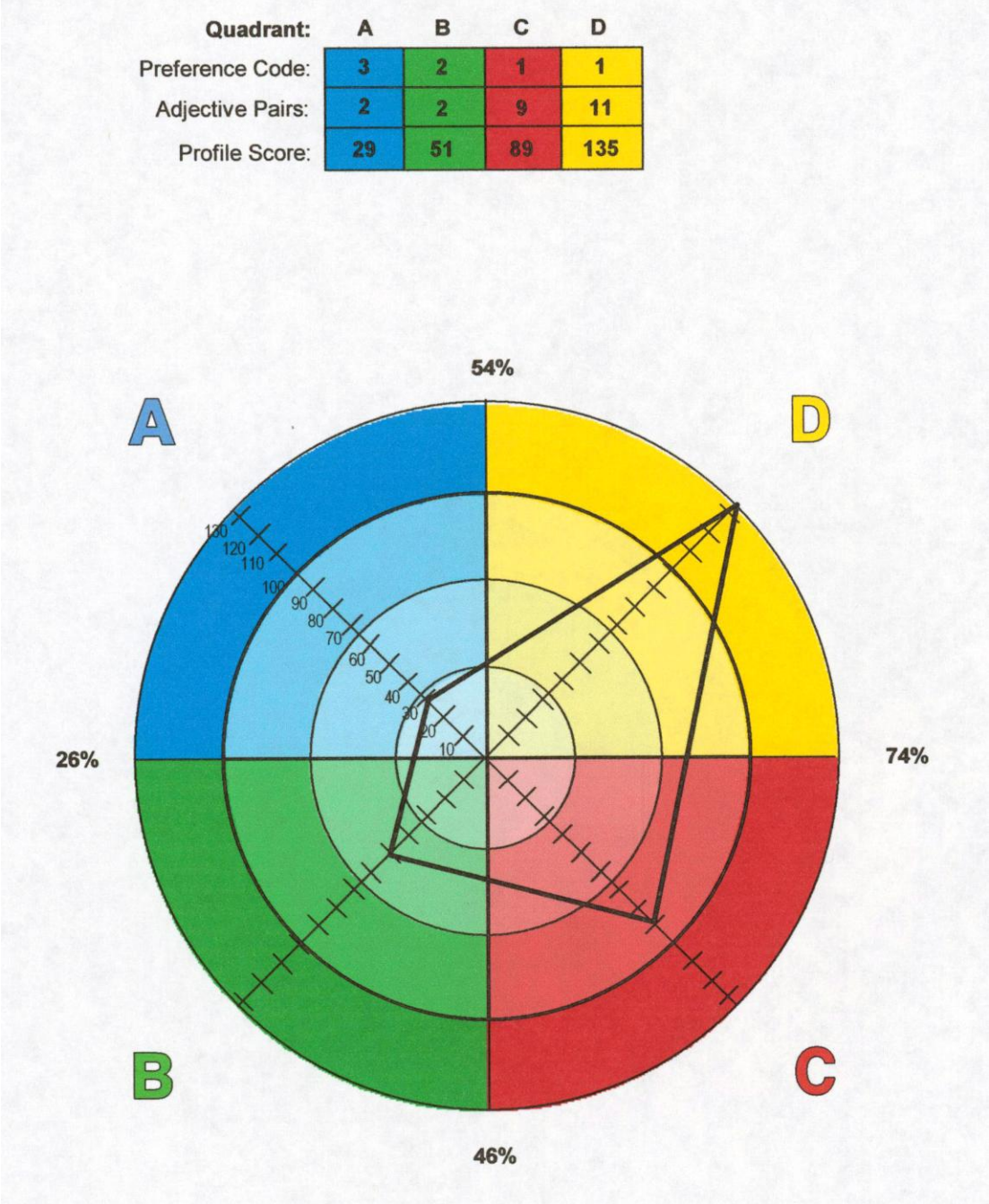


Figure 54. PLAY Participant 12 HBDI™ profile.

APPENDIX E: Case Study Q1–Q12 Interview Responses

Participant 1

Q1: Does the individual HBDI™ personal thinking preference report seem to be valid?

A1: Yes.

Q2: Why does the individual HBDI™ report seem that way?

A1: I think probably because — I haven't done a lot of Meyers Briggs type things HBDI™ type of profile, but this I think they seem to, this one at least, I think that it serves to analyze me pretty well. I think I am pretty high, if I was just to guess where I was I think I'd probably pretty high on the thinking and pretty high on the integration elements. Well I'd say I would I am pretty high on the humanitarian side not a weakness but a Left or preference for the organization side, it seems to really asses who I really am.

Q3: What HBDI™ quadrants do you personally have as your primary thinking preference?

A1: I got a 1 in the thinking, the A, a 1 in the D the innovating, a 1 in the humanitarian the C, and a 2 in the organizing, the B.

Q4: Does the HBDI™ composite average group plot profile for the PLAY Company seem to be valid?

A1: Yes.

Q5: Why does the HBDI™ composite average group plot profile seem that way?

A1: I think that a lot the company's preferences and one of the office's preferences is things like tend way away from. I'd say that seems to map it out pretty actually pretty on target. We looked at this rank order of preferences quadrant and I'd say that is how the company makes decisions and goes through its processes of visualizing, personalizing and organizing, then analyzing. I think that's true. I would say that on here there's not a big difference between the that the art of the analyzing is the thinking and is the lowest of them all. I wonder if, I wonder if it was maybe forgiving on that and ranked higher than it would be because I think

that thinking is our — not our weakest necessarily but it is preferable desire in other areas and that's where we have the lowest tendency. I wonder if it might actually be lower in reality than it was here. It might be the testing. I don't know. And maybe it's right, and maybe my own perception is just wrong. I certainly don't an instrument qualifying measurement for that, but overall, I'd say it is accurate.

Q6: What is the strength in knowing what other members of PLAY HBDI™ individual thinking preferences are?

A1: I would say that it's pretty clear. Although when just look at mine and look at the group's it is hard, but when I had an opportunity to look at everyone's mapped out when we did that a couple of months ago, what I was able to see was that we had Andy , the head of the company who, I remember his profile was essentially a mirror image of Brian's who was his counterpart here at the company and there were several occasions where someone would have — some had an identical profile or a mirror image. I seem to remember they were mainly left to right-brain mirror images, but I think there were some also upper to lower level mirrors, I can't remember exactly but that's helpful because when we're in a session or a meeting or some engagement and Andy says something, what he is talking about is analytically based and so in light of this preference is to ask why, why or to argue against it. for the information or something that is accurate on the innovation side and the humanitarian side I would definitely go to Andy and have no doubt that he was saying something that was accurate where Brian may not have that preference and so pretty much would not believe what he is saying. So with our people it definitely helps. You are able to use variable and figure it out. One of my strengths — one of my preferences was in the analytical side and therefore I thing I was able to get more out of it than other people in the organization. They weren't analyzing the full company spectrum of strengths and protocols preferences. I think it is enjoyable to compare and see people were — I think some people would probably just glance over it and not really care about it so I think that there is definitely value to know where people fall on the map and as for me I got value out of it.

Q7: How does the HBDI™ tool identify innovation at PLAY?

A1: I think that I would say that innovation is something as a company whose product while is being innovative is a company who sells ideas and our income comes from being innovative. Is important to see where on this map the team falls and if they do have that strength or they need to have that strength if that's what they are doing. Similarly, in other areas of the company, they are going to have that expertise, that skill set, that role to fulfill their duties. If they need to be organized, if they're office managers or something like that, then obviously it doesn't quite fit being innovative because you have the opposite, bipolar capabilities. Also,

someone who is high on the organization side, the B quadrant, we shouldn't expect to be up in the innovation quadrant.

DD: Which for you, you say is the D quadrant?

A2: The D quadrant, yes for us. And that would allow us to reconsider the teams and the duties and what people are doing and where they spend their time and energy. In fact we've run into problems in the past when we've had people in the D quadrant that were organizer quadrant and when they weren't operating in that upper right quadrant, it called attention to the team because we weren't thinking. We weren't seeing them in their own way. We tried to force them into some other role.

Q8: What are the HBDI™ indicators of innovation at PLAY?

A1: I would say that we are very definitely more conceptualizing, we are very imaginative. I think we have some abilities in the artistic sense but I would say that's where (poorly ?) because we depend upon innovation bring all those things together. That isn't part of it. We do synthesize, what we try to do is bring things together. So we synthesize. How can we know if a baseball team and how that can impact your office? Synthesizing as well as holistic, were pretty holistic at looking at everybody together.

DD: Are there other characteristics that you can think of strength. Naturally, there are going to be pieces of the D quadrant.

A2: I'd say that we are D quadrants. There are other quadrants that do tap into us but as far as our main profile, I don't have any preference. I think that's

Q9: What are the weaknesses of the HBDI™ individual thinking preference tool for identifying innovation?

A1: I think when we look at innovation there are methods of being innovative. There are some people who like to take some time and process stuff on their own, they like to go away and think about a problem, spend some time and whatever process they go through, they come back with some ideas. There are other people who really need to be on their own and need to be challenged and toss it back, they are given an idea and they bring an idea back. Its a group of people that come up with this stuff. And I think one of the areas that could be, if there's an enhancement element or some different way to measure it, if there's a way to see what people's individual personal style is for innovation for thinking. There is that definitely how the team operates. If you have four people who are very in the moment and you have one person who is entirely away from the group and process something, they need to process and innovate the problem they go away, there is going to be

a rift between that and the rest of the team. Likewise, if you have four people that need to go and be on their own and you have one person that needs other people that process is kind of useless. So I think there's a means of innovation and a means of style perhaps without say it. I think it can capture your personal ability and when you average out everyone else where the group it's not able to measure the interaction that you have with your team mates. So that's one weakness.

Q10: Is there anything else you would like to comment on about the HBDI™ tool?

A1: I think that the ability to divide them up into upper and lower and left and right-brain was. That helps. Again, I've never through a process like this, but it helped me to see where strengths were. I'd like to grow (?). Some of us probably innate and some of us enhancable and people practice it and make it stronger. I know my weaknesses in general is my organizational element and that is one area I would like to grow. So whether or not I may become a CEO, we'll see.

Participant 2

Q1: Does the individual HBDI™ personal thinking preference report seem to be valid?

A1: Yes. It seems to be valid.

Q2: Why does the individual HBDI™ report seem that way?

A1: Because I know myself fairly well at this point, and I have had a number of different roles in the course of my professional career and know that my preference typically is not used to two areas. I am just not at all surprised by the data. I am a little surprised by the spike out there, but then again, the way you described it the things in keeping with I am a very strong off the charts P in the Myers-Briggs described it reminded me of that kind of spontaneous go with the flow. Anything that is gray, I would just as soon not plan anything. In fact when I was first hired at PLAY, I was in a role that required much more of the B quadrant, planning and that kind of thing, and we all figured out pretty quickly it was a misfit because I am not a detail-oriented person nor do I enjoy that, the planning process, getting your ducks in a row type of thing. My passion is more in design of the facilitation or interacting with clients building relationships with them so it is no surprise to me at all that this is how it is.

Q3: What HBDI™ quadrants do you personally have as your primary thinking preference?

A1: My thinking preference.

DD: You kind have answered it already, saying you did not fit within the B. Do you recognize yourself within basically all of the quadrants?

A2: Well I would say just looking at these descriptive words under D and C, it seems to be a mix of both. I'd say especially holistic thinker. I tend to be a big picture conceptual thinker, and it is very difficult for me to talk about the moment if I don't have a context of the larger whole, which is why I love understanding organizational systems in whole and working with leaders and talking about that kind of scope because I enjoy playing that realm and seeing the interconnectedness of things, and all the interpersonal interactions that go along with that. I am sorry if I keep drawing parallels to the Myers-Briggs, but it helps me understand I am a strong E and an F in Myers-Briggs, so it's the way in which I get to that holistic understanding is through interpersonal conversation through connecting emotionally and spiritually in whatever way with clients to understand — to build a rapport quickly to help me understand the bigger picture, if that

makes sense.

Q4: Does the HBDI™ composite average group plot profile for the PLAY Company seem to be valid?

A1: Yes, I guess. I want to qualify that. I don't need to check the box.

Q5: Why does the HBDI™ composite average group plot profile seem that way?

A1: I wanted to sort of have a yes and no answer, so I know you need to check a box here. I guess if you take the individuals and plot them down, I can see why we would have this overall — I feel like we function in a knee-jerk, very reactive way that hits on a gut instinct that seems like we are reactive in terms of we don't plan ahead. We seem to function more of the C and D quadrants and perhaps because probably those of us who are in the design facilitation role are — I don't know — I mean there is just a whole conversation of how decisions are being made here, and I would say that we need and part of the reason we are looking for someone that just hired someone on to be an interim presence in some for, whether GM or COO, is I think, in my opinion we desperately need more weight on the side, and so it looks fairly even if you are to look at it in reality it functions not as evenly. It functions like it is more in these two areas.

Q6: What is the strength in knowing what other members of PLAY HBDI™ individual thinking preferences are?

A1: Strength of knowing? What information does that give me about them?

DD: Right.

A2: The strength of the individuals are? Or what the overall —

DD: The other members as they are mapped within this since this is a group profile.

A3: I am sorry. I don't understand the question. What is the strength? Strength of knowing. I don't — so what do I gain by knowing what the individual —

DD: The other individuals' preferences are.

A4: Well I don't know what the individuals are, but looking at this I can pretty much pull out who probably is pulling the group mean in certain directions though I think that in looking at this in my personal opinion we need to have more of — the strength of things is the thing I am getting caught up on — when I think about strength, I think about the individual strengths versus the power of knowledge of

knowing that this is where our group is — that we need to tap more into the people who have a preference of thinking in quadrants A and B. And bring some more people on board. But it is also I think it is what it is. This is the kind of company we are, and this is why we thrive and that we thrive because I think we have the right people and the right goals at this point in time in terms of their strengths and their way of thinking. Yeah. I don't know if that answered that, but —

DD: That's fine. You articulated how at an earlier time you — it became apparent that you recognized that this was not an active role that you might have played — that you want to switch into something that fits a little bit better for you.

A5: Yeah. And I think that right now we have for the most part people in the right world thinking preference wise for them, and I feel like we could draw out of some people a little more of the — we are too top heavy on the B and the C quadrants in terms of our decision, making process, I think.

Q7: How does the HBDI™ tool identify innovation at PLAY?

A1: I'm not sure other than, well in looking at this, and I may not be understanding the question again, but how does it identify innovation — how is innovation used in that question? Is that part of the question? I think a tendency towards thinking imaginatively and that we sort of definitely skew in that direction is we are definitely conceptualizers and divergent thinkers and that definitely serves us well if we are to be able to get to any kind of innovation for ourselves or for our clients. I think also one of our models here is inspiration creates innovation which you may or may not have heard about but to even have a seed of inspiration, we need to be passionate about something. For me personally that resides in the C quadrant, of course, I know that is not true for everyone, but I am not sure. I guess it would depend on how you define innovation there, but that is probably what you are looking for. Yeah. I think I would say diversion thinking were the main thing.

Q8: What are the HBDI™ indicators of innovation at PLAY?

A1: Definitely imaginative. Are these descriptions?

DD: Or other ones that you would assume exist within that quadrant.

A2: Yeah. Well divergent is the first one that comes to my mind. Playful — I mean not to put a pun on our name of our company, but it is a very playful place. Personal, collaboration is definitely part of it. We tend to be so busy at times that we don't do it as much as we could. But still, any project is never done solo. So I

think it is a combination of ideas that moves us towards innovation. And I'd say it is reactive innovation again because we tend to respond to things that would require innovation of business model of product services for clients, that kind of thing. Sometimes it is brilliant; sometimes the objective of the client driving innovation for them. It is still reactive to their objective, but I think internally if we had a stronger presence in B, we would be able to have innovations that drive towards something that is more strategic, if that makes sense.

Q9: What are the weaknesses of the HBDI™ individual thinking preference tool for identifying innovation?

A1: I guess understanding how these things play out together. I don't have near enough information after looking at this to even answer that question because I don't know how these things play out or what it tells me about — just by looking at, it does not tell me a whole lot about innovation or how the tool is defined in the word "innovation" because that is such a huge chunk of your people to find it in so many different ways. So does that mean a changeable output of innovation? Does it mean innovative thought? Does it mean — you know what, what does it mean? And so it's — I can look at this and have a gut sense about innovation naturally gravitating out of imagination and that kind of thing, conceptual thinking. Yet at the same time, for it to really hit the ground running, I need to have some logical pattern to and some filter processes and stuff that you are running downstairs actually, blueprinting that kind of thing which falls into the A and B quadrant. So I would want to understand better how these things play out and where these descriptive words fall in the perspective of this model around innovation and what someone else's interpretation of it versus just looking at the model it does not say a whole lot other than understanding where people think styles are. It would depend on — I mean it would depend on each individual's definition of the word "innovation" and for them what that means and again that would come from their perspective and their thinking models. So it would change where they would fall in this wheel I would presume.

Q10: Is there anything else you would like to comment on about the HBDI™ tool?

A1: No. I'd say it is validating for me. There aren't too many surprises. Yeah, I'd just be interested getting back to the other question around, based on this model, what the HBDI™ interpretation would be and the way these quadrants play out and what leads the group towards innovation and how innovation is defined for HBDI™. What the tool is trying to measure in order to define that — define innovation and then — Is the purpose of it to understand how to make a group more innovative in terms of the balance? What is the purpose of the model in your opinion?

DD: In my opinion it illustrates what your personal thinking preference is on it.

Where you lie and you would be able to see where your concentrations are. And that it does illustrate that you have what they refer to as whole grain thinking which means that you don't have a quadrant that is so lacking that it become dysfunctional or apparently dysfunctional according to this. I would not know if any organization that was dysfunctional. Also, the other piece of the model is that if you illustrate it with a rubber band is that it has the ability to expand or contract depending on the people that you put in the model. For me, it was kind of bizarre to kind of look at, here you are six months later, I filter the other people out and that the profile is very, very similar to what it was previously.

A2: Is that a surprise? Is that not ordinary?

DD: For me it was a very big surprise. I would think it would be hard to de-construct one-third of a company and still maintain the same —

A3: Profile.

DD: Thinking preference and still have it just as strong in the areas that you need it just as strong. So I think that says a lot about the way that the de-construction was done.

A4: Yeah, that's interesting.

Participant 3

Q1: Does the individual HBDI™ personal thinking preference report seem to be valid?

A1: Yes.

Q2: Why does the individual HBDI™ report seem that way?

A1: Because B and C are right on. It's all about my personality.

Q3: What HBDI™ quadrants do you personally have as your primary thinking preference?

A1: Is C that much about thinking?

DD: That is a valid response. So in the previous question you said B and C and in this one you are saying — and I just want to clarify you are saying that C may not be considered for you a thinking preference. Okay.

A2: C is just the way I feel, but B is the…

DD: would be the model you can see that B would be a thinking preference; C for you doesn't have that type of connection?

A3: Yeah, right.

Q4: Does the HBDI™ composite average group plot profile for the PLAY Company seem to be valid?

A1: Yes.

Q5: Why does the HBDI™ composite average group plot profile seem that way?

A1: Because we are more imaginative. And we are logical and mathematical. Are these right? We are much stronger in D. Not very organized and we are not very strong in planning.

Q6: What is the strength in knowing what other members of PLAY HBDI™ individual thinking preferences are?

A1: I don't get that say that again. What are the strengths?

DD: You may say that you don't see any strengths and being able to see what other members' profiles would be. There's no answer for you?

A2: There is no answer.

DD: Okay, that's fine.

A3: I don't have an answer for it.

DD: Not a problem.

Q7: How does the HBDI™ tool identify innovation at PLAY?

A1: I don't know (?).

DD: Do you see it being a measurement innovation? Or a capability. Okay, and if you do, and you nodded yes, what would be — how would you see it as a way to identify innovation?

A2: I don't know.

DD: Not a problem.

Q8: What are the HBDI™ indicators of innovation at PLAY?

A1: inaudible

DD: Okay, we are going back in and go back to Question No. 7. I am going to ask how does the HBDI™ identify innovation at PLAY?

A2: Quadrant D.

DD: So you see it being acknowledged in Quadrant D.

Q8: What are the HBDI™ indicators of innovation at PLAY? (Repeated)

A1: Very creative, imaginative, off the wall, little bit crazy, little bit unstructured.

Q9: What are the weaknesses of the HBDI™ individual thinking preference tool for identifying innovation? You don't see any or you don't understand the question.

A1: I don't understand the question.

Q10: Is there anything else you would like to comment on about the HBDI™ tool?

A1: I think it is a great tool. I can perfectly see it on paper, I just can't discuss it, but I can see it perfectly on paper.

DD: Not a problem.

Participant 4

Q1: Does the Individual HBDI™ personal thinking preference report seem to be valid?

A1: Yes.

Q2: Why does the Individual HBDI™ report seem that way?

A1: Seems valid in that the five characteristics as part of the D quadrant are those in which I create, strategize, and execute from. In so many ways, the other quadrants contain characteristics that I utilize but it is those in D that compliment even a diametrically opposing characteristic like analyzer...in other words I might look at it by "conceptionally analyzer".

Q3: What HBDI™ quadrants do you personally have as your primary thinking preferences?

A1: My primary thinking preferences lie in the D quadrant...imaginative, synthesizer, artistic, holistic, and conceptualizer

Q4: Does the HBDI™ composite average group plot profile for the PLAY Company seem to be valid (Yes-No)

A1: Yes.

Q5: Why does the HBDI™ composite average group plot profile seem that way?

A1: It was mentioned that the number of participants in certain quadrants could potentially create group think. I think this has become an asset to the organization in a specific aspect...that of creating. The creative process takes a very seamless and elegant approach in that the participants are breathing in and out of each other's mindsets. The different tastes, preferences, influences, etc make the thought process varietal (full of variety), while fluid.

Q6: What is the strength in knowing what others members of PLAY HBDI™ individual thinking preference is?

A1: knowing the individual preferences is very valuable most for its informal benefits. In that I mean the social climate of PLAY is determined by the styles in which we think and process and this very heavily dictates our culture, which is in fact our product. More formally, it is critical in making strategic decisions around hiring and personal development.

Q7: How does the HBDI™ tool identify "Innovation" at PLAY?

A1: the HBDI tool identifies "innovation", or should, as a holistic and integrated process. The brilliant innovations occur out of organizations that not necessarily have each quadrant equally represented, but one that fully understand the broader dynamic by virtue of the information.

Q8: What are the HBDI™ indicators of "Innovation" at PLAY?

A1: The HBDI indicators at PLAY lend themselves toward the D quadrant. This is based on the quantitative results. While relying heavily on these results, it is important to know that organizationally, PLAY leans on outside support and partners who have heavy influences in quadrants A and B.

Q9: What are the weaknesses of the HBDI™ individual thinking preference tool for identifying "Innovation"?

A1: the weakness lie in the fact that many who read their results, quickly gravitate toward developing one of two things...their strongest influences and their weakest influences. The masterful analysis would spread their development around innovating amongst all four quadrants, while being acutely aware of their own S.W.O.T. Analysis in regard to the tool.

Q10: From a leaders perspective did the HBDI™ tool identify any organizational weaknesses at PLAY?

A1: the HBDI tool helped in identifying certain characteristics that should be formally woven into our organizational design.

Q11: What changes if any were made at PLAY due to the HBDI™ profiles?

A1: having become more aware of these characteristics, PLAY's executive team, built a

short, mid, and long term hiring strategy. specifically , individuals who possessed characteristics in quadrants A and B were hired within the past 9 months, which has significantly improved our bottom line as well as our maturity as a business model.

Q12: If organizational changes were made due to the HBDI^{TM} profiles were they initiated by you or the individuals

A1: The changes were ultimately made by me as the leader, yet our informal hierarchy drove the decisions as a results.

Participant 5

Q1: Does the individual HBDI™ personal thinking preference report seem to be valid?

A1: Yes.

Q2: Why does the individual HBDI™ report seem that way?

A1: Because I think that it absolutely reflects the way that I make decisions and I also think it accurately reflects my ability to work within all quadrants while having a strong preference for one. I feel that it is fairly balanced with the exception of the one part of it. It is just a lot stronger than everything else. I think that is a good reflection of how I work.

Q3: What HBDI™ quadrants do you personally have as your primary thinking preference?

A1: I think it is reflected exactly here. I would say that C definitely, D definitely, I would say possibly B, and maybe not quite as much as A. I think that, and this is jumping to a different thing, I think that because of the group matching me here, within this group I feel like these stand out more. I think the group looks to me more for these than what I actually have strength in. It is just that they are looking for somebody that's a little beyond where they are.

DD: And those being the A and —

A2: A and B, yes.

DD: So you see those other single strengths for you, not necessarily for yourself those being strengths, you are identifying both the C and D quadrant for you as being the individual strengths?

A3: Yes. C and D.

Q4: Does the HBDI™ composite average group plot profile for the PLAY Company seem to be valid?

A1: Yes. It does seem to be valid.

Q5: Why does the HBDI™ composite average group plot profile seem that way?

A1: I think that after interpreting the profile the way that we tend to make our decisions is that we tend to visualize it and then ask for self-help fields. We get very caught up in help fields. We have very heated discussions if it does not feel right to certain people. Then I think we begin to figure out how it works. I think the only thing I would disagree about is by looking at this is it looks from this chart like our A quadrant is just a little bit weaker than our B quadrant. I would say our A quadrant is much weaker than our B quadrant. I think we can plan it out, but I don't think we understand the data well enough to — we don't know how to analyze things in a way to support our plans. We have enough people that are tactically driven to say "okay this is how we can make it happen" but we don't very often say "but that is a good thing, and this is why based on the numbers". We say this is why based on what it feels like.

Q6: What is the strength in knowing what other members of PLAY HBDI™ individual thinking preferences are?

A1: Knowing what the group is?

DD: Yes, the other members scoring.

A2: I think it does. I think it makes me understand why maybe — it makes me understand a little bit about some of the things that I am doing. One example would be that in our the loss of some of our people we have been trying to fill in some holes. There are some major things that have fallen off. One of the things that I have taken on, not across the board, but have sort of stepped in and taken on is contracts. And it is interesting that people have looked to me to do that. Contracts would be the least likely thing I would want to do. So that is something that has gotten for them into some of my responsibilities although everybody is doing contracts so it is not entirely — it is not like we officially sat down and traded responsibilities, it is just that they would look to me for more of the scheduling now and look to me for more of the logistics things now, and that is really not as much the strength of mine either, it is just that I am not as far out as they are. So in looking at our organization profile I can kind of see where the organization would look at me for areas where I might be stronger where we overall are not, or to balance the innovation quadrant that is so far out. Does that make sense?

DD: Hmm-huh.

A3: So there is strength in knowing for understanding in how our decisions are made.

A4: But my thinking preferences are more balanced than the groups. In relation to the group, The balance in my thinking preferences explains why the group would

look at me to provide logistics and planning support. Individually, this type of thinking isn't dominant for me, but when I see that even if I offer a little of this type of thinking it's more than what most of the group offers it explains how I've naturally fallen into that role.

DD: Right.

Q7: How does the HBDI™ tool identify innovation at PLAY?

A1: A mindset of quality in thinking; that is again going back to our decision making process. The way that the profile lays out and identifies it as the furthest thing from analysis and the next furthest thing from planning. So it puts those things this sort of opposite of the four as opposed to pairing them in some way. I think there is some opportunity for us to use analysis to fuel our innovation as opposed to working against.

Q8: What are the HBDI™ indicators of innovation at PLAY?

A1: Again, I think it is exactly the same, but on the D quadrant. The imaginative — I think the other qualities that we talked about that are like the D quadrant versus someone who is very vision oriented, a very short attention span, who is more excited by the ideas and the process of creating ideas and seeing what happens, and is not terribly concerned with how well they resonate with other people, other groups, other audiences because they are exciting in and of themselves. Also I would say that again going back to the flow of decision-making, the innovations are also characterized by things that are exciting or feel good as opposed to things that are metrically new or come out of the plan. The only instance where I think that's not true is when our innovations are client directed, so when we create new things based on the client objective, I feel like it does come from the plan.

Q9: What are the weaknesses of the HBDI™ individual thinking preference tool for identifying innovation?

A1: Of the individual?

DD: Doesn't matter, either one.

A2: The only thing I would say could be a potential weakness is that innovation is defined by the organization first. That it is characterized as something and then when we fault in that, what it is, maybe if there were characteristics of innovation that were weak put in and those were sort of measured and in fact would be a little different or maybe we would follow up a little differently. I never recall how long the test was but you could always ask different questions and see how things fall

out again. But that would be a wonderful memory of taking and what the types of questions were and how it was defined. I felt like there were, if anything, there were some overlaps in things that when you have to pick one its kind of mood dependent — if you are having a really exciting day then everything is one way, and if you working a pricing model all morning everything is the other way.

Q10: Is there anything else you would like to comment on about the HBDI™ tool?

A1: Not really. I think all things like this are pretty fascinating. I think it is an accurate reflection of me personally and I would say fairly accurate reflection of our organization. I would like to see a comparison relationships a little more. Like saying maybe we could use someone with stronger A, its kind of good to know how you are, but then how do you use that?

Participant 6

Q1: Does the individual HBDI™ personal thinking preference report seem to be valid?

A1: Yes.

Q2: Why does the individual HBDI™ report seem that way?

A1: It seems that way for me for a couple of reasons. One is I consider myself to have been hired for the skills to be creative, imaginative, artistic-ness is in my family, not necessarily being able to draw but that mentality. I love to conceptualize or I like the idea of holistic. I am reading off these words right here. Also I am a very healing person. I am being real honest, being around people that feel completely comfortable with. The pinnacle of life is being able to walk into anybody's house, home, office building is being able to open up their refrigerator door and not having to ask. That to me is where life is most comfortable. Organization is an afterthought and actual facts — I never really let the facts get in the way of a real good story so should facts back up the way that I feel and brilliance behind the good idea isn't that lovely? And if we can do it in a really nice fashion that actually, it helps to make everybody else feel good about it so I do respect the realization; it comes completely naturally.

DD: No problem.

Q3: What HBDI™ quadrants do you personally have as your primary thinking preference?

A1: You are talking about, I'm sorry — the D quadrant obviously. D and C. Sorry about that. D and C.

Q4: Does the HBDI™ composite average group plot profile for the PLAY Company seem to be valid?

A1: Yes, it does, very. I am pleasantly surprised. I'm not surprised that we are in the C and D quadrants at all. I'm glad to see that we have as much A and B as we have. I don't doubt that we do; it's that when we go to D — when you have D and C around, it tends to override sometimes if the A and B are less dominant which they are in our situation — The D and C almost gain more power. That's the nature of the D. The same thing always happens for an A. A has more power than a D. It can override it; it has too much facts looking back. It didn't surprise me.

Q5: Why does the HBDI™ composite average group plot profile seem that way?

A1: The leader of our group is off the charts D. Like you told us, we obviously fit the C but not because you told us that we have always known; that's how we interview people. I don't care how smart they are. We are not attaching their smarts. Although I think we strive to have more A and B. I just think it's a personal — If someone is too strong A or too strong B, there ends up being a personality conflict so they have to be moderate As and Bs to hang around.

Q6: What is the strength in knowing what other members of PLAY HBDI™ individual thinking preferences are?

A1: Well you know who is going to be thinking in the same patterns as you and then you know who is going to maybe a good communication gap with but then also you know who you can round things out with. I think some of this stuff comes inherent and naturally but sometimes when someone is a A, you don't always know it. When someone is a D it is pretty hard to hide I would think. Since we all communicate with C, I think it is important to identify our As and Bs to make sure that with the A — at the same time make sure you don't have As and Bs that are so strong that they are unreasonable, but I think it is very helpful.

Q7: How does the HBDI™ tool identify innovation at PLAY?

A1: It identifies innovation. First of all we are starting with D quadrant. So obviously you need to have strong creativity thought patterns, ability to synthesize information, see things in the big picture, step away from the way other people see them. So that comes naturally, but I believe that if you don't have some capacity in all of the quadrants it would be almost impossible to be creative — you need to have that balance to turn creativity into something tangible.

Q8: What are the HBDI™ indicators of innovation at PLAY?

A1: I need to ask you a question about that, in the question before I may be repeating that a little bit. You have to be the characteristics of innovation at PLAY. I do think it is important to have all of these things as — all the A, B, C, and D quadrants working together and led through D and have the strength through D. I don't think you are going to have innovation the way we need it, through A. Now if you are a rocket scientist, I can see where you would need to be led through A. I can see that completely. If you are a counselor, I can see where you would need to be led through C completely. If you are an assistant, you would want all of your stuff to be led through B. That all makes sense to me, but the business that we are

in, we need a very strong lead in D. Does that answer the question?

Q9: What are the weaknesses of the HBDI™ individual thinking preference tool for identifying innovation?

A1: I think if there is any way to blow this up bigger so we can see the variations a little bit more so I can see that there is actually a huge difference between Andy and me. Like he is really off the charts, how can I read the bulls eye better, this is here, this is 700. Other than that, I see you've got it right here. So you have given me maybe a look at the creative index. To really see the variations.

DD: Is there anything else you to comment on about the issues?

A1: I think you are doing a great job, and I can't wait to see what the results are.

Q10: Is there anything else you would like to comment on about the HBDI™ tool?

A1: none

Participant 7

Q1: Does the individual HBDI™ personal thinking preference report seem to be valid?

A1: Yes.

Q2: Why does the individual HBDI™ report seem that way?

A1: I am not creative whatsoever. I try to go against it — not go against it, but I avoid it as much as possible. I'm an organizer, that's what I like to do. I definitely like a black and white person. I like to close doors, I like to finish projects and being creative whatsoever I find that's not finishing a project. I want to finish, I don't want to go along, I don't want to think, I just want to do it.

Q3: What HBDI™ quadrants do you personally have as your primary thinking preference?

A1: B and a little bit of C, B and C.

Q4: Does the HBDI™ composite average group plot profile for the PLAY Company seem to be valid?

A1: Yes. I would think that A and B would be a little bit smaller, but yes.

Q5: Why does the HBDI™ composite average group plot profile seem that way?

A1: We've got more Ds, more creative people than ever and then the creative people tend to be to be a little bit more emotional besides. Honestly, I didn't think we have a lot of A's and Bs. I won't mention who the A is so I know I'm a B, I felt we got rid of all of them. It would be my job here, that's my truthful, honest opinion. I think Tracey is an A, but A and B, we think it would be much smaller.

Q6: What is the strength in knowing what other members of PLAY HBDI™ individual thinking preferences are?

A1: The strengths? That they are great. I mean we can get clients because they like to call, they like to chat, they know what customers want

DD: which quadrant?

A2: D and C.

DD: D and C?

A3: Hum hmm.

DD: So you see them having a skill set?

A4: I mean we definitely need the skill set. I just wish once in a blue moon which doesn't happen much that they would pick up on the B and A.

Q7: How does the HBDI™ tool identify innovation at PLAY?

A1: That is a question that would be a great D question, not a B question but I defer to my D colleagues.

DD: If you want to, you are more than welcome.

A2: I do because when it comes at this moment in my life — I've been here for a year and a half when there's not many Bs and A's, creativity and innovation can fall off the bottom of the earth for all I care.

Q8: What are the HBDI™ indicators of innovation at PLAY?

A1: Yes.

DD: And if you do see them, could you tell me which ones they are?

A2: D.

DD: D quadrant and the characteristics within that D quadrant, what are those?

A3: The creative side, creativity. Yeah.

Q9: What are the weaknesses of the HBDI™ individual thinking preference tool for identifying innovation?

A1: Okay, I'm a little confused.

DD: We are using this tool to identify innovation in the organization. What are the instances?

A2: That we don't have enough A and Bs.

DD: From your standpoint what you are saying is that innovation actually encompasses A and B also.

A3: Yes. Yes and C and D. We have a lot of C and D. We have a lot of great ideas, great, great ideas, needs and wants. We want them in this place and that place but we need A and B to say we can't because of money, who is going to organize, all the people get the tasks done, so we need A and B people in where we may have messed up.

Q10: Is there anything else you would like to comment on about the HBDI™ tool?

A1: Right on target.

Participant 8

Q1: Does the Individual HBDI™ personal thinking preference report seem to be valid?

A1: Yes

Q2: Why does the Individual HBDI™ report seem that way?

A1: Because I think it fits with emotionally how I view and react to the world. See below.

Q3: What HBDI™ quadrants do you personally have as your primary thinking preferences?

A1: It's very apparent to me that yellow and green are my strengths. I tend to synthesize, but not analyze. Think in systems and have a very yin-yang viewpoint; not strongly opinionated. I am thinker more than a feeler/talker; I need organization and details zipped up well – I love to-do lists; yet I cannot sit through technical or mathematical tests/puzzles or explanations. I'd rather experience things.

Q4: Does the HBDI™ composite average group plot profile for the PLAY Company seem to be valid?

A1: Yes, although I might have expected a bit more of the red.

Q5: Why does the HBDI™ composite average group plot profile seem that way?

A1: Because it reflects our behavior; we are eager, imaginative people, responsible for making other people the same through emotive means and programs that rely almost entirely on synthesis. Most of our business is based on integrating unlike things into new ideas – so synthesizing and conceptualizing. We all; seem to want more of the green/organization but we don't have quite enough to facilitate our work. We need more of the blue in terms of metrics and logical support for PLAY's methodologies, but I'm not surprised this is low – in our category, we might want to keep this on the low end.

Q6: What is the strength in knowing what others members of PLAY HBDI™ individual thinking preference is?

A1: I don't think I have other individual results. It would help me to know so that I can gain a better understanding of how they view the world and augment my communication to them accordingly.

Q7: How does the HBDI™ tool identify "Innovation" at PLAY?

A1: That our POV might be that innovation is more intuitive and creative.

Q8: What are the HBDI™ indicators of "Innovation" at PLAY?

A1: Systems thinking; conceptualizing, reacting and synthesizing.

Q9: What are the weaknesses of the HBDI™ individual thinking preference tool for identifying "Innovation"?

A1: It seems to be more about how we think vs. innovation.

Participant 9

Q1: Does the individual HBDI™ personal thinking preference report seem to be valid?

A1: Yes.

Q2: Why does the individual HBDI™ report seem that way?

A1: Because at the point in time when I took this test, this is exactly how I was feeling. This is where I was most comfortable in the C quadrant. I previously had jobs which were heavily into the A and B quadrant and I didn't like that and I was enjoying myself in the C quadrant.

Q3: What HBDI™ quadrants do you personally have as your primary thinking preference?

A1: Primary thinking preference of where I want to be?

DD: Where this is illustrated of where you are.

A2: Oh, C.

Q4: Does the HBDI™ composite average group plot profile for the PLAY Company seem to be valid?

A1: Yes it does.

Q5: Why does the HBDI™ composite average group plot profile seem that way?

A1: I looked at the individual profiles for all the teammates were reviewed I could see where they fit within the barriers of this arena. It also helps me understand them a lot better as far as how I should approach them.

Q6: What is the strength in knowing what other members of PLAY HBDI™ individual thinking preferences are?

A1: Working in the accounting environment where everything is basically black or white, there's not much gray and for you to have a lot of people who are in the D quadrant who do not think that way, it helps me to understand them and not to be

as frustrated with them when I approach them to try to get something done and to know that I need to do more follow up with those people (or other people ?) who are in the A or B quadrants.

Q7: How does the HBDI™ tool identify innovation at PLAY?

A1: I think, once again that it verifies it innovation I look at as a high sense of creativity and I look at those people being in the B quadrant and you have to be able to use your imagination to come up with goals, ideas, looking for ways in which you can change companies, move them forward. This to me just verifies that we are the people who we say we are.

Q8: What are the HBDI™ indicators of innovation at PLAY?

A1: Conceptualizer, being imaginative, being artistic, and being open to ideas. They tend to do a lot of blue sky.

DD: When you say blue sky, that means —

A2: Just coming up with different ideas. Looking at things that are around them, looking for ways in which to change it, and not just trying to pigeon hole things into certain buckets.

Q9: What are the weaknesses of the HBDI™ individual thinking preference tool for identifying innovation?

A1: Because we may have a rubber band effect on people, it all depends on when they took it, and what comfort level they were feeling within any particular category. For example, myself, at the time I took it I was more of a C, but right now in my career, I am more of a B and an A right now. You just can't look at this and say that the way it is the way it will always be because it changed the threshold based off of circumstances. And the people who were taking it, there are people who have gone who have left the company, and there are others who have come into the company, so the company and the B (or D?) quadrant has changed.

Q10: Is there anything else you would like to comment on about the HBDI™ tool?

A1: Yes. I liked it and I wish I could get a copy for my husband so he can take it too.

Participant 10

Q1: Does the individual HBDI™ personal thinking preference report seem to be valid?

A1: Yes.

Q2: Why does the individual HBDI™ report seem that way?

A1: I have to qualify it. I think there are some areas that I agree with but because it is a self-report, I think there may be an aspirational quality to it, but I think if you were to have somebody else rank me, and when I say yes to the first question, I would say 80%. Where my concern comes in is I think if somebody else were to rank me I would score considerably lower in the C quadrant, on emotional, spiritual, talker, and I think I may have aspirationally skewed myself higher there. I took the Myers Briggs and I sat down at the center with a friend of mine and we went through the exact same thing and I remember one of the questions was something to do with how outgoing you are, I consider myself to be pretty outgoing person and in the discussion with this friend of mine, he said well if you are at a party how often do you initiate a conversation? And it's almost never. Usually I'll join conversations, and then he goes well then maybe you need to knock that down a notch. It's almost one of those reflective things. I think maybe I have skewed myself a little bit higher on aspirational. But I would like to think that I was logical and a good problem solver, but maybe I don't fully grasp what it takes to be logical or an analyzer so I just assume — well I do think that relatively speaking I tend to be that way. So I think that's sort of a caveat I would put on the yes or no. But I think in terms of the characteristics of each of those, I can relate to some and not others, if that makes sense.

Q3: What HBDI™ quadrants do you personally have as your primary thinking preference?

A1: "A" data is the primary, A is secondary, then B, and C. So it goes in that order.

Q4: Does the HBDI™ composite average group plot profile for the PLAY Company seem to be valid?

A1: I think the company is probably more set than the individual. Sort of a 80/20 on confidence and I'd say 90/10 on this one.

Q5: Why does the HBDI™ composite average group plot profile seem that way?

A1: Well just looking at the balance here. What I think I am sort of doing as I go through this is try to imagine who fits in which quadrant based on the relationship I have with other people, and I knew about X number of people fit into there versus there. And also, it's also assuming that it's looking at the dominant quadrant for each person but also saying that I think other characteristics of the company that skew everyone to the data. That's the nature of the business that we are in. So it almost, you can't help fit into D by just walking in the front door, just by the very nature of being in here that helps you go in that direction. I think in terms of — I am surprised C is not higher, but I think not that much higher. I think just based on the camaraderie of the group, that sort of thing. Emotional, attachment, having a lot of people. I think there is a difficulty to detach emotion from just business so I am surprised it's not a little higher there.

Q6: What is the strength in knowing what other members of PLAY HBDI™ individual thinking preferences are?

A1: I think in terms of partnerships and the way we operate there, it is very, I mean it's cross functional just by the nature. I mean to say cross-functional is almost ridiculous. It's to assume that we have functions in the company. But because we really do operate as a — as one group despite what everybody's primary function is, I think it is good to know that it is always impossible to have a perfect partnership where everybody is going to think in and hopefully a synchronized way or compliment one another. But it is nice to know that how partnerships can compliment one another. So if you do have somebody that really skews in quadrant D, how can you balance that in quadrant B, let's say? And to not get frustrated by their work style. It's nothing person, it's just their approach to business. In recognizing that one is not stronger than the other; that it's both play an equally important role and it's getting the job done. So it is good to know who goes where and how we can start the partners so they compliment one another.

Q7: How does the HBDI™ tool identify innovation at PLAY?

A1: Is this in terms of the characteristics listed in D?

DD: It can be. You could use that as your reference or if there is something else.

A2: I think we are looking at those, I think it nails the first imaginative, and last conceptualizer. Artistic, I think has a tendency for me to be interpreted as more of the traditional painting, that sort of thing. I don't think we have a lot of measures for that and it would not be measured here — I don't think it measures that, I don't think that's anything that would be measured here. Synthesizer is interesting too because it looks at sort of adapting existing things. I think we do a lot of that. I

don't think there is anything else that we can characterize that it doesn't capture there.

Q8: What are the HBDI™ indicators of innovation at PLAY?

A1: For me it is almost like problem solving can be interchanged with creativity. So it's almost like how you frame the objective or the opportunity, and if you want to approach it like a pragmatic hey here's the opportunity and this is what keeps going along so let's use creativity. Things like that. I think from, I think that is probably the way I would approach this, the problem solving where anything that creates a negative connotation of problem solving, a problem exists. I think there is a good balance of that approach versus the opportunity. The opportunity capitalizing, so people don't see, they don't see a problem, they just see an opportunity. I think that is a good measure. I think on quadrant C, inter personal and emotional, and talker, talker is probably the strongest I — I think we do a lot of conversations. We call it discovery through discussions, so there is probably a lot of that character side of it. And also in D I think that conceptualizer imaginative synthesize. But it is interesting, I'm looking at B and I can't think of — I am looking at the characteristics of Beth and trying to figure out what role that Beth would play in innovation. It certainly adds a process to it, but as for paradoxes, innovation is something you could put a process to where it doesn't just happen. The best you can do is provide the environment for it to just happen. I think there is a way to control it so maybe control isn't the right word. If there is some word that can capture that, create the atmosphere that is conducive for it to just happen. And there probably is some degree control over that. We control the environment, we control to a degree the culture, we control who is part of the company, so I think maybe that's where the control is, putting all those ingredients together so it creates the environment for imagination and conceptualization.

Q9: What are the weaknesses of the HBDI™ individual thinking preference tool for identifying innovation?

A1: I think that it is indicating term that problem solving for me would be interchangeable with maybe degrees of synthesizing your imagination or conceptualizing what it is almost. I'm going to conceptualize a solution to the problem. And usually I'm more black and white, philosophically speaking when I approach things so if I am not holistic, I don't characterize myself as emotional, I'm going look for the — I think emotional, logical fits — its sort of what's the opposite of holistic, it's just looking at one thing versus the big picture — that sort of thing. So I'd say that is one of the weaknesses. And I also think — aspirationally thinking I'd love to think I'm really that innovative person, so I might do a little imprinting and say well based on what I've read from so and so, I read a great article and here's how innovative people operate and I'm going to say okay, I need to start thinking like that, but I might be my own biggest enemy to

thinking like that. You know for me it is impossible. If I hear — I heard a great story on the radio the other day from the old Secretary of Labor from the Clinton administration, and my first thing was that's great, everything he was saying I can align myself with and really identify with. But then I thought about it, it is easier for me to find time because I do not feel that way so it was easier for me to think counter to that way. It was like okay, well maybe I'm not — maybe I'm not in that area. So he may have been speaking about the importance of emotions or creativity, but that's right. I'm passionate about what I do. But then the more I think about, and I might be wrong. I think I try to detach myself a little bit, I think. More like Spock and less like Dr. Bones.

Q10: Is there anything else you would like to comment on about the HBDI™ tool?

A1: I do like it because it does measure certain characteristics here, and I think that's very helpful. I'm sure it exists, but just a little greater detail in each of these. In fact in a folder it exists, and I do remember kind of looking those up and comparing and contrasting. But I do like the fact it breaks it up into degrees of quadrants so there is no absolute that you are, and I think that helps. The trick is how you visualize that when you are with a group of people to think it's — You know, I'm an absolutist, it's sort of like — the added characteristics of that and how do you reference it or compliment yourself or somebody else that has the better characteristics, so I do like that about it.

Participant 11

Q1: Does the individual HBDI™ personal thinking preference report seem to be valid?

A1: Yes.

Q2: Why does the individual HBDI™ report seem that way?

A1: Obviously taking the time that we took to think about the responses to the questions going back, I am 38 years old, going back my whole life, not just my recent ventures here at PLAY, I would say it is a perfect measurement of me and in every aspect of my life, not just at work.

Q3: What HBDI™ quadrants do you personally have as your primary thinking preference?

A1: Rather mind or just the way that I am.

DD: So you see that really fits well?

A2: I really do. It's how I approach things. I want to make sure that they are going to work, I don't have time to waste, I'm very busy. A mother now, having other people I am responsible to and for. I get the most out of my life being able to plan things and having them set, rather than throwing them to the wind to do it in a different way just cant ruin the picture. Just cant blow the whole thing out of the water if that makes sense.

Q4: Does the HBDI™ composite average group plot profile for the PLAY Company seem to be valid?

A1: It does. Yes.

Q5: Why does the HBDI™ composite average group plot profile seem that way?

A1: Because I know the people that I am surrounded by all day, who I work with, basically. There were a few surprises when we did stand in our quadrants because we did that exercise and I don't think you were here to do that for us so we did that ourselves because we wanted to see how we balanced. There were a few surprises and I wanted to question some of those folks and whether they could interpret some questions and figure out what would skew them in one way versus

another not to secure their job or not to prove to anyone that they are out of the box thinkers versus logical thinkers but that knowing them for five years and then seeing them in a different — with a predominant quadrant that I wasn't aware of. It was a little bit question but it's not for me to question. But I think as a whole, I could very well easily, probably with 80% accuracy put people where they should have been.

Q6: What is the strength in knowing what other members of PLAY HBDI™ individual thinking preferences are?

A1: We do — CCL came and did a similar thing with us and plotted us on a linear sort of a thinking path. And, whether it helped me to turn around and say Lori Everett, although she is a financial person was a very much of an out of the box thinker, whether that makes me deal with it in another way, I'm not sure, but it makes me think of her in a different way. The task at hand has always been a drive the way that I deal with someone in my own way, how I deal with someone. But certainly knowing personality preferences and strengths and weaknesses is going to help, absolutely. I think it helps.

Q7: How does the HBDI™ tool identify innovation at PLAY?

A1: Quadrant wise? Certainly D just for the conceptual nature of that and it clues that type of a person is not to strained by anything. That's really what innovation to me means. No constraints, no rules, no boundaries, and those thinkers are the ones who can think like that. I'm constrained. If I can even sit for 5 minutes, I can be unconstrained. Five minutes later I can be and it's blown.

Q8: What are the HBDI™ indicators of innovation at PLAY?

A1: The whole notion, maybe it has been planted in my mind by just hearing it over and over from people here whether this would be my answer five years ago or not, I'm not sure but possibilities — probabilities vs. realities has always been classified as two areas that we need to be responsible to — the possibilities area and no constraints, and no boundaries, and the who cares and the what if? All those are characteristics what I would consider to describe innovation here.

Q9: What are the weaknesses of the HBDI™ individual thinking preference tool for identifying innovation?

A1: All of those same characteristics — no boundaries is a little unrealistic. If it is driven by that 100% of the time, what we spoke about before off record was the complete. If everyone is playing in D and then C and then we move to B, then A,

there's a lot of time and energy that was wrapped in D and C areas and by the time it gets to B and A if it's not a pretty picture everybody that does play in D gets really pissed off and thinks you are party pooper. But that's reality.

Q10: Is there anything else you would like to comment on about the HBDI™ tool?

A1: I think it is extremely interesting. It's more in depth I think than other personality models that try to categorize people in and it's much more flexible. I have enjoyed being a part of it, it's great. What else is there?

Participant 12

Q1: Does the individual HBDI™ personal thinking preference report seem to be valid?

A: Yes.

Q2: Why does the individual HBDI™ report seem that way?

A1: If it reflects preferences, that is accurate to what I prefer, although I am not sure to skills necessarily but definite where I prefer to play.

Q3: What HBDI™ quadrants do you personally have as your primary thinking preference?

A1: D and C.

DD: And you recognize that? Does that fit for you?

A2: Yes.

DD: Okay. So does it seem very valid? Okay. Now we are going to jump over to the group profile.

Q4: Does the HBDI™ composite average group plot profile for the PLAY Company seem to be valid? That's a yes or no.

A1: Yes.

Q5: Why does the HBDI™ composite average group plot profile seem that way?

A1: Because we have all of our bases covered with the site preference to the D, quadrant, the artistic and conceptualization because that is our business.

Q6: What is the strength in knowing what other members of PLAY HBDI™ individual thinking preferences are using a tool like this?

A1: Knowing what resources we have, whether we are utilizing skills that we have or we don't have those skills, which could be used for hiring or filling gaps where the next employee should come from or if we can re-balance. If we did not have any A and B, we would certainly need to get some.

Q7: How does the HBDI™ tool identify innovation at PLAY?

A1: Identify innovation? Well it is aligned with the D quadrant if that is with a quality decision. The D quadrant of imagination, artistic, and conceptualization, those are the strongest qualities involved in innovation.

Q8: What are the HBDI™ indicators of innovation at PLAY?

A1: Imagination, and the ability to make an analogy, or drop something else and apply it. Artistic is up for grabs, a word that has baggage. I think conceptualization being able to create something from nothing will make it tangible when it is not tangible yet.

Q9: What are the weaknesses of the HBDI™ individual thinking preference tool for identifying innovation?

A1: I am not sure I can answer that. One might be that by virtue of those who are innovative thinking do they respond to tests? So that perhaps it is accurate with personality which you know but when you are trying to put language around what is esoteric or intuitive, is that accurate? That would be my impression where any tool failed in this category.

Q10: Is there anything else you would like to comment on about the HBDI™ tool?

A1: inaudible response, presumably a no answer.

APPENDIX F: Case Study Interview Questions Correlation Matrix

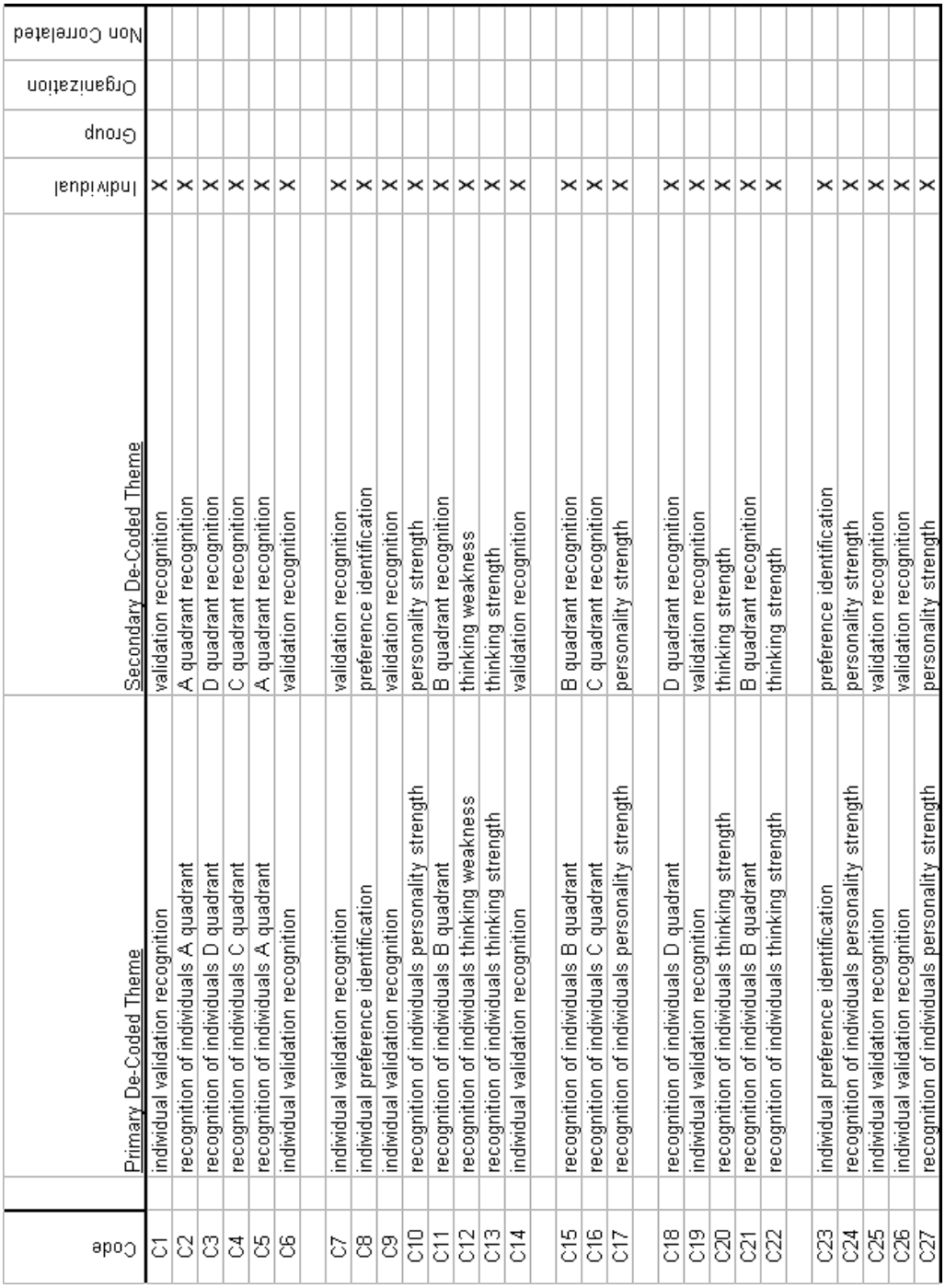
Q2 Correlation Matrix

Code	Participant	Question	Response		Text Description		Primary De-Coded Theme
C1	P1	Q2	R1		serves to analyze me pretty well		individual validation recognition
C2	P1	Q2	R2		pretty high on the thinking		recognition of individuals A quadrant
C3	P1	Q2	R3		pretty high on the integration elements		recognition of individuals D quadrant
C4	P1	Q2	R4		pretty high on the humanitarian side		recognition of individuals C quadrant
C5	P1	Q2	R5		Left or preference for organization side		recognition of individuals A quadrant
C6	P1	Q2	R6		assesses who I really am		individual validation recognition
C7	P2	Q2	R1		I know myself pretty well at this point		individual validation recognition
C8	P2	Q2	R2		I know that my preference typically is not used in two areas		individual preference identification
C9	P2	Q2	R3		not at all surprised by the data		individual validation recognition
C10	P2	Q2	R4		I am a very strong off the charts P in the Myers-Briggs		recognition of individuals personality strength
C11	P2	Q2	R5		I was in a role that required much more of the B		recognition of individuals B quadrant
C12	P2	Q2	R6		I am not a detail oriented person		recognition of individuals thinking weakness
C13	P2	Q2	R7		my passion is more in design of the facilitation		recognition of individuals thinking strength
C14	P2	Q2	R8		it is no surprise to me at all that this is how it is		individual validation recognition
C15	P3	Q2	R1		because B and C are right on		recognition of individuals B quadrant
C16	P3	Q2	R1				recognition of individuals C quadrant
C17	P3	Q2	R2		its all about my personality		recognition of individuals personality strength
C18	P4	Q2	R1		5 charactoristics as part of the D quadrant		recognition of individuals D quadrant
C19	P4	Q2	R2		create, strategize, and execute		individual validation recognition
C20	P4	Q2	R3		other quadrants contain charactoristics that I utilize		recognition of individuals thinking strength
C21	P4	Q2	R4		diametrically apposing charactoristic like analizer		recognition of individuals B quadrant
C22	P4	Q2	R5		conceptionally analyzer		recognition of individuals thinking strength
C23	P5	Q2	R1		it absolutely reflects the way I make decisions		individual preference identification
C24	P5	Q2	R2		it accurately reflects my ability to work within those areas		recognition of individuals personality strength
C25	P5	Q2	R3		fairly balanced with the exception of one part		individual validation recognition
C26	P5	Q2	R4		A lot stronger than everything else		individual validation recognition
C27	P5	Q2	R5		good reflection for how I work		recognition of individuals personality strength

Figure 55. Q2 primary decoding sheet 1.

C28	P6	Q2	R1	been hired for the skills to be creative, imaginative		recognition of individuals personality strength
C29	P6	Q2	R2	I love to conceptualize		recognition of individuals D quadrant
C30	P6	Q2	R3	I like the idea of holistic		recognition of individuals C quadrant
C31	P6	Q2	R4	It helps everyone feel good about it		recognition of extrinsic value
C32	P6	Q2	R5	I do respect the realization		individual validation recognition
C33	P7	Q2	R1	I am not creative what so ever		recognition of individuals D quadrant
C34	P7	Q2	R2	I am an organizer		recognition of individuals B quadrant
C35	P7	Q2	R3	I definitely like a black and white person		recognition of individuals personality strength
C36	P7	Q2	R4	I like to close doors		recognition of individuals personality strength
C37	P7	Q2	R5	I want to finish		recognition of individuals personality strength
C38	P7	Q2	R6	I don't want to think, I just to do it		recognition of individuals thinking weakness
C39	P8	Q2	R1	fits with emotionally how I view and react to the world		recognition of individuals C quadrant
C40	P9	Q2	R1	this is exactly how I was feeling		individual validation recognition
C41	P9	Q2	R2	I was most comfortable in the C quadrant		recognition of individuals C quadrant
C42	P9	Q2	R3	I previously had jobs which were heavily into the A and B		recognition of individuals A quadrant
C43	P9	Q2	R3			recognition of individuals B quadrant
C44	P9	Q2	R4	I was enjoying myself in the C quadrant		recognition of individuals C quadrant
C45	P10	Q2	R1	I think there are some areas I agree with		individual validation recognition
C46	P10	Q2	R2	I think there may be and aspirational quality to it		recognition of individuals personality strength
C47	P10	Q2	R3	I would score myself considerably lower in the C quadrant		recognition of individuals C quadrant
C48	P10	Q2	R4	I think maybe I have skewed myself a little bit higher		recognition of individuals thinking weakness
C49	P10	Q2	R5	I would like to think that I was logical and a good problem solver		recognition of individuals D quadrant
C50	P10	Q2	R6	maybe I don't fully grasp what it takes to be logical or an analyzer		recognition of individuals A quadrant
C51	P10	Q2	R7	I can relate to some and not others		individual validation recognition
C52	P11	Q2	R1	I would say it is a perfect measurement of me		recognition of individuals personality strength
C53	P11	Q2	R2	In every aspect of my life, not just work		individual validation recognition
C54	P12	Q2	R1	it reflects preferences, that is accurate to what I prefer		recognition of individuals personality strength
C55	P12	Q2	R2	but definite where I prefer to play		individual validation recognition

Figure 56. Q2 primary decoding sheet 2.



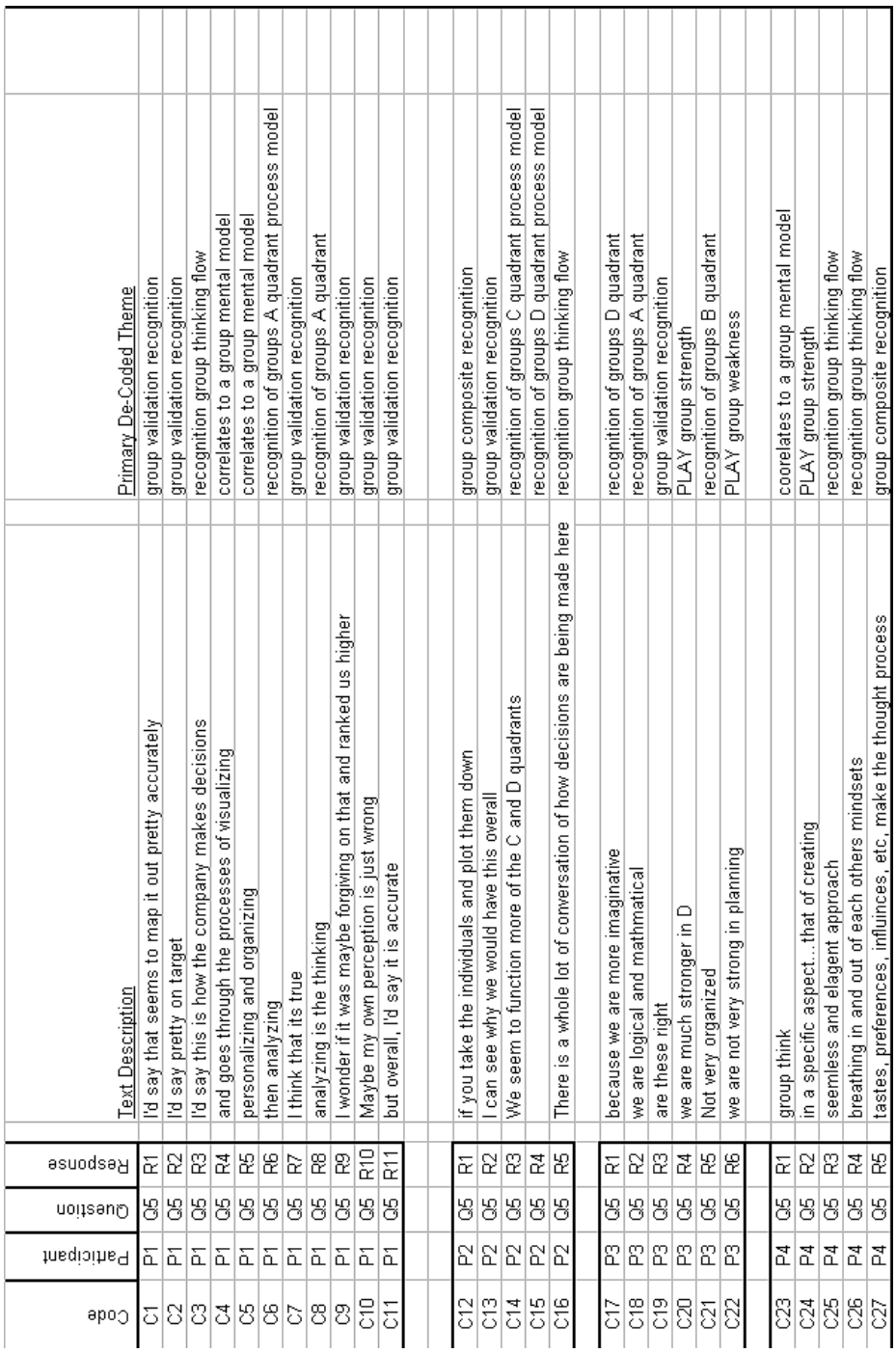
Code	Primary De-Coded Theme	Secondary De-Coded Theme	Individual	Group	Organization	Non Correlated
C1	individual validation recognition	validation recognition	X			
C2	recognition of individuals A quadrant	A quadrant recognition	X			
C3	recognition of individuals D quadrant	D quadrant recognition	X			
C4	recognition of individuals C quadrant	C quadrant recognition	X			
C5	recognition of individuals A quadrant	A quadrant recognition	X			
C6	individual validation recognition	validation recognition	X			
C7	individual validation recognition	validation recognition	X			
C8	individual preference identification	preference identification	X			
C9	individual validation recognition	validation recognition	X			
C10	recognition of individuals personality strength	personality strength	X			
C11	recognition of individuals B quadrant	B quadrant recognition	X			
C12	recognition of individuals thinking weakness	thinking weakness	X			
C13	recognition of individuals thinking strength	thinking strength	X			
C14	individual validation recognition	validation recognition	X			
C15	recognition of individuals B quadrant	B quadrant recognition	X			
C16	recognition of individuals C quadrant	C quadrant recognition	X			
C17	recognition of individuals personality strength	personality strength	X			
C18	recognition of individuals D quadrant	D quadrant recognition	X			
C19	individual validation recognition	validation recognition	X			
C20	recognition of individuals thinking strength	thinking strength	X			
C21	recognition of individuals B quadrant	B quadrant recognition	X			
C22	recognition of individuals thinking strength	thinking strength	X			
C23	individual preference identification	preference identification	X			
C24	recognition of individuals personality strength	personality strength	X			
C25	individual validation recognition	validation recognition	X			
C26	individual validation recognition	validation recognition	X			
C27	recognition of individuals personality strength	personality strength	X			

Figure 57. Q2 secondary decoding sheet 1.

C28		recognition of individuals personality strength	personality strength	X				
C29		recognition of individuals D quadrant	D quadrant recognition	X				
C30		recognition of individuals C quadrant	C quadrant recognition	X				
C31		recognition of extrinsic value	extrinsic value		X			
C32		individual validation recognition	validation recognition	X				
C33		recognition of individuals D quadrant	D quadrant recognition	X				
C34		recognition of individuals B quadrant	B quadrant recognition	X				
C35		recognition of individuals personality strength	personality strength	X				
C36		recognition of individuals personality strength	personality strength	X				
C37		recognition of individuals personality strength	personality strength	X				
C38		recognition of individuals thinking weakness	thinking weakness	X				
C39		recognition of individuals C quadrant	C quadrant recognition	X				
C40		individual validation recognition	validation recognition	X				
C41		recognition of individuals C quadrant	C quadrant recognition	X				
C42		recognition of individuals A quadrant	A quadrant recognition	X				
C43		recognition of individuals B quadrant	B quadrant recognition	X				
C44		recognition of individuals C quadrant	C quadrant recognition	X				
C45		individual validation recognition	validation recognition	X				
C46		recognition of individuals personality strength	personality strength	X				
C47		recognition of individuals C quadrant	C quadrant recognition	X				
C48		recognition of individuals thinking weakness	thinking weakness	X				
C49		recognition of individuals D quadrant	D quadrant recognition	X				
C50		recognition of individuals A quadrant	A quadrant recognition	X				
C51		individual validation recognition	validation recognition	X				
C52		recognition of individuals personality strength	personality strength	X				
C53		individual validation recognition	validation recognition	X				
C54		recognition of individuals personality strength	personality strength	X				
C55		individual validation recognition	validation recognition	X				

Figure 58. Q2 secondary decoding sheet 2.

Q5 Correlation Matrix

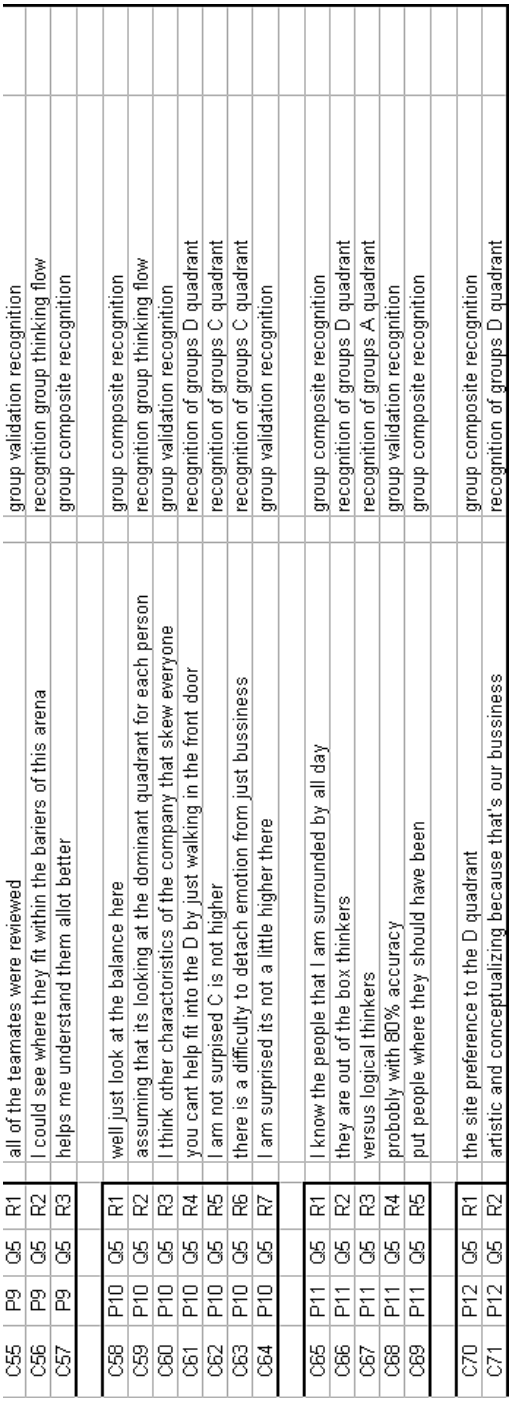


Code	Participant	Question	Response	Text Description	Primary De-Coded Theme
C1	P1	Q5	R1	I'd say that seems to map it out pretty accurately	group validation recognition
C2	P1	Q5	R2	I'd say pretty on target	group validation recognition
C3	P1	Q5	R3	I'd say this is how the company makes decisions	recognition group thinking flow
C4	P1	Q5	R4	and goes through the processes of visualizing	correlates to a group mental model
C5	P1	Q5	R5	personalizing and organizing	correlates to a group mental model
C6	P1	Q5	R6	then analyzing	recognition of groups A quadrant process model
C7	P1	Q5	R7	I think that its true	group validation recognition
C8	P1	Q5	R8	analyzing is the thinking	recognition of groups A quadrant
C9	P1	Q5	R9	I wonder if it was maybe forgiving on that and ranked us higher	group validation recognition
C10	P1	Q5	R10	Maybe my own perception is just wrong	group validation recognition
C11	P1	Q5	R11	but overall, I'd say it is accurate	group validation recognition
C12	P2	Q5	R1	if you take the individuals and plot them down	group composite recognition
C13	P2	Q5	R2	I can see why we would have this overall	group validation recognition
C14	P2	Q5	R3	We seem to function more of the C and D quadrants	recognition of groups C quadrant process model
C15	P2	Q5	R4		recognition of groups D quadrant process model
C16	P2	Q5	R5	There is a whole lot of conversation of how decisions are being made here	recognition group thinking flow
C17	P3	Q5	R1	because we are more imaginative	recognition of groups D quadrant
C18	P3	Q5	R2	we are logical and mathmatical	recognition of groups A quadrant
C19	P3	Q5	R3	are these right	group validation recognition
C20	P3	Q5	R4	we are much stronger in D	PLAY group strength
C21	P3	Q5	R5	Not very organized	recognition of groups B quadrant
C22	P3	Q5	R6	we are not very strong in planning	PLAY group weakness
C23	P4	Q5	R1	group think	coorelates to a group mental model
C24	P4	Q5	R2	in a specific aspect...that of creating	PLAY group strength
C25	P4	Q5	R3	seemless and elagent approach	recognition group thinking flow
C26	P4	Q5	R4	breathing in and out of each others mindsets	recognition group thinking flow
C27	P4	Q5	R5	tastes, preferences, influinces, etc, make the thought process	group composite recognition

Figure 59. Q5 primary decoding sheet 1.

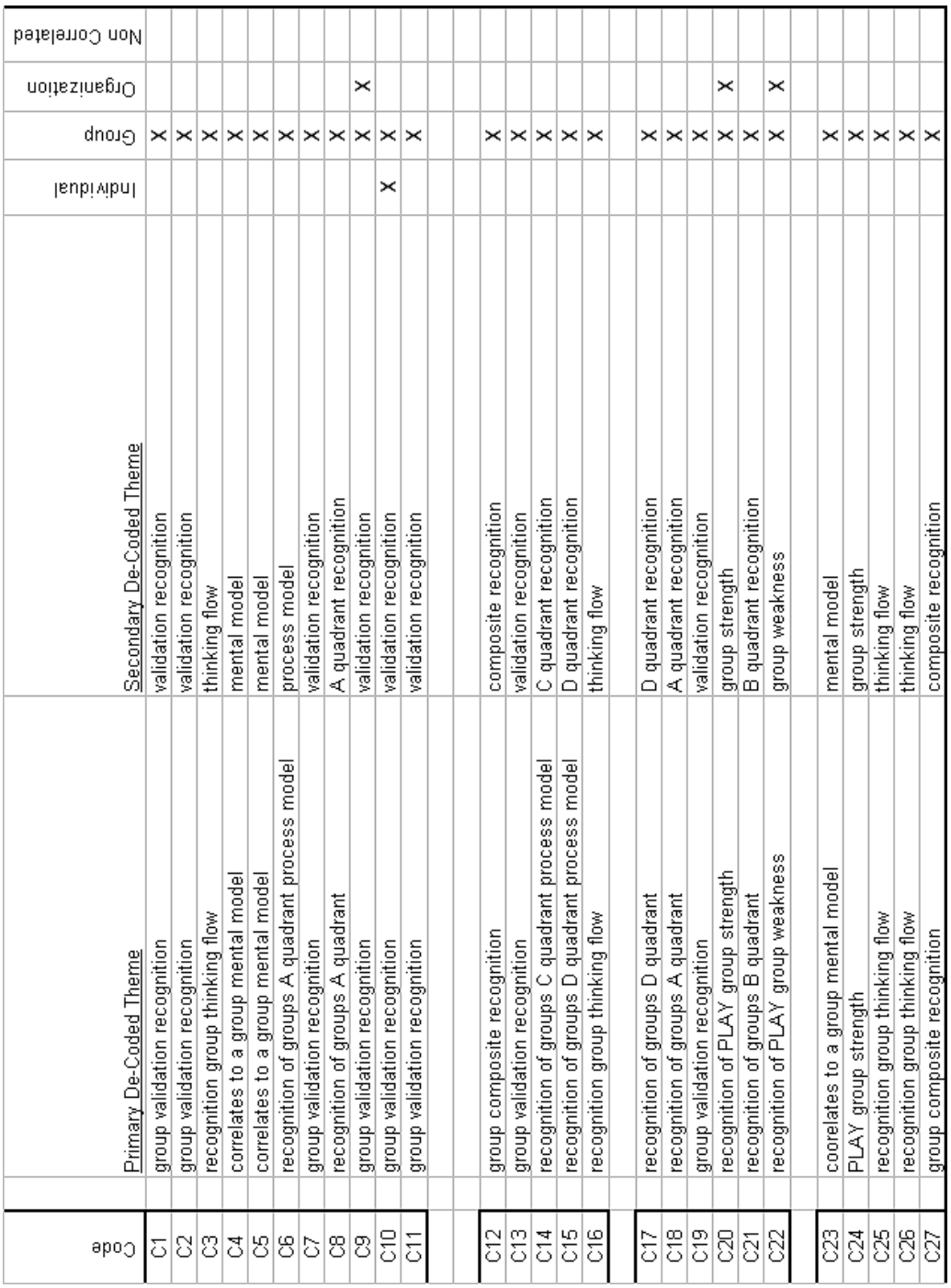
C28	P5	Q5	R1	the way that we tend to make our decisions is that we tend to visualize it	coorelates to a group mental model	
C29	P5	Q5	R2	our A quadrant is just a little bit weaker than our B quadrant	recognition of groups A quadrant	
C30	P5	Q5	R3		recognition of groups B quadrant	
C31	P5	Q5	R4	We don't know how to analize things in a way to support our plans	recognition of groups A quadrant process model	
C32	P5	Q5	R5	we don't bring that numbers piece into it very often	recognition group thinking flow	
C33	P5	Q5	R6	when we do its way down the path	recognition group thinking flow	
C34	P6	Q5	R1	the leader of the group is off the charts D	recognition of groups D quadrant	
C35	P6	Q5	R2	we obviously fit the C	recognition of groups C quadrant	
C36	P6	Q5	R3	but not because you told us, we have always known	coorelates to a group mental model	
C37	P6	Q5	R4	although I think we strive to have more A and B	recognition of groups A quadrant	
C38	P6	Q5	R5		recognition of groups B quadrant	
C39	P6	Q5	R6	if someone is to strong A or too strong B	recognition of groups A quadrant process model	
C40	P6	Q5	R7		recognition of groups B quadrant process model	
C41	P6	Q5	R8	they have to be moderate A's and B's	group composite recognition	
C42	P7	Q5	R1	We've got more D's	recognition of groups D quadrant	
C43	P7	Q5	R2	I didn't think we have a lot of A's and B's	recognition of groups A quadrant	
C44	P7	Q5	R3		recognition of groups B quadrant	
C45	P7	Q5	R4	I wont mention who the A is	recognition of groups A quadrant	
C46	P7	Q5	R5	I know I am the B	recognition of groups B quadrant	
C47	P7	Q5	R6	we think it would much smaller	group validation recognition	
C48	P8	Q5	R1	because it reflects our behavior	group composite recognition	
C49	P8	Q5	R2	through emotive means	recognition of groups C quadrant	
C50	P8	Q5	R3	programs that rely almost entirely on synthesis	recognition of groups D quadrant	
C51	P8	Q5	R4	most of our bussiness is based on conceptualizing	recognition of groups D quadrant	
C52	P8	Q5	R5	seem to want more of the green/organization	recognition of groups B quadrant	
C53	P8	Q5	R6	we need more of the blue in terms of metrics and logical support	recognition of groups A quadrant	
C54	P8	Q5	R7	in our category we might want to keep this on the low end	group composite recognition	

Figure 60. Q5 primary decoding sheet 2.



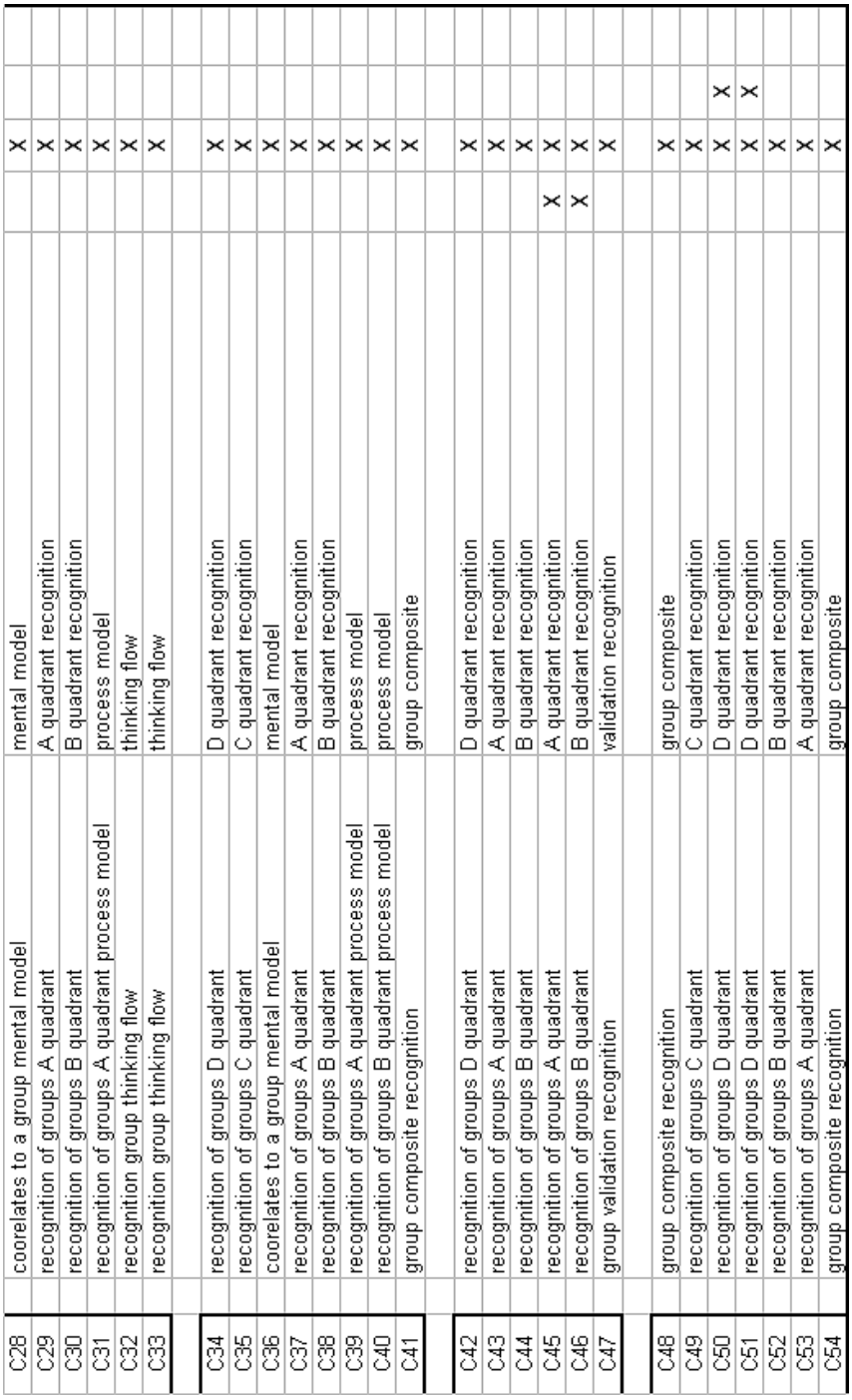
C55	P9	Q5	R1	all of the teamates were reviewed	group validation recognition
C56	P9	Q5	R2	I could see where they fit within the bariers of this arena	recognition group thinking flow
C57	P9	Q5	R3	helps me understand them allot better	group composite recognition
C58	P10	Q5	R1	well just look at the balance here	group composite recognition
C59	P10	Q5	R2	assuming that its looking at the dominant quadrant for each person	recognition group thinking flow
C60	P10	Q5	R3	I think other charactoristics of the company that skew everyone	group validation recognition
C61	P10	Q5	R4	you cant help fit into the D by just walking in the front door	recognition of groups D quadrant
C62	P10	Q5	R5	I am not surpised C is not higher	recognition of groups C quadrant
C63	P10	Q5	R6	there is a difficulty to detach emotion from just bussiness	recognition of groups C quadrant
C64	P10	Q5	R7	I am surprised its not a little higher there	group validation recognition
C65	P11	Q5	R1	I know the people that I am surrounded by all day	group composite recognition
C66	P11	Q5	R2	they are out of the box thinkers	recognition of groups D quadrant
C67	P11	Q5	R3	versus logical thinkers	recognition of groups A quadrant
C68	P11	Q5	R4	probobly with 80% accuracy	group validation recognition
C69	P11	Q5	R5	put people where they should have been	group composite recognition
C70	P12	Q5	R1	the site preference to the D quadrant	group composite recognition
C71	P12	Q5	R2	artistic and conceptualizing because that's our bussiness	recognition of groups D quadrant

Figure 61. Q5 primary decoding sheet 3.



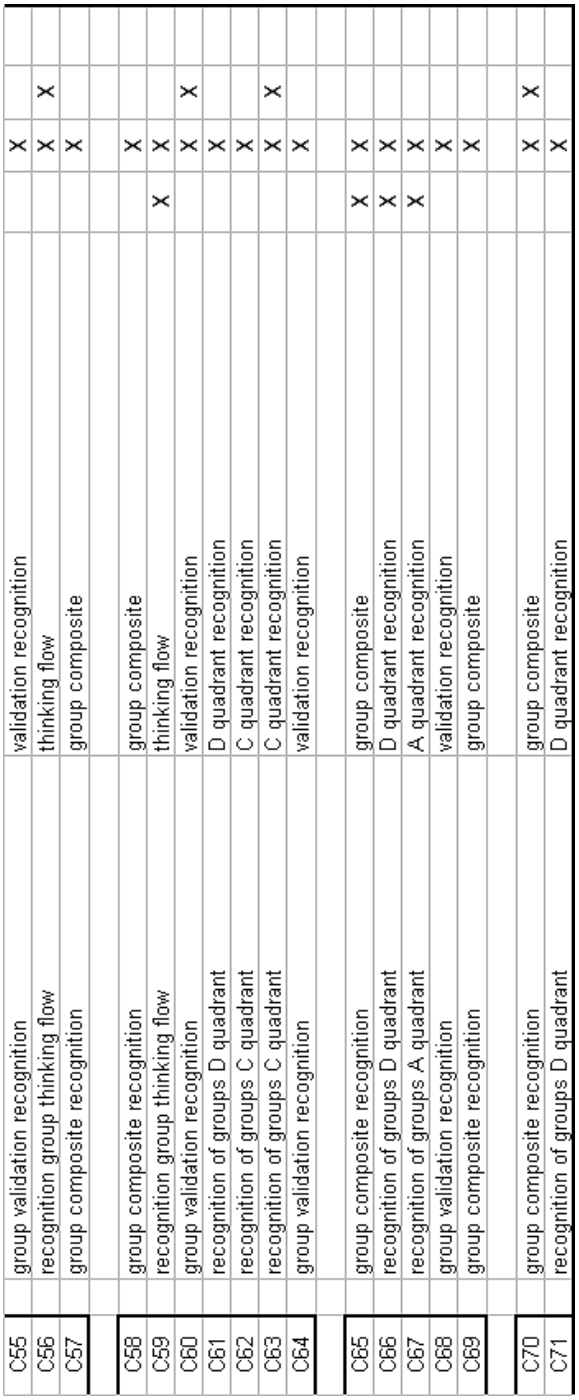
Code	Primary De-Coded Theme	Secondary De-Coded Theme	Individual	Group	Organization	Non Correlated
C1	group validation recognition	validation recognition		X		
C2	group validation recognition	validation recognition		X		
C3	recognition group thinking flow	thinking flow		X		
C4	correlates to a group mental model	mental model		X		
C5	correlates to a group mental model	mental model		X		
C6	recognition of groups A quadrant process model	process model		X		
C7	group validation recognition	validation recognition		X		
C8	recognition of groups A quadrant	A quadrant recognition		X		
C9	group validation recognition	validation recognition		X	X	
C10	group validation recognition	validation recognition	X	X		
C11	group validation recognition	validation recognition		X		
C12	group composite recognition	composite recognition		X		
C13	group validation recognition	validation recognition		X		
C14	recognition of groups C quadrant process model	C quadrant recognition		X		
C15	recognition of groups D quadrant process model	D quadrant recognition		X		
C16	recognition group thinking flow	thinking flow		X		
C17	recognition of groups D quadrant	D quadrant recognition		X		
C18	recognition of groups A quadrant	A quadrant recognition		X		
C19	group validation recognition	validation recognition		X		
C20	recognition of PLAY group strength	group strength		X	X	
C21	recognition of groups B quadrant	B quadrant recognition		X		
C22	recognition of PLAY group weakness	group weakness		X	X	
C23	coorelates to a group mental model	mental model		X		
C24	PLAY group strength	group strength		X		
C25	recognition group thinking flow	thinking flow		X		
C26	recognition group thinking flow	thinking flow		X		
C27	group composite recognition	composite recognition		X		

Figure 62. Q5 secondary decoding sheet 1.



C28	coorelates to a group mental model	mental model		X		
C29	recognition of groups A quadrant	A quadrant recognition		X		
C30	recognition of groups B quadrant	B quadrant recognition		X		
C31	recognition of groups A quadrant process model	process model		X		
C32	recognition group thinking flow	thinking flow		X		
C33	recognition group thinking flow	thinking flow		X		
C34	recognition of groups D quadrant	D quadrant recognition		X		
C35	recognition of groups C quadrant	C quadrant recognition		X		
C36	coorelates to a group mental model	mental model		X		
C37	recognition of groups A quadrant	A quadrant recognition		X		
C38	recognition of groups B quadrant	B quadrant recognition		X		
C39	recognition of groups A quadrant process model	process model		X		
C40	recognition of groups B quadrant process model	process model		X		
C41	group composite recognition	group composite		X		
C42	recognition of groups D quadrant	D quadrant recognition		X		
C43	recognition of groups A quadrant	A quadrant recognition		X		
C44	recognition of groups B quadrant	B quadrant recognition		X		
C45	recognition of groups A quadrant	A quadrant recognition	X	X		
C46	recognition of groups B quadrant	B quadrant recognition	X	X		
C47	group validation recognition	validation recognition		X		
C48	group composite recognition	group composite		X		
C49	recognition of groups C quadrant	C quadrant recognition		X		
C50	recognition of groups D quadrant	D quadrant recognition		X	X	
C51	recognition of groups D quadrant	D quadrant recognition		X	X	
C52	recognition of groups B quadrant	B quadrant recognition		X		
C53	recognition of groups A quadrant	A quadrant recognition		X		
C54	group composite recognition	group composite		X		

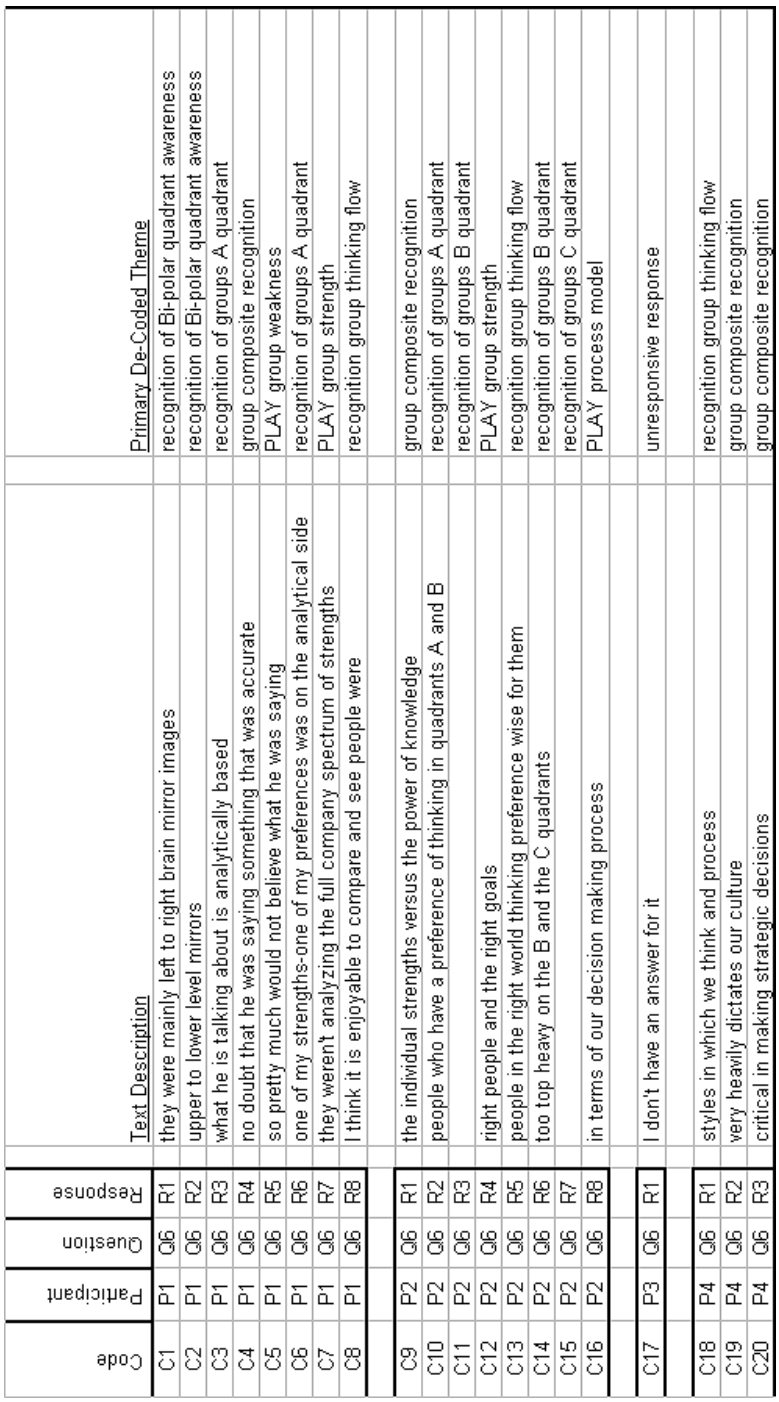
Figure 63. Q5 secondary decoding sheet 2.



C55	group validation recognition	validation recognition		X	
C56	recognition group thinking flow	thinking flow		X	X
C57	group composite recognition	group composite		X	
C58	group composite recognition	group composite		X	
C59	recognition group thinking flow	thinking flow	X	X	
C60	group validation recognition	validation recognition		X	X
C61	recognition of groups D quadrant	D quadrant recognition		X	
C62	recognition of groups C quadrant	C quadrant recognition		X	
C63	recognition of groups C quadrant	C quadrant recognition		X	X
C64	group validation recognition	validation recognition		X	
C65	group composite recognition	group composite	X	X	
C66	recognition of groups D quadrant	D quadrant recognition	X	X	
C67	recognition of groups A quadrant	A quadrant recognition	X	X	
C68	group validation recognition	validation recognition		X	
C69	group composite recognition	group composite		X	
C70	group composite recognition	group composite		X	X
C71	recognition of groups D quadrant	D quadrant recognition		X	

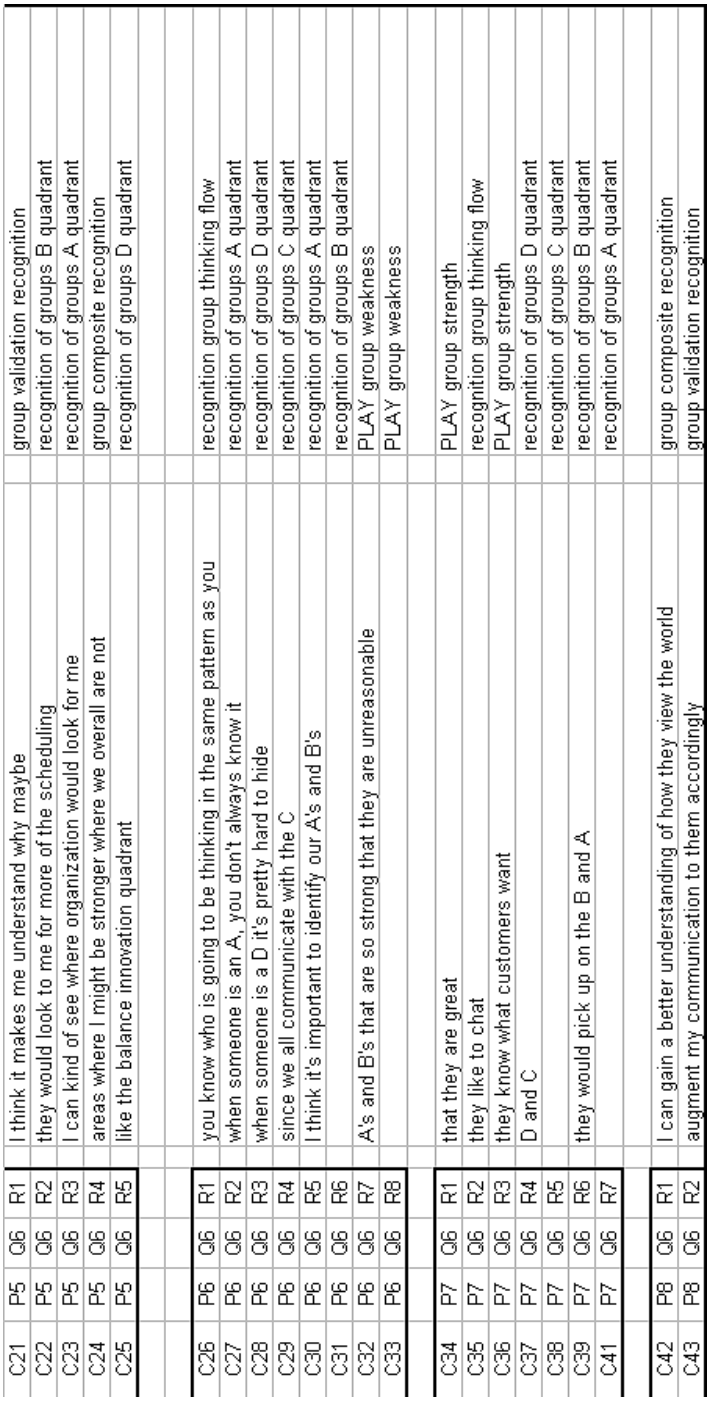
Figure 64. Q5 secondary decoding sheet 3.

Q6 Correlation Matrix



Code	Participant	Question	Response	Text Description		Primary De-Coded Theme
C1	P1	Q6	R1	they were mainly left to right brain mirror images		recognition of Bi-polar quadrant awareness
C2	P1	Q6	R2	upper to lower level mirrors		recognition of Bi-polar quadrant awareness
C3	P1	Q6	R3	what he is talking about is analytically based		recognition of groups A quadrant
C4	P1	Q6	R4	no doubt that he was saying something that was accurate		group composite recognition
C5	P1	Q6	R5	so pretty much would not believe what he was saying		PLAY group weakness
C6	P1	Q6	R6	one of my strengths-one of my preferences was on the analytical side		recognition of groups A quadrant
C7	P1	Q6	R7	they weren't analyzing the full company spectrum of strengths		PLAY group strength
C8	P1	Q6	R8	I think it is enjoyable to compare and see people were		recognition group thinking flow
C9	P2	Q6	R1	the individual strengths versus the power of knowledge		group composite recognition
C10	P2	Q6	R2	people who have a preference of thinking in quadrants A and B		recognition of groups A quadrant
C11	P2	Q6	R3			recognition of groups B quadrant
C12	P2	Q6	R4	right people and the right goals		PLAY group strength
C13	P2	Q6	R5	people in the right world thinking preference wise for them		recognition group thinking flow
C14	P2	Q6	R6	too top heavy on the B and the C quadrants		recognition of groups B quadrant
C15	P2	Q6	R7			recognition of groups C quadrant
C16	P2	Q6	R8	in terms of our decision making process		PLAY process model
C17	P3	Q6	R1	I don't have an answer for it		unresponsive response
C18	P4	Q6	R1	styles in which we think and process		recognition group thinking flow
C19	P4	Q6	R2	very heavily dictates our culture		group composite recognition
C20	P4	Q6	R3	critical in making strategic decisions		group composite recognition

Figure 65. Q6 primary decoding sheet 1.

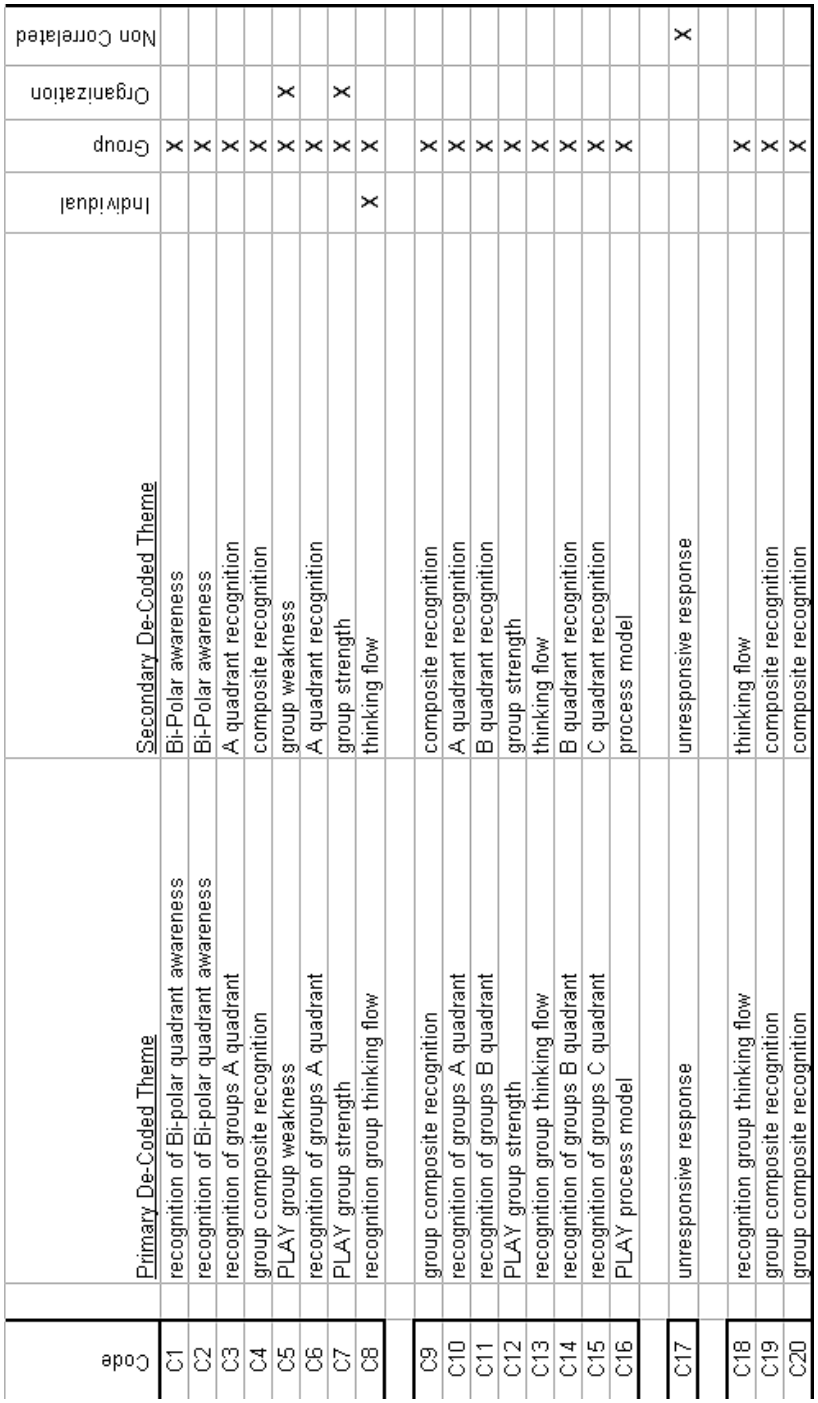


C21	P5	Q6	R1	I think it makes me understand why maybe		group validation recognition
C22	P5	Q6	R2	they would look to me for more of the scheduling		recognition of groups B quadrant
C23	P5	Q6	R3	I can kind of see where organization would look for me		recognition of groups A quadrant
C24	P5	Q6	R4	areas where I might be stronger where we overall are not		group composite recognition
C25	P5	Q6	R5	like the balance innovation quadrant		recognition of groups D quadrant
C26	P6	Q6	R1	you know who is going to be thinking in the same pattern as you		recognition group thinking flow
C27	P6	Q6	R2	when someone is an A, you don't always know it		recognition of groups A quadrant
C28	P6	Q6	R3	when someone is a D it's pretty hard to hide		recognition of groups D quadrant
C29	P6	Q6	R4	since we all communicate with the C		recognition of groups C quadrant
C30	P6	Q6	R5	I think it's important to identify our A's and B's		recognition of groups A quadrant
C31	P6	Q6	R6			recognition of groups B quadrant
C32	P6	Q6	R7	A's and B's that are so strong that they are unreasonable		PLAY group weakness
C33	P6	Q6	R8			PLAY group weakness
C34	P7	Q6	R1	that they are great		PLAY group strength
C35	P7	Q6	R2	they like to chat		recognition group thinking flow
C36	P7	Q6	R3	they know what customers want		PLAY group strength
C37	P7	Q6	R4	D and C		recognition of groups D quadrant
C38	P7	Q6	R5			recognition of groups C quadrant
C39	P7	Q6	R6	they would pick up on the B and A		recognition of groups B quadrant
C41	P7	Q6	R7			recognition of groups A quadrant
C42	P8	Q6	R1	I can gain a better understanding of how they view the world		group composite recognition
C43	P8	Q6	R2	augment my communication to them accordingly		group validation recognition

Figure 66. Q6 primary decoding sheet 2.

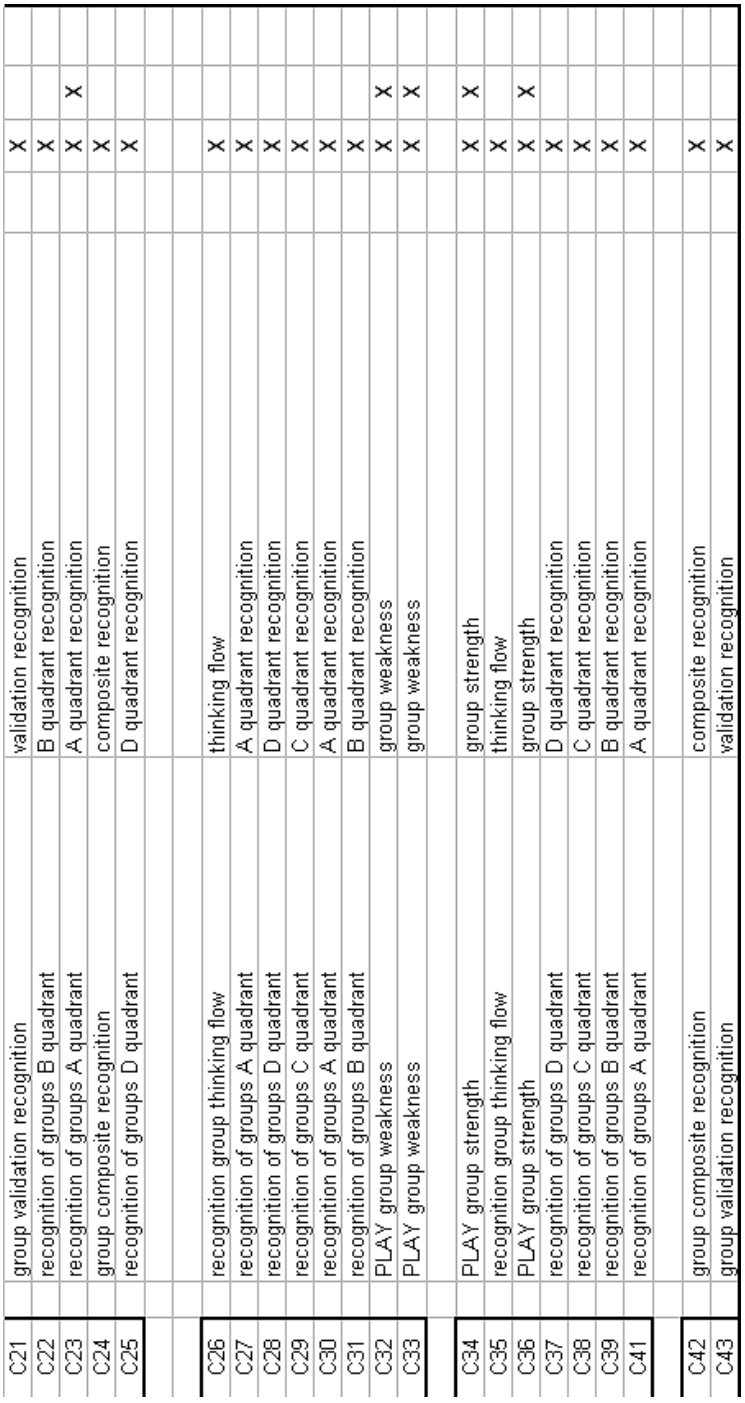
C44	P9	Q6	R1	people who are in the D quadrant who do not think that way		recognition of groups D quadrant
C45	P9	Q6	R2	It helps me understand them		recognition group thinking flow
C46	P9	Q6	R3	not to be as frustrated with them		PLAY group weakness
C47	P9	Q6	R4	Who are in the A or B quadrants		recognition of groups A quadrant
C48	P9	Q6	R5			recognition of groups B quadrant
C49	P10	Q6	R1	in terms of partnership and the way we operate there		group composite recognition
C50	P10	Q6	R2	as one group despite what everyone's primary function is		recognition group thinking flow
C51	P10	Q6	R3	it is always impossible to have a perfect partnership		PLAY group weakness
C52	P10	Q6	R4	everybody is going to think in and hopefully a synchronized way		recognition group thinking flow
C53	P10	Q6	R5	somebody that really skews in D quadrant		recognition of groups D quadrant
C54	P10	Q6	R6	how can you balance that in quadrant B		recognition of groups B quadrant
C55	P10	Q6	R7	in recognizing that one is not stronger than the other		PLAY group strength
C56	P10	Q6	R8	so it is good to know who goes where		recognition group thinking flow
C57	P10	Q6	R9	how can we start the partners so they compliment one another		recognition group thinking flow
C58	P11	Q6	R1	financial person was a very much of an out of the box thinker		group composite recognition
C66	P11	Q5	R2	how I deal with someone		recognition of Bi-polar quadrant awareness
C67	P11	Q5	R3	but certantly knowing personality preferences		recognition group thinking flow
C68	P11	Q5	R4	strengths and weaknesses		PLAY group strength
C69	P11	Q5	R5	I think it helps		group validation recognition
C70	P12	Q6	R1	knowing what resources we have		PLAY group strength
C71	P12	Q6	R2	whether we are utilizing skills		group composite recognition
C72	P12	Q6	R3	If we did not have any A and B		recognition of groups A quadrant
C73	P12	Q6	R4			recognition of groups B quadrant

Figure 67. Q6 primary decoding sheet 3.



Code	Primary De-Coded Theme	Secondary De-Coded Theme	Individual	Group	Organization	Non Correlated
C1	recognition of Bi-polar quadrant awareness	Bi-Polar awareness		X		
C2	recognition of Bi-polar quadrant awareness	Bi-Polar awareness		X		
C3	recognition of groups A quadrant	A quadrant recognition		X		
C4	group composite recognition	composite recognition		X		
C5	PLAY group weakness	group weakness		X	X	
C6	recognition of groups A quadrant	A quadrant recognition		X		
C7	PLAY group strength	group strength		X	X	
C8	recognition group thinking flow	thinking flow	X	X		
C9	group composite recognition	composite recognition		X		
C10	recognition of groups A quadrant	A quadrant recognition		X		
C11	recognition of groups B quadrant	B quadrant recognition		X		
C12	PLAY group strength	group strength		X		
C13	recognition group thinking flow	thinking flow		X		
C14	recognition of groups B quadrant	B quadrant recognition		X		
C15	recognition of groups C quadrant	C quadrant recognition		X		
C16	PLAY process model	process model		X		
C17	unresponsive response	unresponsive response				X
C18	recognition group thinking flow	thinking flow		X		
C19	group composite recognition	composite recognition		X		
C20	group composite recognition	composite recognition		X		

Figure 68. Q6 secondary decoding sheet 1.



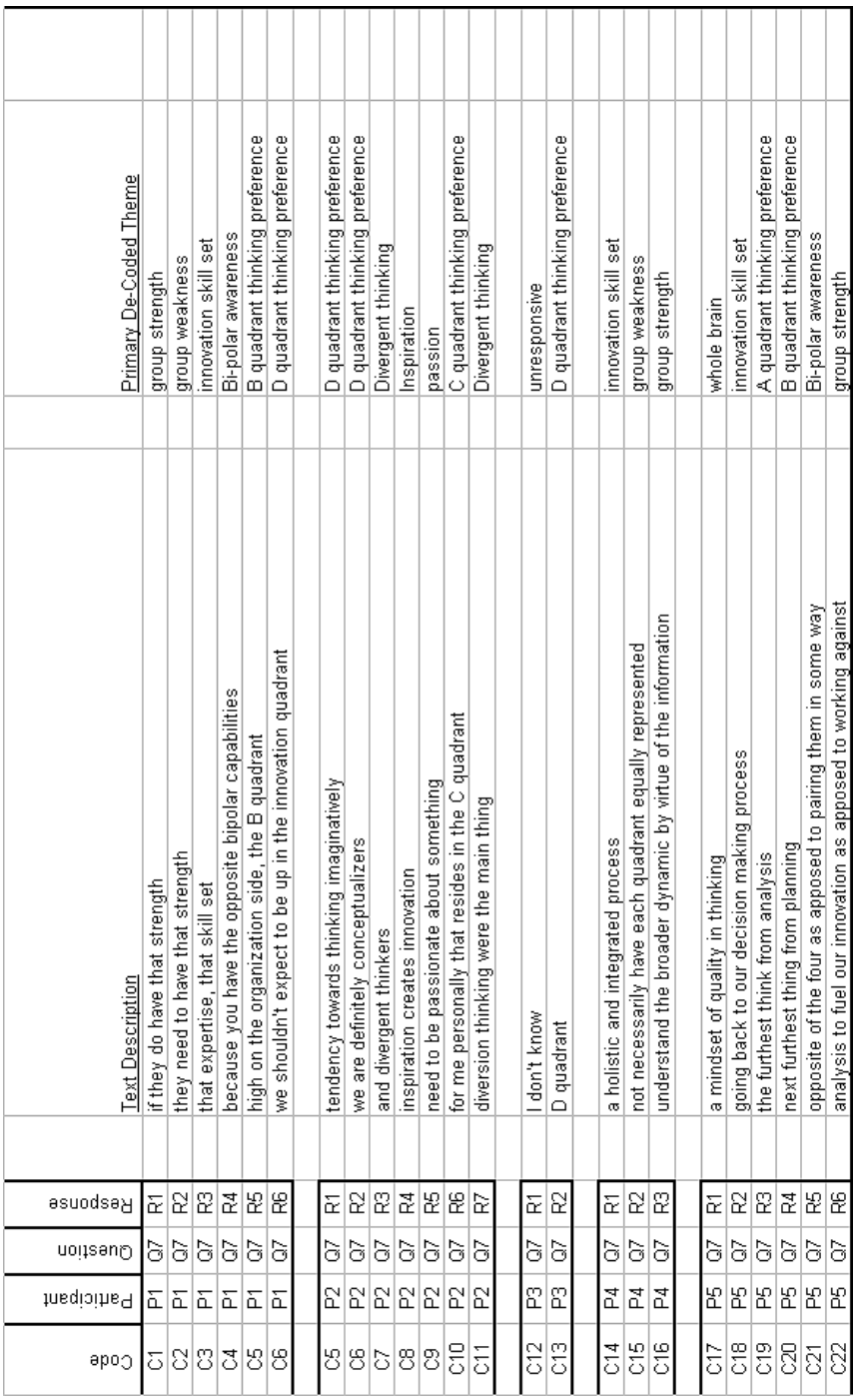
C21	group validation recognition	validation recognition		X	
C22	recognition of groups B quadrant	B quadrant recognition		X	
C23	recognition of groups A quadrant	A quadrant recognition		X	X
C24	group composite recognition	composite recognition		X	
C25	recognition of groups D quadrant	D quadrant recognition		X	
C26	recognition group thinking flow	thinking flow		X	
C27	recognition of groups A quadrant	A quadrant recognition		X	
C28	recognition of groups D quadrant	D quadrant recognition		X	
C29	recognition of groups C quadrant	C quadrant recognition		X	
C30	recognition of groups A quadrant	A quadrant recognition		X	
C31	recognition of groups B quadrant	B quadrant recognition		X	
C32	PLAY group weakness	group weakness		X	X
C33	PLAY group weakness	group weakness		X	X
C34	PLAY group strength	group strength		X	X
C35	recognition group thinking flow	thinking flow		X	
C36	PLAY group strength	group strength		X	X
C37	recognition of groups D quadrant	D quadrant recognition		X	
C38	recognition of groups C quadrant	C quadrant recognition		X	
C39	recognition of groups B quadrant	B quadrant recognition		X	
C41	recognition of groups A quadrant	A quadrant recognition		X	
C42	group composite recognition	composite recognition		X	
C43	group validation recognition	validation recognition		X	

Figure 69. Q6 secondary decoding sheet 2.

C44	recognition of groups D quadrant	D quadrant recognition		X		
C45	recognition group thinking flow	thinking flow		X		
C46	PLAY group weakness	group weakness		X	X	
C47	recognition of groups A quadrant	A quadrant recognition		X		
C48	recognition of groups B quadrant	B quadrant recognition		X		
C49	group composite recognition	composite recognition		X		
C50	recognition group thinking flow	thinking flow		X		
C51	PLAY group weakness	group weakness		X	X	
C52	recognition group thinking flow	thinking flow		X		
C53	recognition of groups D quadrant	D quadrant recognition		X		
C54	recognition of groups B quadrant	B quadrant recognition		X		
C55	PLAY group strength	group strength		X	X	
C56	recognition group thinking flow	thinking flow		X		
C57	recognition group thinking flow	thinking flow		X		
C58	group composite recognition	composite recognition		X		
C66	recognition of Bi-polar quadrant awareness	Bi-Polar awareness		X		
C67	recognition group thinking flow	thinking flow		X		
C68	PLAY group strength	group strength		X	X	
C69	group validation recognition	validation recognition		X		
C70	PLAY group strength	group strength		X	X	
C71	group composite recognition	composite recognition		X		
C72	recognition of groups A quadrant	A quadrant recognition		X		
C73	recognition of groups B quadrant	B quadrant recognition		X		

Figure 70. Q6 secondary decoding sheet 3.

Q7 Correlation Matrix

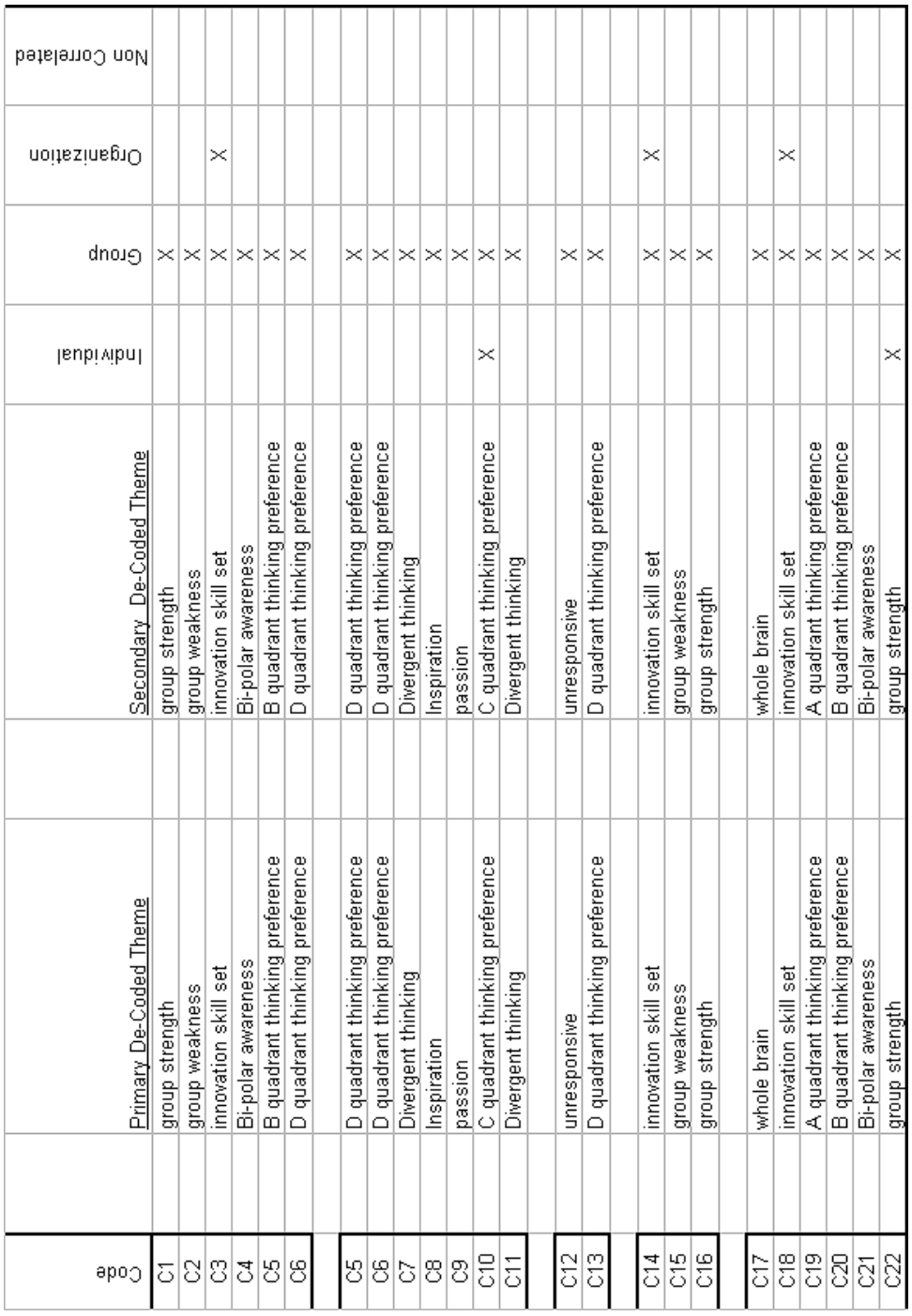


Code	Participant	Question	Response		Text Description		Primary De-Coded Theme
C1	P1	Q7	R1		if they do have that strength		group strength
C2	P1	Q7	R2		they need to have that strength		group weakness
C3	P1	Q7	R3		that expertise, that skill set		innovation skill set
C4	P1	Q7	R4		because you have the opposite bipolar capabilities		Bi-polar awareness
C5	P1	Q7	R5		high on the organization side, the B quadrant		B quadrant thinking preference
C6	P1	Q7	R6		we shouldn't expect to be up in the innovation quadrant		D quadrant thinking preference
C5	P2	Q7	R1		tendency towards thinking imaginatively		D quadrant thinking preference
C6	P2	Q7	R2		we are definitely conceptualizers		D quadrant thinking preference
C7	P2	Q7	R3		and divergent thinkers		Divergent thinking
C8	P2	Q7	R4		inspiration creates innovation		Inspiration
C9	P2	Q7	R5		need to be passionate about something		passion
C10	P2	Q7	R6		for me personally that resides in the C quadrant		C quadrant thinking preference
C11	P2	Q7	R7		diversion thinking were the main thing		Divergent thinking
C12	P3	Q7	R1		I don't know		unresponsive
C13	P3	Q7	R2		D quadrant		D quadrant thinking preference
C14	P4	Q7	R1		a holistic and integrated process		innovation skill set
C15	P4	Q7	R2		not necessarily have each quadrant equally represented		group weakness
C16	P4	Q7	R3		understand the broader dynamic by virtue of the information		group strength
C17	P5	Q7	R1		a mindset of quality in thinking		whole brain
C18	P5	Q7	R2		going back to our decision making process		innovation skill set
C19	P5	Q7	R3		the furthest think from analysis		A quadrant thinking preference
C20	P5	Q7	R4		next furthest thing from planning		B quadrant thinking preference
C21	P5	Q7	R5		opposite of the four as apposed to pairing them in some way		Bi-polar awareness
C22	P5	Q7	R6		analysis to fuel our innovation as apposed to working against		group strength

Figure 71. Q7 primary decoding sheet 1.

C23	P6	Q7	R1	first of all we are starting with the D quadrant		D quadrant thinking preference
C24	P6	Q7	R2	strong creativity thought patterns		group strength
C25	P6	Q7	R3	ability to synthesize information		D quadrant thinking preference
C26	P6	Q7	R4	see things in the big picture		mental model
C27	P6	Q7	R5	capacity in all of the quadrants		whole brain
C28	P6	Q7	R6	balance to turn creativity into something tangible		innovation skill set
C29	P7	Q7	R1	that would be a great D question		D quadrant thinking preference
C30	P7	Q7	R2	not a B question		B quadrant thinking preference
C31	P7	Q7	R3	Not many B's and A's		B quadrant thinking preference
C32	P7	Q7	R4			A quadrant thinking preference
C33	P8	Q7	R1	that our POV		mental model
C34	P8	Q7	R2	innovation is more intuitive		group strength
C35	P8	Q7	R3	and creative		D quadrant thinking preference
C36	P9	Q7	R1	high sense of creativity		inspiration
C37	P9	Q7	R2	people being in the B quadrant		B quadrant thinking preference
C38	P9	Q7	R3	use your imagination to come up with goals, ideas		D quadrant thinking preference
C39	P9	Q7	R4	change companies, move them forward		group strength
C40	P10	Q7	R1	characteristics listed in D		D quadrant thinking preference
C41	P10	Q7	R2	first imaginative		innovation skill set
C42	P10	Q7	R3	last conceptualizer		D quadrant thinking preference
C43	P10	Q7	R4	artistic		D quadrant thinking preference
C44	P10	Q7	R5	synthesizer is interesting because it looks at sort of adapting existing things		D quadrant thinking preference
C45	P11	Q7	R1	certantly D just for the conceptual nature of that		D quadrant thinking preference
C46	P11	Q7	R2	is not to strained by anything		innovation skill set
C47	P11	Q7	R3	no constraints		innovation skill set
C48	P11	Q7	R4	no rules		innovation skill set
C49	P11	Q7	R5	no boundaries		innovation skill set
C50	P11	Q7	R6	I can be unconstrained. Five minutes later I can be and its blown		innovation skill set
C51	P12	Q7	R1	Well it is aligned with the D quadrant		D quadrant thinking preference
C52	P12	Q7	R2	imagination		innovation skill set
C53	P12	Q7	R3	artistic		innovation skill set
C54	P12	Q7	R4	conceptualization		D quadrant thinking preference
C55	P12	Q7	R1	strongest qualities involved in innovation		innovation skill set

Figure 72. Q7 primary decoding sheet 2.



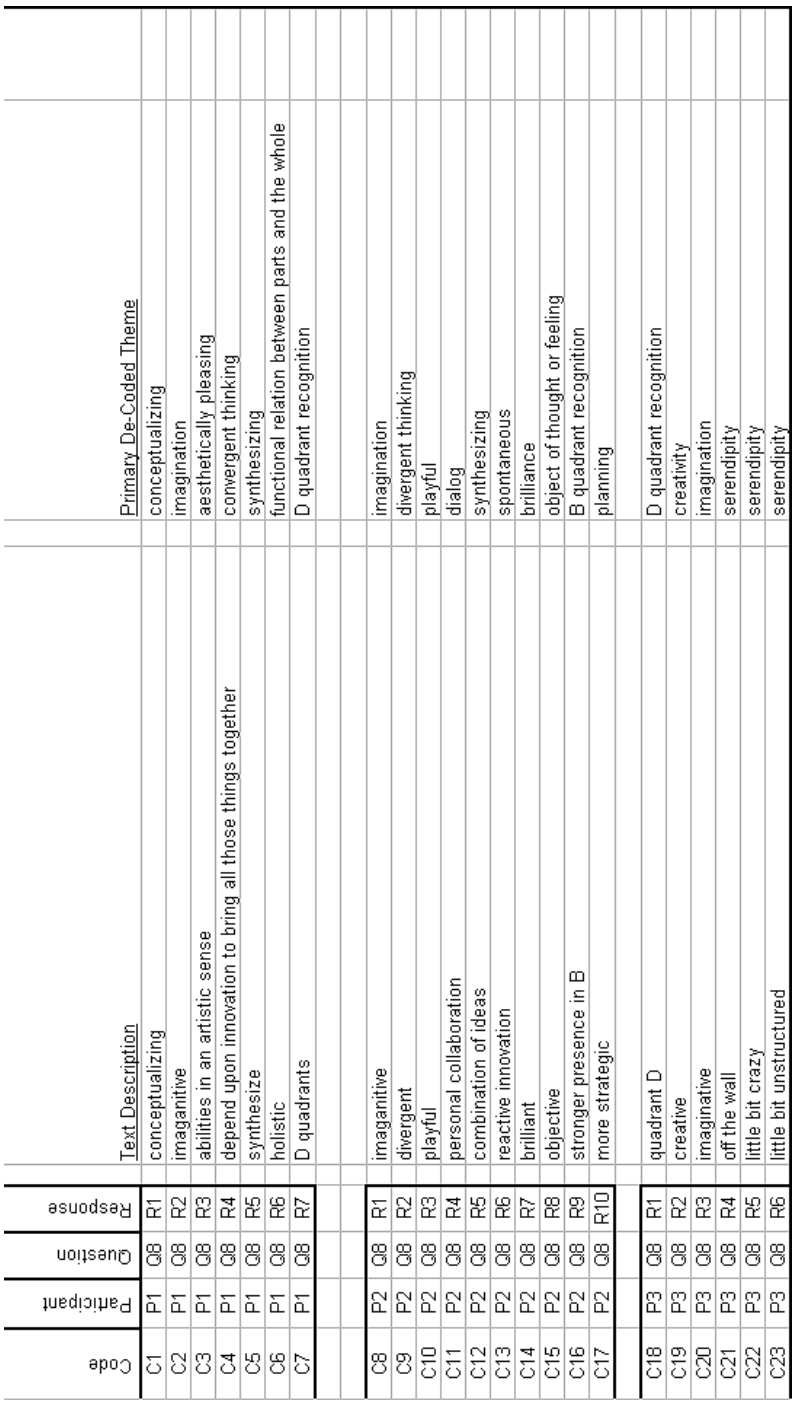
Code	Primary De-Coded Theme			Secondary De-Coded Theme	Individual	Group	Organization	Non Correlated
C1	group strength			group strength		X		
C2	group weakness			group weakness		X		
C3	innovation skill set			innovation skill set		X	X	
C4	Bi-polar awareness			Bi-polar awareness		X		
C5	B quadrant thinking preference			B quadrant thinking preference		X		
C6	D quadrant thinking preference			D quadrant thinking preference		X		
C5	D quadrant thinking preference			D quadrant thinking preference		X		
C6	D quadrant thinking preference			D quadrant thinking preference		X		
C7	Divergent thinking			Divergent thinking		X		
C8	Inspiration			Inspiration		X		
C9	passion			passion		X		
C10	C quadrant thinking preference			C quadrant thinking preference	X	X		
C11	Divergent thinking			Divergent thinking		X		
C12	unresponsive			unresponsive		X		
C13	D quadrant thinking preference			D quadrant thinking preference		X		
C14	innovation skill set			innovation skill set		X	X	
C15	group weakness			group weakness		X		
C16	group strength			group strength		X		
C17	whole brain			whole brain		X		
C18	innovation skill set			innovation skill set		X	X	
C19	A quadrant thinking preference			A quadrant thinking preference		X		
C20	B quadrant thinking preference			B quadrant thinking preference		X		
C21	Bi-polar awareness			Bi-polar awareness		X		
C22	group strength			group strength	X	X		

Figure 73. Q7 secondary decoding sheet 1.

C23		D quadrant thinking preference		D quadrant thinking preference		X		
C24		group strength		group strength		X		
C25		D quadrant thinking preference		D quadrant thinking preference		X		
C26		mental model		mental model		X		
C27		whole brain		whole brain		X		
C28		innovation skill set		innovation skill set		X	X	
C29		D quadrant thinking preference		D quadrant thinking preference	X	X		
C30		B quadrant thinking preference		B quadrant thinking preference	X	X		
C31		B quadrant thinking preference		B quadrant thinking preference	X	X		
C32		A quadrant thinking preference		A quadrant thinking preference	X	X		
C33		mental model		mental model		X	X	
C34		group strength		group strength		X		
C35		D quadrant thinking preference		D quadrant thinking preference		X		
C36		inspiration		inspiration		X		
C37		B quadrant thinking preference		B quadrant thinking preference		X		
C38		D quadrant thinking preference		D quadrant thinking preference		X		
C39		group strength		group strength		X	X	
C40		D quadrant thinking preference		D quadrant thinking preference		X		
C41		innovation skill set		innovation skill set		X		
C42		D quadrant thinking preference		D quadrant thinking preference		X		
C43		D quadrant thinking preference		D quadrant thinking preference		X		
C44		D quadrant thinking preference		D quadrant thinking preference		X		
C45		D quadrant thinking preference		D quadrant thinking preference		X		
C46		innovation skill set		innovation skill set		X		
C47		innovation skill set		innovation skill set		X		
C48		innovation skill set		innovation skill set		X		
C49		innovation skill set		innovation skill set		X		
C50		innovation skill set		innovation skill set	X	X		
C51		D quadrant thinking preference		D quadrant thinking preference		X		
C52		innovation skill set		innovation skill set		X		
C53		innovation skill set		innovation skill set		X		
C54		D quadrant thinking preference		D quadrant thinking preference		X		
C55		innovation skill set		innovation skill set		X		

Figure 74. Q7 secondary decoding sheet 2.

Q8 Correlation Matrix

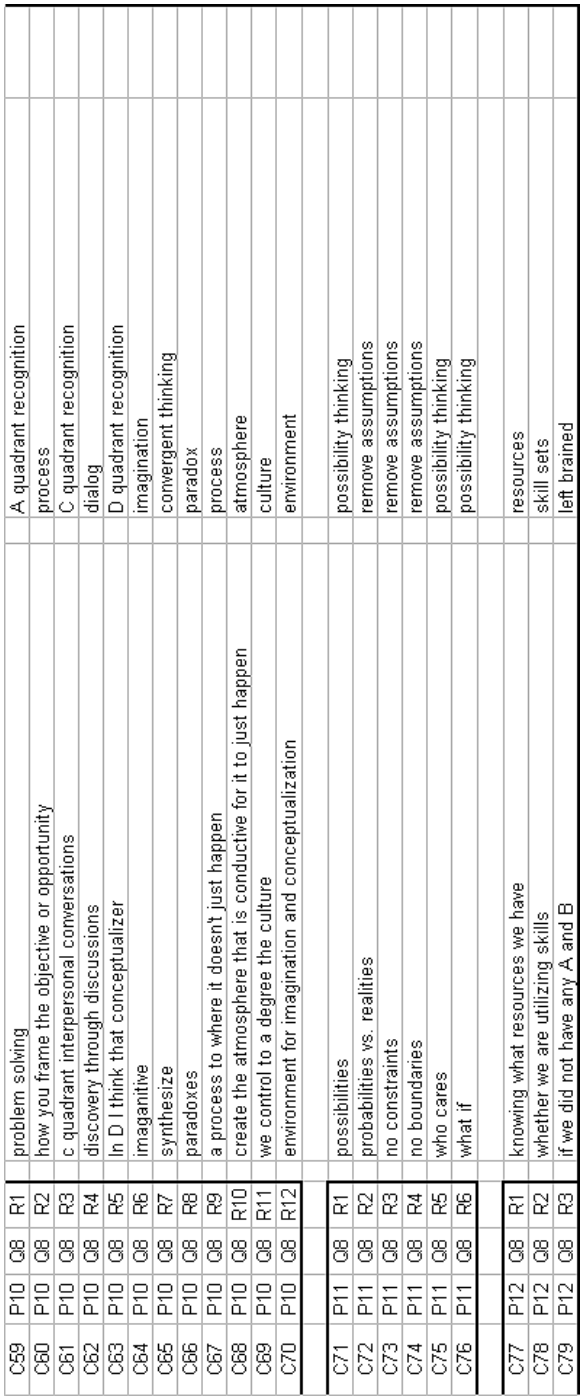


Code	Participant	Question	Response	Text Description	Primary De-Coded Theme
C1	P1	Q8	R1	conceptualizing	conceptualizing
C2	P1	Q8	R2	imaganitive	imagination
C3	P1	Q8	R3	abilities in an artistic sense	aesthetically pleasing
C4	P1	Q8	R4	depend upon innovation to bring all those things together	convergent thinking
C5	P1	Q8	R5	synthesize	synthesizing
C6	P1	Q8	R6	holistic	functional relation between parts and the whole
C7	P1	Q8	R7	D quadrants	D quadrant recognition
C8	P2	Q8	R1	imaganitive	imagination
C9	P2	Q8	R2	divergent	divergent thinking
C10	P2	Q8	R3	playful	playful
C11	P2	Q8	R4	personal collaboration	dialog
C12	P2	Q8	R5	combination of ideas	synthesizing
C13	P2	Q8	R6	reactive innovation	spontaneous
C14	P2	Q8	R7	brilliant	brilliance
C15	P2	Q8	R8	objective	object of thought or feeling
C16	P2	Q8	R9	stronger presence in B	B quadrant recognition
C17	P2	Q8	R10	more strategic	planning
C18	P3	Q8	R1	quadrant D	D quadrant recognition
C19	P3	Q8	R2	creative	creativity
C20	P3	Q8	R3	imaginative	imagination
C21	P3	Q8	R4	off the wall	serendipity
C22	P3	Q8	R5	little bit crazy	serendipity
C23	P3	Q8	R6	little bit unstructured	serendipity

Figure 75. Q8 primary decoding sheet 1.

C24	P4	Q8	R1	the D quadrant	D quadrant recognition
C25	P4	Q8	R2	based on quantitative results	Awareness
C26	P4	Q8	R3	leans on outside support	open to change
C27	P4	Q8	R4	partners who have heavy influinces in Quadrant A and B	A quadrant recognition
C28	P4	Q8	R5		B quadrant recognition
C29	P5	Q8	R1	D quadrant	D quadrant recognition
C30	P5	Q8	R2	imaginative	imagination
C31	P5	Q8	R3	exciting	excitement
C32	P5	Q8	R4	flow of decision making	convergent thinking
C33	P5	Q8	R5	metrically new	planning
C34	P5	Q8	R6	come out of a plan	planning
C35	P6	Q8	R1	all of the A, B, C, and D quadrants working together led thru D	systems thinking
C36	P6	Q8	R2	innovation the way we need it, thru A	A quadrant recognition
C37	P6	Q8	R3	we need a very strong lead in the D	D quadrant recognition
C36	P7	Q8	R1	D	D quadrant recognition
C37	P7	Q8	R2	creative side	creativity
C38	P7	Q8	R3	creativity	creativity
C48	P8	Q8	R1	systems thinking	systems thinking
C49	P8	Q8	R2	conceptualizing	D quadrant recognition
C50	P8	Q8	R3	reacting	spontaneous
C51	P8	Q8	R4	synthesizing	synthesizing
C52	P9	Q8	R1	conceptualizer	D quadrant recognition
C53	P9	Q8	R2	being imaginative	imagination
C54	P9	Q8	R3	being artistic	aesthetically pleasing
C55	P9	Q8	R4	being open to ideas	open to change
C56	P9	Q8	R5	coming up with different ideas	divergent thinking
C57	P9	Q8	R6	looking at things that are around them	awareness
C58	P9	Q8	R7	looking for ways in which to change it	open to change

Figure 76. Q8 primary decoding sheet 2.



C59	P10	Q8	R1	problem solving	A quadrant recognition
C60	P10	Q8	R2	how you frame the objective or opportunity	process
C61	P10	Q8	R3	c quadrant interpersonal conversations	C quadrant recognition
C62	P10	Q8	R4	discovery through discussions	dialog
C63	P10	Q8	R5	In D I think that conceptualizer	D quadrant recognition
C64	P10	Q8	R6	imaganitive	imagination
C65	P10	Q8	R7	synthesize	convergent thinking
C66	P10	Q8	R8	paradoxes	paradox
C67	P10	Q8	R9	a process to where it doesn't just happen	process
C68	P10	Q8	R10	create the atmosphere that is conductive for it to just happen	atmosphere
C69	P10	Q8	R11	we control to a degree the culture	culture
C70	P10	Q8	R12	environment for imagination and conceptualization	environment
C71	P11	Q8	R1	possibilities	possibility thinking
C72	P11	Q8	R2	probabilities vs. realities	remove assumptions
C73	P11	Q8	R3	no constraints	remove assumptions
C74	P11	Q8	R4	no boundaries	remove assumptions
C75	P11	Q8	R5	who cares	possibility thinking
C76	P11	Q8	R6	what if	possibility thinking
C77	P12	Q8	R1	knowing what resources we have	resources
C78	P12	Q8	R2	whether we are utilizing skills	skill sets
C79	P12	Q8	R3	if we did not have any A and B	left brained

Figure 77. Q8 primary decoding sheet 3.

Code	Primary De-Coded Theme	Secondary De-Coded Theme	Individual	Group	Organization	Non Correlated
C1	conceptualizing	D quadrant recognition		X		
C2	imagination	imagination	X	X		
C3	aesthetically pleasing	positive energy		X		
C4	convergent thinking	convergent thinking		X		
C5	synthesizing	convergent thinking		X		
C6	functional relation between parts and the whole	systems thinking		X	X	
C7	D quadrant recognition	D quadrant recognition		X		
C8	imagination	imagination	X	X		
C9	divergent thinking	divergent thinking		X		
C10	playful	positive energy		X		
C11	dialog	communication	X	X	X	
C12	synthesizing	convergent thinking		X		
C13	spontaneous	positive energy		X		
C14	brilliance	possibility thinking		X	X	
C15	object of thought or feeling	positive energy		X		
C16	B quadrant recognition	B quadrant recognition		X		
C17	planning	B quadrant recognition		X		
C18	D quadrant recognition	D quadrant recognition		X		
C19	creativity	positive energy		X		
C20	imagination	imagination	X	X		
C21	serendipity	serendipity		X		
C22	serendipity	serendipity		X		
C23	serendipity	serendipity		X		

Figure 78. Q8 secondary decoding sheet 1.

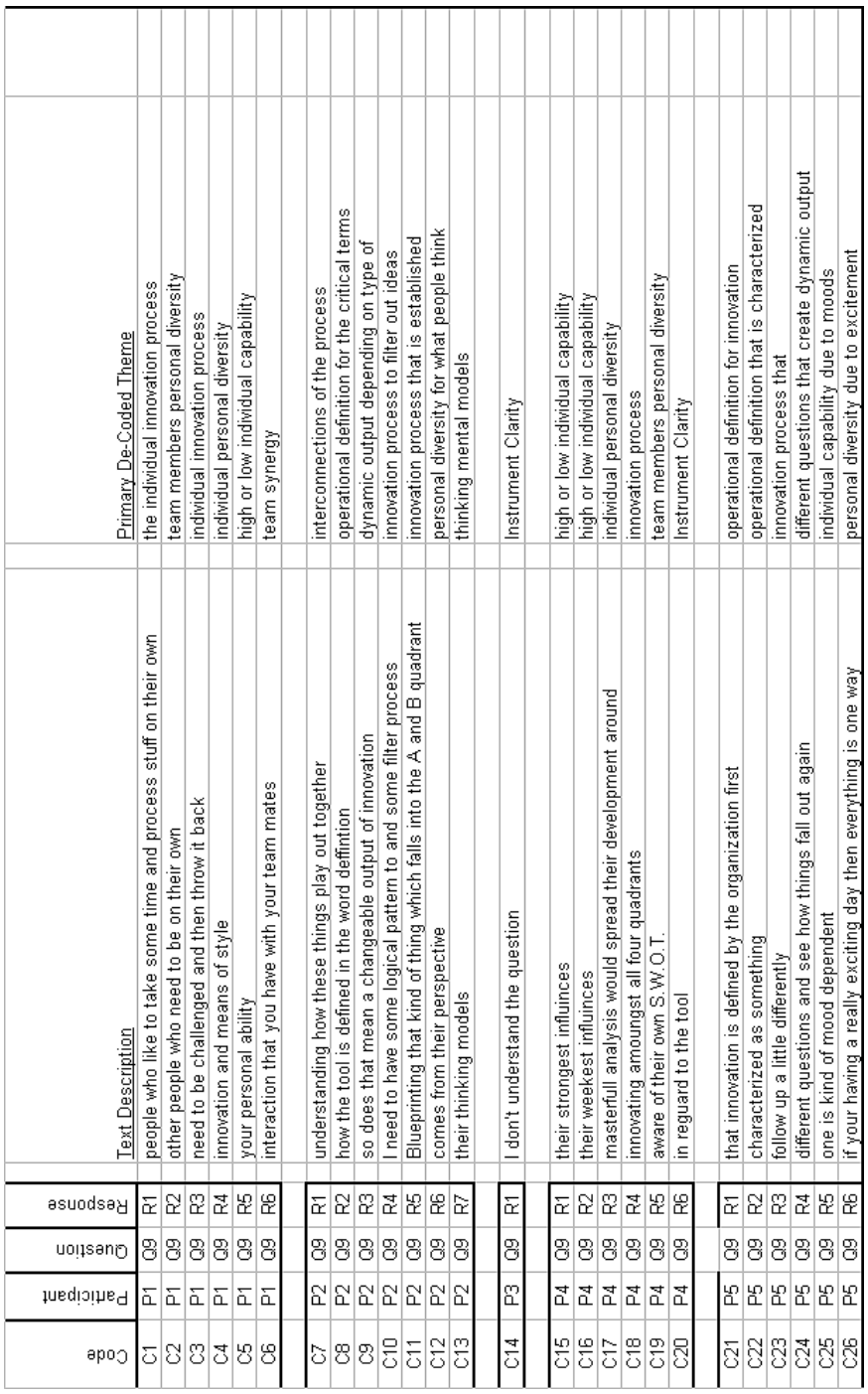
C24	D quadrant recognition	D quadrant recognition		X	
C25	Awareness	possibility thinking		X	X
C26	open to change	communication		X	X
C27	A quadrant recognition	A quadrant recognition		X	
C28	B quadrant recognition	B quadrant recognition		X	
C29	D quadrant recognition	D quadrant recognition		X	
C30	imagination	imagination	X	X	
C31	excitement	positive energy		X	
C32	convergent thinking	convergent thinking		X	
C33	planning	B quadrant recognition		X	
C34	planning	B quadrant recognition		X	
C35	systems thinking	systems thinking		X	X
C36	A quadrant recognition	A quadrant recognition		X	
C37	D quadrant recognition	D quadrant recognition		X	
C36	D quadrant recognition	D quadrant recognition		X	
C37	creativity	positive energy		X	
C38	creativity	positive energy		X	
C48	systems thinking	systems thinking		X	X
C49	D quadrant recognition	D quadrant recognition		X	
C50	spontaneous	positive energy		X	
C51	synthesizing	convergent thinking		X	
C52	D quadrant recognition	D quadrant recognition		X	
C53	imagination	imagination	X	X	
C54	aesthetically pleasing	positive energy		X	
C55	open to change	possibility thinking		X	X
C56	divergent thinking	divergent thinking		X	
C57	awareness	possibility thinking		X	X
C58	open to change	communication	X	X	X

Figure 79. Q8 secondary decoding sheet 2.

C59	A quadrant recognition	A quadrant recognition		X			
C60	process	systems thinking		X	X		
C61	C quadrant recognition	C quadrant recognition		X			
C62	communication	communication	X	X	X		
C63	D quadrant recognition	D quadrant recognition		X			
C64	imagination	imagination	X	X			
C65	convergent thinking	convergent thinking		X	X		
C66	paradox	paradigm shift	X	X			
C67	process	systems thinking		X	X		
C68	atmosphere	possibility thinking		X	X		
C69	culture	shared learning		X	X		
C70	environment	shared learning		X	X		
C71	possibility thinking	possibility thinking		X	X		
C72	remove assumptions	paradigm shift	X	X	X		
C73	remove assumptions	paradigm shift	X	X	X		
C74	remove assumptions	paradigm shift	X	X	X		
C75	possibility thinking	possibility thinking		X	X		
C76	possibility thinking	possibility thinking		X	X		
C77	resources	shared learning		X	X		
C78	skill sets	systems thinking		X			
C79	left brained	A quadrant recognition		X			

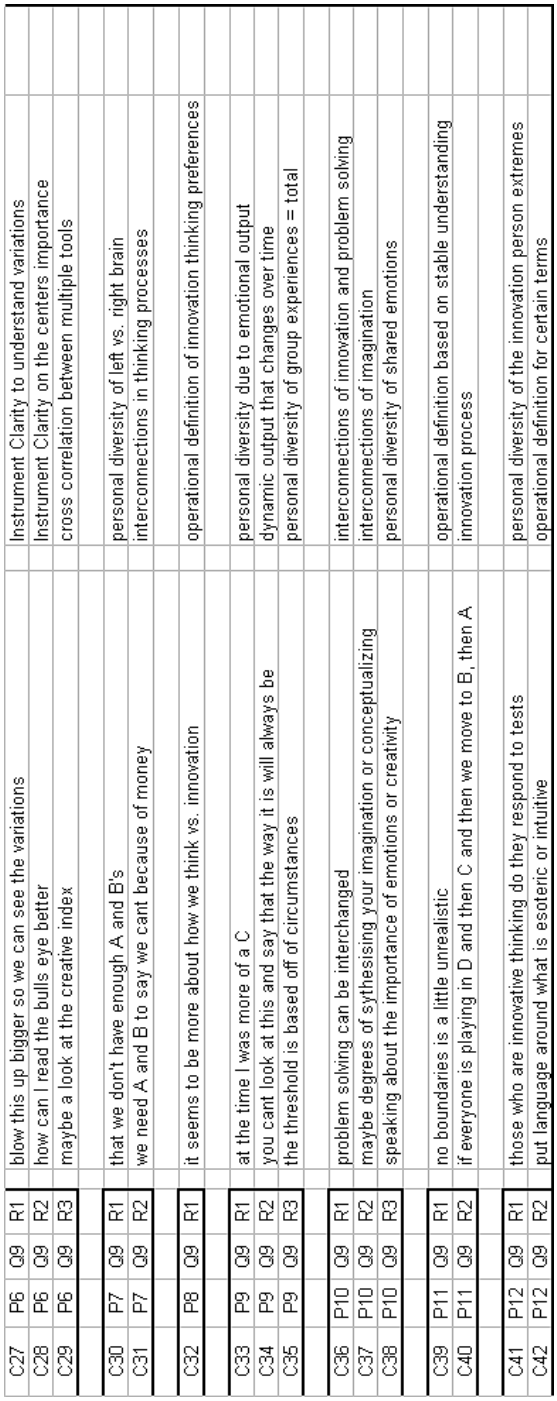
Figure 80. Q8 secondary decoding sheet 3.

Q9 Correlation Matrix



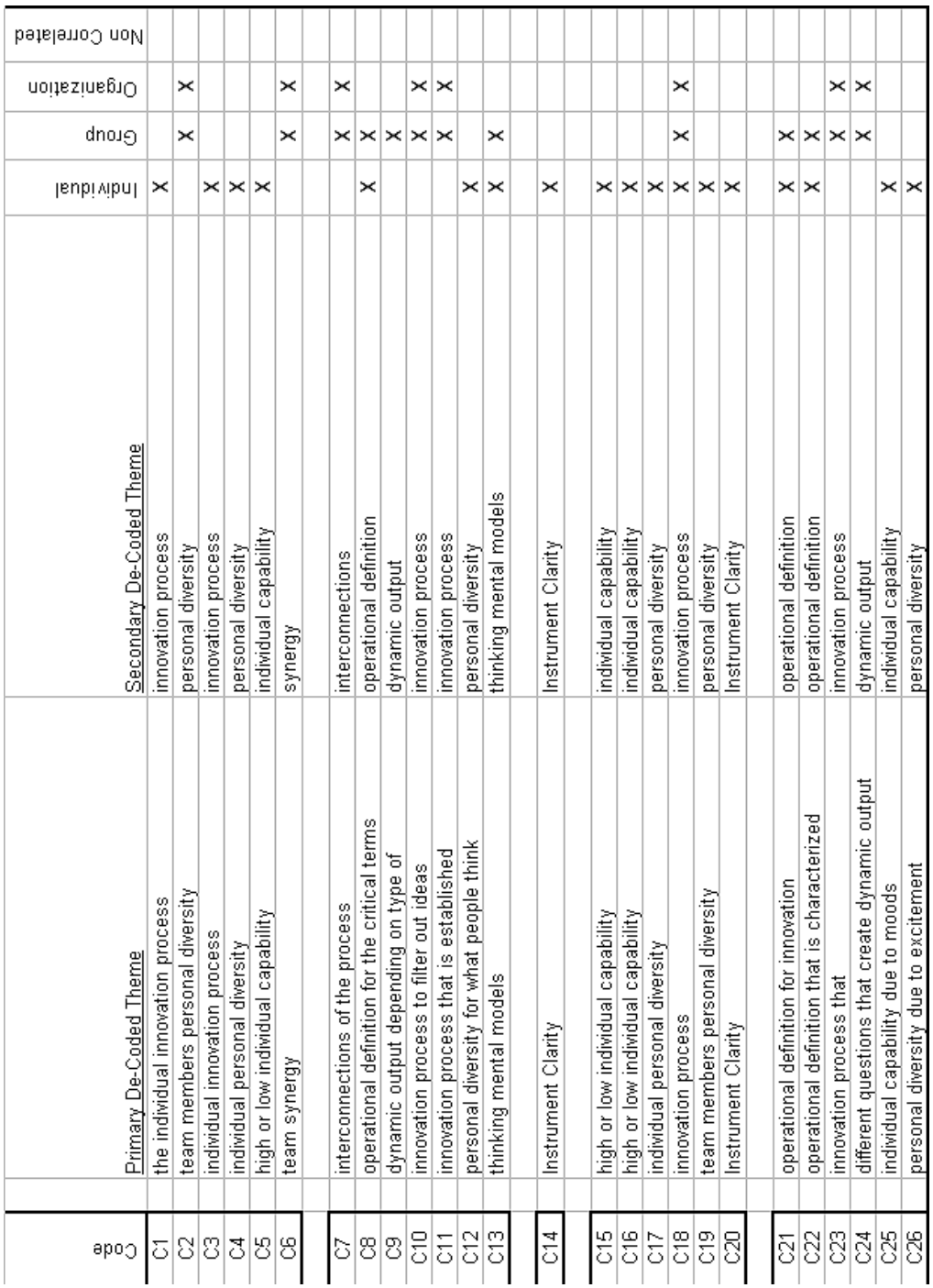
Code	Participant	Question	Response	Text Description	Primary De-Coded Theme
C1	P1	Q9	R1	people who like to take some time and process stuff on their own	the individual innovation process
C2	P1	Q9	R2	other people who need to be on their own	team members personal diversity
C3	P1	Q9	R3	need to be challenged and then throw it back	individual innovation process
C4	P1	Q9	R4	innovation and means of style	individual personal diversity
C5	P1	Q9	R5	your personal ability	high or low individual capability
C6	P1	Q9	R6	interaction that you have with your team mates	team synergy
C7	P2	Q9	R1	understanding how these things play out together	interconnections of the process
C8	P2	Q9	R2	how the tool is defined in the word deffinition	operational definition for the critical terms
C9	P2	Q9	R3	so does that mean a changeable output of innovation	dynamic output depending on type of
C10	P2	Q9	R4	I need to have some logical pattern to and some filter process	innovation process to filter out ideas
C11	P2	Q9	R5	Blueprinting that kind of thing which falls into the A and B quadrant	innovation process that is established
C12	P2	Q9	R6	comes from their perspective	personal diversity for what people think
C13	P2	Q9	R7	their thinking models	thinking mental models
C14	P3	Q9	R1	I don't understand the question	Instrument Clarity
C15	P4	Q9	R1	their strongest influinces	high or low individual capability
C16	P4	Q9	R2	their weekest influinces	high or low individual capability
C17	P4	Q9	R3	masterfull analysis would spread their development around	individual personal diversity
C18	P4	Q9	R4	innovating amoungst all four quadrants	innovation process
C19	P4	Q9	R5	aware of their own S.W.O.T.	team members personal diversity
C20	P4	Q9	R6	in reguard to the tool	Instrument Clarity
C21	P5	Q9	R1	that innovation is defined by the organization first	operational definition for innovation
C22	P5	Q9	R2	characterized as something	operational definition that is characterized
C23	P5	Q9	R3	follow up a little differently	innovation process that
C24	P5	Q9	R4	different questions and see how things fall out again	different questions that create dynamic output
C25	P5	Q9	R5	one is kind of mood dependent	individual capability due to moods
C26	P5	Q9	R6	if your having a really exciting day then everything is one way	personal diversity due to excitement

Figure 81. Q9 primary decoding sheet 1.



C27	P6	Q9	R1	blow this up bigger so we can see the variations	Instrument Clarity to understand variations
C28	P6	Q9	R2	how can I read the bulls eye better	Instrument Clarity on the centers importance
C29	P6	Q9	R3	maybe a look at the creative index	cross correlation between multiple tools
C30	P7	Q9	R1	that we don't have enough A and B's	personal diversity of left vs. right brain
C31	P7	Q9	R2	we need A and B to say we cant because of money	interconnections in thinking processes
C32	P8	Q9	R1	it seems to be more about how we think vs. innovation	operational definition of innovation thinking preferences
C33	P9	Q9	R1	at the time I was more of a C	personal diversity due to emotional output
C34	P9	Q9	R2	you cant look at this and say that the way it is will always be	dynamic output that changes over time
C35	P9	Q9	R3	the threshold is based off of circumstances	personal diversity of group experiences = total
C36	P10	Q9	R1	problem solving can be interchanged	interconnections of innovation and problem solving
C37	P10	Q9	R2	maybe degrees of sythesising your imagination or conceptualizing	interconnections of imagination
C38	P10	Q9	R3	speaking about the importance of emotions or creativity	personal diversity of shared emotions
C39	P11	Q9	R1	no boundaries is a little unrealistic	operational definition based on stable understanding
C40	P11	Q9	R2	if everyone is playing in D and then C and then we move to B, then A	innovation process
C41	P12	Q9	R1	those who are innovative thinking do they respond to tests	personal diversity of the innovation person extremes
C42	P12	Q9	R2	put language around what is esoteric or intuitive	operational definition for certain terms

Figure 82. Q9 primary decoding sheet 2.



Code	Primary De-Coded Theme	Secondary De-Coded Theme	Individual	Group	Organization	Non Correlated
C1	the individual innovation process	innovation process	X			
C2	team members personal diversity	personal diversity		X	X	
C3	individual innovation process	innovation process	X			
C4	individual personal diversity	personal diversity	X			
C5	high or low individual capability	individual capability	X			
C6	team synergy	synergy		X	X	
C7	interconnections of the process	interconnections		X	X	
C8	operational definition for the critical terms	operational definition	X	X		
C9	dynamic output depending on type of	dynamic output		X		
C10	innovation process to filter out ideas	innovation process		X	X	
C11	innovation process that is established	innovation process		X	X	
C12	personal diversity for what people think	personal diversity	X			
C13	thinking mental models	thinking mental models	X	X		
C14	Instrument Clarity	Instrument Clarity	X			
C15	high or low individual capability	individual capability	X			
C16	high or low individual capability	individual capability	X			
C17	individual personal diversity	personal diversity	X			
C18	innovation process	innovation process	X	X	X	
C19	team members personal diversity	personal diversity	X			
C20	Instrument Clarity	Instrument Clarity	X			
C21	operational definition for innovation	operational definition	X	X		
C22	operational definition that is characterized	operational definition	X	X		
C23	innovation process that	innovation process		X	X	
C24	different questions that create dynamic output	dynamic output		X	X	
C25	individual capability due to moods	individual capability	X			
C26	personal diversity due to excitement	personal diversity	X			

Figure 83. Q9 secondary decoding sheet 1.

C27	Instrument Clarity to understand variations	Instrument Clarity	X	X			
C28	Instrument Clarity on the centers importance	Instrument Clarity	X	X			
C29	cross correlation between multiple tools	cross correlation		X	X		
C30	personal diversity of left vs. right brain	personal diversity	X				
C31	interconnections in thinking processes	interconnections	X	X			
C32	operational definition of innovation thinking preferences	operational definition	X				
C33	personal diversity due to emotional output	personal diversity	X				
C34	dynamic output that changes over time	dynamic output	X				
C35	personal diversity of group experiences = total	personal diversity	X				
C36	interconnections of innovation and problem solving	interconnections		X			
C37	interconnections of imagination	interconnections		X			
C38	personal diversity of shared emotions	personal diversity	X				
C39	operational definition based on stable understanding	operational definition	X				
C40	innovation process	innovation process	X	X			
C41	personal diversity of the innovation person extremes	personal diversity	X				
C42	operational definition for certain terms	operational definition	X	X			

Figure 84. Q9 secondary decoding sheet 2.