THE PLEISTOCENE MANAGER: AN EMPIRICAL INVESTIGATION OF AGENCY SOCIAL CONTRACTS IN ORGANIZATIONS

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Submitted to the Graduate Faculty of

The Katz Graduate School of Business in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy

University of Pittsburgh

2005

UNIVERSITY OF PITTSBURGH

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This research project takes the position that there is a biological basis to social contract formation in business and to social contract dissolution. Its stance is that individuals cannot escape the natural forces that govern these relationships, by rite that these forces have on the structuring of the neural architecture of the human brain. While it is argued in this project that the neural algorithms in the brain are formed through evolutionary time to perform specific tasks that aided in the economizing activities of our ancestors, this structural design is not absolute. Rather, the neural circuits which formed in response to adaptive challenges facing our ancestors are susceptible to cultural influences, hierarchical arrangements, and organizational elaboration. So, although it is inescapable that biological forces shaped a fixed neural structure that guides and limits humans' abilities in the present day, naturally formed cultural variables in corporations moderate the activation of these neural circuits in ordinary business social contract situations.

This dissertation attempts to inform the business ethics field with insights from evolutionary psychology by examining business respondents' behavior when confronted with a social contract situation that involves cheating. En route to this goal, the research project empirically tests for the presence of cheater-detection/social-contract neural algorithms in a sample of business practitioners and undergraduate business students, as an extension of the research conducted by evolutionary psychologists, Leda Cosmides and John Tooby. Based on the theoretical groundwork laid by evolutionary psychology and other natural science disciplines,

the study examined whether human brain circuits are structured to recognize one specific type of social relationship in firms— agency arrangements.

Ultimately, this study's central thesis is: Although corporate agents' minds are biologically evolved to identify cheaters in social contract situations, the neural circuits responsible for detecting these breaches are influenced by organizational and cultural components that affect the individuals' perceptions of the terms of the exchange. Results from the main study empirically confirm that cheater-detection algorithms are present within a business population but that these "hardwired" circuits are moderated by cultural influences in business organizations. Implications for organizations and ethical decision making are offered and discussed.

TABLE OF CONTENTS

PREFACE xi
1. INTRODUCTION 1
1.1 Overview and Statement of the Problem 1
1.2 Purpose and Research Questions 3
1.3. Research Project Goals 5
1.4. Dissertation Outline 8
2. THEORETICAL BACKGROUND 9
2.1. Thermodynamics: Time's Destructive Drift 9
2.1.1. Natural Systems 9
2.1.2. Entropy & Thermodynamic Equilibrium: The Second Law of Thermodynamics 10
2.1.3. Organizations as a Temporary Solution: The First Law of Thermodynamics 12
2.2. Theories of Adaptive Function: Evolutionary Biology and Natural Selection 14
2.2.1. Evolutionary Theory 14
2.2.2. Evolutionary Biology 16
2.3. Adaptive Problem: Social Exchange 20
2.3.1. Altruism 22
2.3.2. Reciprocal Altruism 23
2.4. Nature-Nurture Debate 27
3. COSMIDES' SOCIAL CONTRACT ALGORITHM THEORY 30
3.1. The Integrated Causal Model of the Human Mind 30
3.1.1. Revisiting the Level of Analysis Problem 33
3.2. The Evolutionary Psychology Approach: The Design of the Mind 34
3.3. How Do Humans Reason? 35
3.3.1. Pragmatic Reasoning 35
3.4. Computational Theory of Social Exchange 38
3.4.1. Form Follows Function 38
3.4.2. Specificity of Domains 39
3.4.3. Social Contracts 41
3.4.4. Cosmides' (1989) Social-Contract Algorithm Theory 44
3.4.5. Cosmides' Theory: A Refinement 46
3.4.6. Deontic Reasoning 47
3.5. Conclusion 49
4. THE WASON SELECTION TASK 51
4.1. The Original Wason Selection Task 51
4.2. Factors and Biases that Affect Card Choices on the Selection Task 54
4.2.1. Confirmation Bias 54
4.2.2. Matching Bias 55
4.2.3. Instructional Manipulations 57
4.2.4. Other Effects on Selection Task Card Choices 58
4.2.5. Content Effects on the Wason Selection Task 59
4.3. Pragmatic Reasoning Schemas in the Wason Selection Task 63
4.4. Social Contract Tasks 65
4.4.1. Switched Social Contract Rules 68

5. HYPOTHESIS DEVELOPMENT 71
5.1. Exposition 71
5.2. Background Assumptions of Main Effects Hypotheses 73
5.3. Independent Variables 75
5.3.1. Benefit received by cheating 75
5.3.2. Intent to cheat 75
5.3.3. Agency Relationship 76
5.4. Cheater-Detection Hypotheses 76
5.4.1. Interaction Effect 78
5.5. Agency Hypothesis 78
5.6. Populations Hypothesis 81
5.7. Expected Results 85
5.8. Toward an Evolutionary Psychology Theory of Organizational Social Contracts 87
6. RESEARCH DESIGN AND METHODOLOGY 89
6.1. Adapted Wason Selection Task and Test Statistic Development: Pilot Studies 89
6.1.1. Pilot Study A: First Iteration 90
6.1.2. Test Statistics and Procedures for Data Analysis 91
6.1.3. Pilot Study A: Instrument 94
6.1.4. Pilot Study A: Results 96
6.1.5. Pilot Study B 102
6.2. Main Study Methods 107
6.2.1. Operationalization of Variables: Main Study 107
6.3. Main Instrument 109
6.4. Sample Size Determination 112
6.5. Research Design 114
6.6. Subjects and Data Collection 116
6.6.1. Materials and Procedure 118
7. DATA ANALYSIS AND RESULTS 120
7.1. Test Results for Cheater-Detection Hypotheses 120
7.2. Test Results on Agency Hypothesis 128
7.3. Test Results on Populations Hypothesis 130
7.4. Summary 131
8. DISCUSSION AND IMPLICATIONS 133
8.1. Analysis of Main Study Results 134
8.1.1. Re-Examining the Theory 135
8.1.2. Research Design and Methodology 143
8.2. Organizational Factors on Cheater Detection in a Business Population 149
8.2.1. Revisiting Social-Contract Algorithm Theory 150
8.2.2. Future Research Avenues 151
8.3. Concluding Remarks 156
APPENDIX A 158
Manipulation Check Questions for Pilot Study 158
APPENDIX B 159
Institutional Review Board Script for Administering Instrument 159
APPENDIX C 160
Adapted Social Contract Wason Selection Task Instrument: Main Study 160

APPENDIX D 167
Follow-up Study Tasks 167
BIBLIOGRAPHY 172

LIST OF TABLES

Table 1 Manipulation of Independent Variable in Pilot Study A: Operationalization 95
Table 2 Pilot Study A Results: Percentage of Subjects Choosing q and not-p 97
Table 3 Manipulation of Independent Variable in Pilot Study B: Operationalization 105
Table 4 Pilot Study B Results: Percentage of Subjects Choosing q and not-p 106
Table 5 Manipulation of Independent Variable in Final Study: Operationalization 111
Table 6 Verification of Sample Size per Treatment 114
Table 7 2 x 2 Factorial Design for Agency Tasks 115
Table 8 Sample Demographic: Business Practitioner Sample (Final Study) 117
Table 9 Cheater-Detection Rates for Agency-Type Tasks 121
Table 10 One-way Analysis of Variance for Entire Sample 122
Table 11 Significant Differences in Cheater-Detection Rates—Entire Sample (n= 389) 123
Table 12 Significant Differences in Cheater-Detection Rates— 123
Table 13 Significant Differences in Cheater-Detection Rates— 124
Table 14 Cheater-detection Rates by Presence or Absence of Independent Variables 127
Table 15 Significant Differences in Cheater-Detection Rates—Entire Sample (n= 389) 127
Table 16 Significant Differences in Cheater-Detection Rates— 127
Table 17 Significant Differences in Cheater-Detection Rates— 127
Table 18 Comparison of Cheater-Detection Rates--Manipulating Agency Variable 129
Table 19 Comparison of Cheater-detection Rates between Populations 130
Table 20 Balanced Latin Square Order used for Follow-Up Study 139
Table 21 Follow-Up Study Results (Replication Study) 140
Table 22 MBA Business Practitioner Frequency of Card Choices on Main Study (n=269) 148
Table 23 Undergraduate Frequency of Card Choices on Main Study (n=120) 148

LIST OF FIGURES

Figure 1 Standard Abstract Logic Structure Wason Task 53
Figure 2 Standard Social Contract Structure Wason Task..... 67

Dedication

This dissertation thesis is dedicated to my mother, Velma P. Wasieleski, who initially inspired me to pursue my doctorate and who sacrificed her life to make mine better.

PREFACE

Anyone who writes a dissertation knows that it is an emotional process that oftentimes requires personal and professional support from friends and loved ones. I would like to acknowledge several people without whose encouragement, affection, and guidance none of this would have been possible. My dearest wife, Stephanie, has gone through the trials and tribulations of the doctoral program with me from the day I received acceptance. Steadfast and strong, she stood by me through all the pinnacles and troughs of obtaining the degree. For everything she has done for me, she has my deepest admiration and love.

Four short years ago I was given a novel opportunity to take a doctoral seminar with one of the most important and influential scholars in the business ethics and social responsibility field—Bill Frederick. He is the one who introduced me to the natural science approach to our field and opened my mind to a new paradigm. In addition, he mentored me through the latter stages of my program of study and became my advisor, role model, and friend. It has been the ultimate honor to work with him and learn from one of the all-time great scholars in the area. It is my hope that I will be able to expand on the critical work he has done bridging the social and natural sciences throughout my career.

I would also like to express my sincere gratitude to my dissertation committee. Being a pioneering study, this project was not the easiest to guide. My friend, Jim Weber wore many hats to help get me to this point in my career. I will never forget everything he has done for me over the years from MBA to Assistant Professor. Donna Wood demonstrated an open mind throughout this dissertation process by offering numerous valuable insights. She taught me the Business and Society field through the doctoral program and supported me in all my professional choices. It was fitting that Jake Birnberg graciously offered to be a member of my thesis

committee because he was the one who arranged for Bill Frederick's seminar on these theories. His support and input on the committee made a distinct difference. Many thanks also to Steve Gaulin who stayed with me and this project even after he changed universities. His guidance was important in bridging the gap between business and evolutionary psychology.

I am grateful also to Leda Cosmides and John Tooby for extending their hospitality and knowledge to me when I visited their Center for Evolutionary Psychology at the University of California at Santa Barbara. They were critical resources for me in constructing my instrument and designing my study. I always appreciated the many phone calls and faxes that took place during the writing of my dissertation.

I must not neglect to mention another important person in my life who was instrumental in this project as well. Millie Myers advised and taught me through the doctoral program and showed great affection towards me, which truly enabled me to get past some difficult obstacles in my life.

Finally, one other person who needs to be acknowledged for helping me achieve my dreams is my father, Richard Wasieleski. Throughout my life he has shown me great love and wonderful direction, which enabled me to achieve my goals. Always my greatest proponent, my dad afforded me every opportunity that I ever wanted. Without his love and sacrifices I could *never* have reached this point in my life. Although his modesty would never allow him to take credit for my achievement, in my heart I hope he knows how much his actions and support have meant to me.

1. INTRODUCTION

1.1 Overview and Statement of the Problem

> *"Human beings exist wholly within nature as part of natural order in every respect."—Jane Jacobs, 2000*

Business firms are an outgrowth of natural processes. Their formation, maintenance, and survival are made possible by the physical, biological, and psychological machinery of nature. Corporations originated as a means to an end. What may not be easily accomplished by individuals alone may be quite feasible when the efforts of several individuals are combined toward a single purpose or mission. Throughout evolutionary time, individuals achieved goals by entering into exchanges with other individuals in their social group (i.e., tribe or band). Organizations serve a similar purpose by facilitating humans' ability to economize in their natural world. The very existence of business firms depends upon the anti-entropic tendencies of the agents who comprise the organization. Individuals working in business organizations are driven by biological impulses and motivations which affect the way they interact with each other and respond to environmental forces. "Their decisions and policies are molded…by complex environmental natural forces over which they exert little or no direct rational control…" (Frederick, 2004: 145). Corporations sustain themselves by virtue of the persistence of the firm's independent agents to cumulatively economize. One way for a firm's agents to economize effectively is to engage in social exchange relationships.

Organizations are also described as a nexus of contracts, whether they take the form of written agreements or informal understandings (Jensen & Meckling, 1976). For any organization to function properly, these binding agreements between two or more parties must be upheld. They are a necessary feature of firms, without which achievement of organizational goals would be impossible (Robinson, Kraatz, & Rousseau, 1994). The breaking of agreements

between individuals is widely recognized in organizational life as a serious impediment to an efficiently operating organization (Eisenhardt, 1989). Social contract theorists have also wrestled with this problem in organizational settings when breaches of social contracts between two parties are caused by either party's dishonoring of the contract terms (Donaldson, 1989). If individuals who form these agreements with each other in organizational settings are biologically equipped to interact contractually in a certain way, it is not difficult to believe that evolutionary forces are in part responsible for the formation and failure of relationships in firms.

The international news is littered with reports of cheating behavior in business organizations. This phenomenon, while not new by any means, recently has received more media attention and has exploded into a chronic feature of business relationships. Certainly, the executives at Enron violated the social exchange relationships they had with their employees by telling them to hold on to their stock as they removed their own interests and watched their value diminish and employee pension funds become worthless. Executives at companies like Tyco, Parmalat, and WorldCom also broke a similar social contract with their firms' stakeholders when they falsely reported earnings at their respective companies for personal gain. These examples are not isolated, nor are they representative of all the social exchange infractions taking place in the ordinary course of business interactions. Cheating on social contracts can be found in many various business practices and may constitute an epidemic given the impact these unethical acts have on those affected. Thus, it is important to examine social contract situations in business where cheating is taking place to understand why these breaches occur.

1.2 Purpose and Research Questions

> *"The motive of the drama of human life is the necessity, laid upon every man who comes into the world, of discovering the mean between self-assertion and self-restraint suited to his character and his circumstances."*—Thomas Huxley, Evolution and Ethics

This dissertation research project takes the position that there is a biological basis to social contract formation in business and to social contract dissolution. Its stance is that individuals cannot escape the natural forces that govern these relationships, by rite that these forces have on the structuring of the neural architecture of the human brain. While it is argued in this project that the neural algorithms in the brain are formed through evolutionary time to perform specific tasks that aided in the economizing activities of our ancestors, this structural design is not absolute. Rather, the neural circuits which formed in response to adaptive challenges facing our ancestors are susceptible to cultural influences, hierarchical arrangements, and organizational elaboration. So, although it is inescapable that biological forces shaped a fixed neural structure that guides and limits humans' abilities in the present day, naturally formed cultural variables in corporations moderate the activation of these neural circuits in ordinary business social contract situations.

An ongoing debate ensues in the evolutionary psychology field. One side argues that the brain is composed of a fixed neural architecture that formed in prehistoric times to solve adaptive problems facing our ancestors. Natural selection informed the design of these circuits, which have remained relatively unchanged since the Pleistocene period. The other side argues that the neural circuits are malleable and are activated in and employed in a variety of ways dependent upon the symbolic interpretation of one's own environment. It is the posture taken in this dissertation that both perspectives warrant attention. While neither view explicitly rejects the other, I argue that neither is complete without the other. The former view, advocated by Leda

Cosmides and John Tooby, allows room for cultural variation. This dissertation takes the stance that a more comprehensive understanding of social exchanges in business contexts can be achieved by leaving the door open to the possibility that the neural algorithms in the brain are not stoic to the point of being unaffected by cultural influences (Ridley, 2003).

This dissertation attempts to inform the business ethics field with insights from evolutionary psychology by examining business respondents' behavior when confronted with a social contract situation that involves cheating. En route to this goal, my dissertation research project empirically tests for the presence of cheater-detection/social-contract neural algorithms in a sample of business practitioners and undergraduate business students, as an extension of the research conducted by evolutionary psychologists, Leda Cosmides and John Tooby. Based on the theoretical groundwork laid by evolutionary psychology and other natural science disciplines, I examined whether human brain circuits are structured to recognize one specific type of social relationship in firms— agency arrangements. The agency problem—the dilemma of not having an agent behave in the way directed by the principal—"exists in all organizations and in all cooperative efforts—at every level of management in firms…" (Jensen & Meckling, 1976: 309). The agency relationship serves merely as an interesting, common organizational arrangement in modern-day businesses for this study and thus, is the study's behavioral context.

In this line of inquiry, the major research questions explored were:

A. Is there evidence that the minds of individuals in a business population evolved to recognize social exchanges in a business context?

B. Are social-contract algorithms among business students and practitioners activated in a manner consistent with research findings from the evolutionary psychology literature?

C. What cultural variables could be responsible for moderating the activation of the social-contract algorithms in a business population?

Ultimately, this dissertation's central thesis is: *Although corporate agents' minds are biologically evolved to identify cheaters in social contract situations, the neural circuits responsible for detecting these breaches are influenced by organizational and cultural components that affect the individuals' perceptions of the terms of the exchange.*

1.3. **Research Project Goals**

"…the initiators of the Scientific Revolution worked to clear away the passive impedimenta of old beliefs. Breaking through the inertia of ages is no easy task, for incumbency brings enormous advantages…"—Stephen Jay Gould, 2003

The use of biology and the natural sciences as an explanatory tool for business behavior is not foreign to organizational literature (Pierce & White, 1999; Lovins, Lovins, & Hawken, 1999; Petzinger, 1999; Jacobs, 2000; Lawrence & Nohria, 2002). Arguably however, little conceptual integration has been accomplished in organizational theory. Never before have the discoveries from evolutionary psychology been applied to business contexts; nor has a business population ever been tested using the assumptions and methodology from evolutionary psychology. The first major goal of this dissertation is to introduce the Cosmides and Tooby approach to business and society. Their work and research stream has been validated and respected in the evolutionary psychology literature for years (Dennett, 1995; Gaulin & McBurney, 2001). It has been used to discover how individuals reason through social dilemmas involving cooperation, punishment, reciprocity, and cheating. I believe their work can and should be extended to the business and society area. I introduce their approach as a new way to view how moral choices are made in corporations.

It follows that another potential outcome of this project is the connection of the social sciences with the natural sciences. The intent is not to reject social science views on behavior, but rather, use insights from evolutionary biology and evolutionary psychology to inform the Business and Society field. Cultural variability is "data that can give insight into the structure of the psychological mechanism that helped generate it" (Cosmides, Tooby, & Barkow, 1992: 5). In other words, assumptions from the natural science view of human behavior are useful in explaining cultural phenomena in organizations like cheating in social contract situations.

This research utilizes the Integrated Causal Model (ICM) as the conceptual foundation of human behavior, rather than the Standard Social Science Model (SSSM), which has been governing the social science disciplines for decades. Essentially, the SSSM gathers its knowledge about human behavior and cultural phenomena from direct common human experiences (Tooby & Cosmides, 1992). The ICM takes a step back from social science-dominated explanations of behavior and assumes that cultural phenomena are derived from natural manifestations of selection pressures acting upon our Pleistocene ancestors. It recognizes that the human mind is composed of domain-specific modules that were selected evolutionarily to solve various adaptive problems. One of these adaptive problems facing our ancestors was cooperation in social exchanges (Tooby & Cosmides, 1992). These social exchange mechanisms in turn, manufacture elements of human culture. Thus, the model of human motivation is expanded in this dissertation from a rational choice view to one that reflects the social nature and biological impulses of human beings, as a strategy for finding consistency between evolutionary psychology and cultural explanations of behavior in the corporate world.

Lastly, this project is an important step in expanding Cosmides and Tooby's approach. Prior research in the evolutionary psychology field has only focused on situations that involve

two direct exchange partners. My project accepts the strong evidence from the numerous empirical studies conducted by researchers in evolutionary psychology and builds on those findings. A major contribution of this study to the evolutionary psychology field is to introduce the agency-type arrangement to the social exchange. To date, no work in the area has examined how a third party affects an individual's ability to detect cheaters in business social contract situations. Social contracting in business organizations often does not involve a direct one-on-one exchange between two individuals. Modern day organizational structures are likely to involve power differentials in the ranks of the firm that social contract rules are being evaluated by a third party who acts as an agent of the organization's owner. Our Pleistocene ancestors were also placed in social arrangements with power differences (Cummins, 1998). While evolutionary psychology acknowledges the fact that these hierarchical relationships in social groups were familiar to our ancient predecessors, the field has not empirically tested the operation of neural algorithms related to social exchanges in this context. Insights learned from my study can be applied to the existing breadth of knowledge accumulated in the evolutionary psychology field by taking into account the effects of an organization's structure and culture on the activation of the brain's neural algorithms. As I test for the presence of social-contract algorithms in a business population, thereby seeing if Cosmides' theory is applicable to the study of organizations, it is important to be aware of the influence of organizational culture on the sensitivity of neural algorithms to business-type social contract exchanges. The personal and psychological perceptions of social contracting parties that moderate these circuits are explored in my work.

1.4. **Dissertation Outline**

The study is reported in seven remaining chapters. Chapter 2 lays the broad theoretical groundwork of natural science approaches to human behavior and serves as the exposition to a more detailed discussion of evolutionary psychology and cognitive neuroscience in Chapter 3. Specifically, Cosmides and Tooby's framework and main arguments are presented in the third chapter, followed by a critical assessment of their theory. It is here that the cultural components of the evolutionary psychology approach are presented. Chapter 4 moves from the conceptual analysis of evolutionary psychology into a discussion of the empirical methods and research designs employed by researchers in this area. The Wason selection task is described, discussed, and criticized in this section. In Chapter 5 the hypotheses for the main empirical study are offered, outlining the proposed relationships among the constructs. The operationalization of the theoretical constructs into the independent and dependent variables used in the study is explained as well. The next chapter details the methodology and research design employed in this dissertation. My adapted Wason selection task instrument is presented. A summary of this project's two pilot studies and their results is given to demonstrate how the final revision of the scenarios emerged. Chapter 7 provides an in-depth description of the results of the hypothesis testing. Here the data are statistically analyzed with analysis of variance technique and subsequent Z-tests. Finally, Chapter 8 discusses the results and interprets their meaning. Potential explanations of the data results include a discussion of methodological limitations, theoretical weaknesses, and intervening cultural influences. Implications for business ethics research are proffered and propositions for future research involving insights from both evolutionary psychology and organizational theory are made.

2. THEORETICAL BACKGROUND

An appropriate starting point for this dissertation project is with an explanation of evolution itself; focusing first on the utility living organisms derive from evolution's processes. The chapter begins with a discussion of the laws of thermodynamics, which provides the basis for understanding nature's tendencies toward chaos and disorder. The means for arresting physical reality's constant drift to disorganization in the short-term are covered next with a discussion of the driving force behind evolution—natural selection. Here, the basic background of evolutionary biology is presented. The theory is described in terms of how physical features are formed through natural selection, but also in the context of other adaptive pressures facing our ancestors. The chapter ends with a description of the specific adaptive challenges related to social exchange as a stepping stone to Chapter 3 on evolutionary psychology.

2.1. **Thermodynamics: Time's Destructive Drift**

> *"You cannot step twice into the same river, for other waters are continually flowing on." –Heraclitus*

2.1.1. Natural Systems

Life is in constant flux. In open systems, there exists a continuous exchange of energy in the environment. Transformation of energy from one form into another occurs in an ongoing cycle (Baskin, 1998). The ebb and flow of energy transformation takes place in all living systems, all going in a single direction. Through the arrow of time, all life forms drift toward their ultimate fate—death and disorder. This is the end-state equilibrium for all species on the planet, including humans. Despite this long-range prognosis, humans have become adept at staving off the inevitable through short-run management techniques that preserve order and

sustain life. Paradoxically, the same processes that lead to death are the keys to ordered life as well. Business organizations are a natural manifestation of life's anti-entropic tendencies (Frederick, 2004).

The laws of thermodynamics are concerned with energy transformation. Definitions of systems and their boundaries and the evaluation of energy flows in isolated systems make up the main foci of thermodynamics (Ruth, 1993: 51). Attention in thermodynamics is typically on the interior, closed system. "It is the purpose of thermodynamics to find general relations among the thermodynamic coordinates which are consistent with the principle of the conservation of energy…" (Zemansky, 1937: 23-24). However, these closed systems are in constant contact with their environment. Conservation of energy and the stabilization of coordinates are impossible in the long-term. Organisms can change spontaneously or by dint of interaction with their external surroundings. Technically, when no external force in the environment and no internal transformation of energy are taking place, the closed system is said to be in mechanical equilibrium. This is a short-lived phenomenon in nature, indeed. Rather, as time progresses, natural systems are subject to continuous change. The transformation of energy by an organism from a useful form to a form which provides less utility for the organism leads to a state of change. In closed systems, energy is wasted and lost to the environment. While energy can never be completely destroyed, it dissipates and constantly transforms into different forms. Over time, organisms drift toward an altered state.

2.1.2. Entropy & Thermodynamic Equilibrium: The Second Law of Thermodynamics

These natural processes as dictated by the laws of thermodynamics are irreversible. Neither the organism, nor the environment in which the organism exists can return to their initial

states (Zemansky, 1937). The procession from the organism's original state to its final state is unavoidable. The final state is thermodynamic equilibrium. This is the point at which a system has exhausted all of its change potential. The means to this end is the process of entropy. Entropy is "a quantity that relentlessly grows with dissipation and attains its maximum value when all the potential for further work is spent" (Coveney & Highfield, 1990: 151). It represents the "transformation content" of physical processes. The arrow of time is clearly pointing towards disorder, degradation, and thermodynamic equilibrium—the point at which all change ceases to occur, or when all energy has been transformed. Thermodynamic equilibrium is the point when entropy has reached its greatest quantitative value in a given system. Entropy, as expressed in the Second Law of Thermodynamics, is essentially what happens through time as all energy and matter evolves toward the end state equilibrium. "Increasing entropy is a sign of the progression of time" (Coveney & Highfield, 1990: 149). As closed systems interact with their environment, the relationship becomes disordered and dysfunctional. Essentially, entropy represents a system's capacity for change and continuously increases through time.

The second law holds that "all physical processes are irreversible" because in open systems (like the ecosystem) some energy is always lost to the environment as heat (Coveney & Highfield, 1990: 148). This energy cannot be retrieved. Through evolutionary time, energy and matter move towards maximum disintegration (Frederick, 1995: 50). Energy and matter cannot be completely destroyed, however. They are merely transformed into another state. According to this law, physical systems move away from organized states to states of maximum disorder (Feynman, Leighton, & Sands, 1963). As energy is lost to the environment, this degradation occurs.

2.1.3. Organizations as a Temporary Solution: The First Law of Thermodynamics

The principle of energy conservation applied to a thermodynamic system and its environment is the first law. Based on this principle, the first law is broken down into two sub-principles: 1) Energy cannot completely be created or destroyed and, 2) Energy in closed systems remains constant over time even though it metamorphoses into a different type (Zemansky, 1937: 50). The First Law of Thermodynamics states that "energy will always be conserved in a physical process…" although it does get converted into different forms (Coveney & Highfield, 1990: 150). The fact that living systems are able to continue to work and operate, despite processes dictated by the second law, suggests that a source of internal energy exists to sustain closed systems in the short-term. Thermodynamics does not describe this source of internal energy but recognizes that it maintains systems.

Put another way, living systems are able to self-create and renew themselves. Autopoiesis is the "capacity for self-reproduction through a closed system of relations" (Baskin, 1998: 253). All organisms, as types of closed systems, respond to changes in their environment by finding ways to regulate and manufacture sources of energy necessary to survive. Along the way towards the end state equilibrium, life naturally staves off entropy in an ongoing battle of wills and wits. Entropy has the will; life has the wits. If entropy alone were to act upon living organisms, then life would not exist for long. Life contradicts the second law by holding entropy at bay, albeit temporarily. Self-organization is the process underlying non-equilibrium thermodynamics which provides the means to which organized structures form in the midst of increasing disorder (Coveney & Highfield, 1990).

Functional order as described in the first law does not spontaneously manifest itself, however. Darwin recognized the fact that life forms are subject to forces which cause ultimate

degradation. He spoke of self-contained organization within individual members of a species in terms of the preservation and accumulation of variation. "This improvement inevitably leads to the gradual advancement of the organization of the greater number of living beings throughout the world" (Darwin, 1859:122). According to Tooby, Cosmides, and Barrett (2003), Darwin's theory of natural selection was the solution to the thermodynamic problem outlined by the second law. Physical systems are organized in such a way as to allow themselves to maintain and propagate. When the order of some organisms is degraded, the chances of reproduction and maintenance over time decreases. The closed system designs that effectively interact with a stable environment are the ones that are more likely to reproduce themselves.

Thermodynamic systems analysis can be applied to machines, biology, or economic systems. "An economy receives material and energy inputs from its environment and provides outputs to its environment" (Ruth, 1993: 48). By virtue of the second law, efficiency of energy transformation is constrained on the growth of economic and ecological systems. Entities must find ways to conserve energy and transform energy inputs into useful outputs. One of those ways is discussed next.

Economizing is the process of taking energy from one's environment and transforming it into useful work (Frederick, 1995: 31). It is essentially the natural process offsetting the end-state equilibrium condition. The second law allows for temporary interruptions of the entropic process, which is called economizing (Frederick, 1995: 38). Temporary cycles in the rhythm of time allow for life to self-organize and develop ways to avoid the end-state equilibrium a little longer. The particular form that economizing structures and behaviors take is dependent on the evolutionary process. Natural selection informs economizing. "Selection is the only known counterweight to the tendency of physical systems to lose rather than grow functional

organization" (Tooby, Cosmides, & Barrett, 2003: 858). Evolutionary biology demonstrates that organisms which adaptively fit their environment are favored by natural selection. The best at staving off entropy by self-organizing, or economizing, will propagate its species. Evolutionary biology is explained in more detail in the next section.

2.2. **Theories of Adaptive Function: Evolutionary Biology and Natural Selection**

2.2.1. Evolutionary Theory

Evolutionary theory, as originally conceived by Lamarck (1809) and Chambers (1844) and later developed by Charles Darwin (1859), describes a detailed process of how species are continually designed and developed. Darwin himself referred to his theory as a doctrine of "modification" (445). In his The Origin of Species, he implies that all living organisms, including humans, are designed through an accumulation of features over time. He envisioned a tree of life, where as modifications in species accumulated through generations, a new branch grew to signify a different species altogether. In this sense, Darwin believed his theory to be progressive—organisms further out on the tree of life were thought to be more complicated and more highly developed than organisms that appeared on the tree's earliest branches (Hull, 2002). Scientific confirmation for evolution can be found in various disciplines in the life sciences including geology, paleontology, and genetics. The evidence is strong and immutable that evolution through variation is the cause of the origin of species (Dennett, 1995).

Once Darwin demonstrated (through a vast collection of plant and animal specimens and arguments drawn therein) that species surely evolve, his attention turned to the mechanisms by which evolution is driven. If every present day species is descendent from a common ancestor, then how did the changes occur? To begin with, it must be understood that evolution is an

adaptive theory. In other words, "species exist because only certain arrays of forms are adapted to the environment they occupy" (Ridley, 1985: 93). In order for a species to adapt to its surroundings, individual members and groups of members must be able to survive the conditions facing them. Features of living organisms are the result of adaptations to the environment (Futuyma, 1979). Herbert Spencer coined the term, "survival of the fittest," which came to mean that only organisms capable of manipulating and exploiting their environment (often in direct competition with other species' members) were able to sexually reproduce themselves and thus sustain the species (Hull, 2002). Adaptation indicates a successful design for life at a certain moment in time. When physical traits are well-designed to increase the likelihood that its possessor survives the trials and tribulations of the environment, an adaptation has occurred (Ridley, 1985). Specifically, the inanimate mechanism that Darwin deemed responsible for these gradual changes in the blueprints of species is natural selection.

This insight that all designs of living organisms are the product of a mindless process—a "blind watchmaker," as Richard Dawkins called it (1976)—is critical to understanding how revisions in species have emerged over time (Dennett, 1995: 188). Driven by changes in the conditions of life, natural selection is an active mechanism responsible for "profitable variations" in the designs of creatures (Darwin, 1859: 89). Natural selection is essentially "design with modification." Darwin described the importance of natural selection by referring to the adaptive advantages which result from the process.

> "*…as all the inhabitants of each country are struggling together with nicely balanced forces, extremely slight modifications of the same kind would often still further increase the advantage, as long as the species continued under the same conditions of life and profited by similar means of subsistence and defence" (1859: 89).*

Natural selection crafts these modifications and ultimately, adaptations. Over countless generations, the process designs organisms that are continuously better suited to cope with the

current environment. Each design modification serves a particular purpose, or function for coping with the surroundings. These new designs are transferred from one generation to the next through sexual reproduction. Useful traits to a species cannot be sustained by a species if its members do not reproduce. So, more exactly, natural selection is the mechanism by which organisms create adaptations that allow them to reproduce themselves. Gradual alterations in lines of descent on the tree of life are not possible without some form of reproduction (Williams, 1997). "Designs for reproduction are transmitted to offspring; other kinds of designs are not transmitted and therefore disappear" (Gaulin & McBurney, 2001: 22).

In order to better understand what unique designs were favored by natural selection, the discussion now turns to those environmental conditions facing our ancestors in the Pleistocene Period—the period of natural history dating back 1.5 million to 11,000 years before the present. It was during this period that the last major glacial progression ended and Homo sapiens spread all over the globe. The events of the Ice Age had a major impact on the distribution of species on the planet, as well as the major design features of the human species as a whole (Futuyma, 1979: 115). The study of the structures formed during this time period in human history is the mission of evolutionary biology.

2.2.2. Evolutionary Biology

Evolutionary biology "consists of the logically derivable set of causal principles that necessarily govern the dynamics of reproducing systems" and that are responsible for the properties that compose a living being (Tooby & Cosmides, 2000: 1186). Evolutionary biology also identifies the principles that govern which kinds of organic features are selected for, and which are selected out. The anti-entropic forces of evolution have designed a biological system

for adapting to various problems our Pleistocene ancestors had to face. Various environmental pressures that jeopardized survival faced our ancestors. To deal with these adaptive problems, certain structures are selected for, which enable organisms to cope. Thus, the form of the organism follows the function that that particular structure is designed by natural selection to serve. In other words, evolution does not select for behavior. Instead, it "only selects for mechanisms that produce a behavior or predispose" an organism to that behavior (Wilson, 1993: 127). Successful features are those which allow an organism to propagate. Natural selection, evolution's process for choosing the structures that solve adaptive challenges, engineers a fit between the design features of the organism and the function necessary for survival.

Evolutionary biologists work backwards by discovering and defining adaptive problems facing our ancestors and trying to deduce the physical structure needed to solve those dilemmas. Often times, there is more than one way to solve a dilemma, however. "But the more precisely you can define the goal of processing—the more tightly you can constrain what would count as a solution—the more clearly you can see what a program capable of producing that solution would have to look like" (Cosmides & Tooby, 2000b: 1259). This computational approach (Marr, 1982) to information-processing problems provides "a task analysis defining what a…device does and why…" (Cosmides & Tooby, 2000b: 1259). Essentially, modern evolutionary biology "constitutes…a foundational organism design theory, whose principles can be used to fit together research findings into coherent models of specific cognitive and neural mechanisms" (Tooby & Cosmides, 2000: 1186).

One issue under debate in evolutionary biology concerns the level of analysis over which this natural selection occurs (Hull, 2002). How is the mechanism of design modification realized in life forms? The different levels of analysis under question are the gene level (building blocks

level), the phenotype level (organism level), and the group level (tribes and kin). My focus will be on the former two levels as discussed in the subsequent section. Groups will be discussed later in the chapter when my focus switches to the adaptive challenges facing our ancestors from living in social groups.

A gene is the basic unit to natural selection. Specifically, it is "any portion of chromosomal material that potentially lasts for generations to serve as a unit of natural selection" (Dawkins, 1976: 28). Genes dictate the structure and function of the organisms which house them. The organism is essentially a gene's survival machine. A gene's survival depends on the efficiency of the bodies in which it lives. Genes' success in replicating themselves across future generations depends on the survival machine's survival success. Genes can live on indefinitely if they build successful survival machines, i.e., organisms, that can reproduce themselves. The survival machine is programmed by natural selection to maximize the number of genes that survive. Genes are in the business of programming structures and functions that fit and adapt to the survival machine's environment.

Evolution is best thought of in terms of gene competition. Genes act for themselves; that is, they are programmed to replicate themselves. Chemically, they are merely instructions that are able to be copied. Genes have no direction or purpose, per se. Their only function is to copy themselves (Dawkins, 1976), which is only possible if the host organisms (survival machines) survive the adaptive challenges facing them and are able to reproduce. So, evolution is not technically at the organism level of analysis; it exists at the gene level—the building blocks of life. Since genes do not "think" in terms of reasoning through situations, the term, "selfish gene," popularized by Dawkins (1976), is only a metaphor for their static function and composition.

Dawkins (1976) calls these survival machines which are the receptacle for the genes, a purposive machine. This is not meant to sound deterministic because natural selection does not have an end-state "in mind." However, it does serve as another useful metaphor in that Dawkins claims the organisms act *as if* there was a grand purpose controlling their behavior. Consciousness evolved as a way of evaluating the discrepancies between desired states of existence and actual states. Once a discrepancy, caused by entropic forces, acts upon the organism, the survival machine works harder to economize and overcome the gap. Genes are the programmer for the organism.

One cannot think of the gene as sole basis of evolution. Though the groundwork (i.e., program) is laid out at the gene level of analysis, the survival machine, or organism, must survive the trials and tribulations facing it through the odyssey of life. How do organisms survive in a social environment? Dawkins admits that "kin selection and selection in favor of reciprocal altruism may have acted on human genes to produce many of our basic psychological attributes and tendencies" (p.191). He feels that a discussion on evolution must go beyond the gene to include the meme, which is a replicator of human culture (See next section.). Memes are essentially pieces of information that can be directly transmitted from person to person or generation to generation by way of culture, not the genes. Dawkins ties the development of memes back to the gene. To him, memes owe their manifestation to the programs dictated by the genes in the brain. The study of memetics involves discovering what information and ideas are imitated from one generation to the next by the survival machines. Any useful information to a person for overcoming adaptive challenges is passed down across generations and stored in the brain. Memes are the vehicles through which culture is transferred in populations. They are

"instructions for carrying out behaviour, stored in brains and passed on by imitation" (Blackmore, 1999: 17).

A clever and useful way of viewing the evolutionary process in general is to think of it as an algorithmic design (Dennett, 1995). Algorithms—the unit of analysis studied in this dissertation—are mechanical procedures or instruction manuals of evolution. "An algorithm is a certain sort of formal process that can be counted on—logically—to yield a certain sort of result whenever it is 'run' or instantiated" (p. 50). Algorithms are substrate-neutral according to Dennett—they operate at any level of analysis. While they have distinct programs or formulas which guide the evolutionary process (natural selection), they can only produce similar results if they start at exactly the same initiating point. This is an important point because it accounts for the fact that many different designs exist. Intricate designs cannot be predicted from an algorithm, only the kind of pattern can be predicted (Blackmore, 1999: 12). Specific neural algorithms will be discussed in detail in the following chapter as the discussion shifts to the procedures in the brain used for detecting cheaters in social exchanges.

2.3. **Adaptive Problem: Social Exchange**

Some of the most important adaptive problems that faced our ancestors were to "navigate the social world" (Cosmides & Tooby, 2000b: 1259). Social exchange is pervasive to human social life. Social exchange is defined as "cooperation between two or more individuals for mutual benefit" (Cosmides & Tooby, 1989: 52). In some capacity, social exchange occurs in every culture on the planet. "Humans are disposed to be social" (Wilson, 1993: 125). The reason for this innate behavior is because our ancestors were only able to solve some adaptive problems in their environment, collectively. "Sociability dominates in man because individuals

have evolved in ways that place their most self-centered instincts under some kind of higher control" (p.132).

Humans biologically formed as hunter-gatherers who were used to life in small groups (Greenwood & Stini, 1977). It was within these small groups that all exchanges took place. Humans' mental capacities and physical capabilities evolved in this context for millennia. "Our species spent over 99% of its evolutionary history as hunter-gatherers in Pleistocene environments" (Cosmides & Tooby, 1987: 280). The conditions facing our ancestors over that period of time have more of an influence on the way humans are designed than do conditions in the modern industrialized age in which we live. Only in recent evolutionary history did humans begin to interact in much larger groups. What we must remember is that modern conditions could not possibly have had the time to manipulate the physical and mental structures of individuals. We are currently a product of our evolutionary past, and that past was a very different world than it is today. Natural selection principally allows design structures which offer reproductive value to organisms. It zeroes in on an adaptive problem caused by our ancestral environment and addresses the problem with a particular structure. One of the adaptive problems was how to interact with others (kin and non-kin) in small groups. "The computational theory of social exchange suggests cognitive processes that govern human reasoning might have a number of design features specialized for reasoning about social exchange" (Cosmides & Tooby, 1995: 1202). (This theory will be covered in detail in the next chapter.)

2.3.1. Altruism

"As the reasoning powers and foresight…became improved, each man would soon learn from experience that if he aided his fellow-men, he would commonly receive aid in return"—Darwin (1871)

In biology, altruism occurs when a living being performs an act that benefits another being at the expense of the creature performing the act. It is when someone behaves for the sake of someone else at a personal expense with no immediate observable benefit (Blackmore, 1999). With biological altruism, no conscious motive needs to underlie the behavior (Williams, 1966). This is quite different from philosophical notions of altruism, which are centered on the idea that individuals consciously behave to help others for the sake of the good of the act. The implicit motive is based on the moral sensibilities of the person performing the act. In classical economics, altruism was counterintuitive to the rationally self-interested human. In evolution, altruism made more sense because of the purpose it served.

William Hamilton (1963, 1964) addressed the issue by examining individuals' survival abilities in their environment. He posited that altruism is not dispensed randomly but with reference to kin. Individuals will discriminate against those organisms which do not appear to be close kin to the individual offering the altruistic act. In the face of the concept "survival of the fittest" Hamilton argued that genes can only be spread if the gene benefits from a behavior. It has little to do with whether the host of the gene benefits from a behavior. So once again, the levels of analysis are the issue. Altruistic tendencies proliferate in groups of individuals if the behavior is toward family members who may possess that altruist's genes. Thus, Hamilton developed his concept of inclusive fitness (1964), where the principles of survival and adaptability not only pertained to the individual person, but also to anyone in the group who may

have similar genes. Behavior that seemingly costs the altruist in some regard at the organism level may in fact benefit the altruist's building blocks at the gene level of analysis.

Dawkins says that selfishness is good and altruism is undesirable *at the gene level.* Genes are in the business of programming structures and functions that fit and adapt the survival machine to its environment. A variety of behaviors will suffice for survival in many different circumstances. The argument becomes focused on confusion over the level of analysis. For instance, during sexual reproduction, genes compete for dominance in the formation of eggs and sperm (Dawkins, 1995). Genes proliferate based on chance processes unless one gene mutates and biases its probability of being passed on. This could greatly enhance the fitness of organism 'B' at the expense of organism 'A' (Williams, 1997). However, genes may also proliferate at the expense of other competing genes. The mutant gene increases its frequency in the pool even if it does not have a positive effect on survival machine. At the gene level, altruism cannot take place. At the organism level, altruism in the form of kin selection and inclusive fitness is very much a part of human interaction. Another type of altruism occurs naturally among individuals living in social groups. That is discussed next.

2.3.2. Reciprocal Altruism

Beyond immediate kin, it makes sense from an evolutionary standpoint for social beings to maximize friendships and minimize antagonistic relationships with others with whom they interact in a social group (Williams, 1966). Certain sentiments are useful for survival by regulating altruism. Friendship, trust, and suspicion (among others) are important adaptations to our Pleistocene ancestors for navigating the social world. Altruism, as demonstrated by kin selection, involves actually helping another individual who likely possesses similar genes. It is

also helpful to an organism to give other individuals further removed from a social group the impression that an altruistic act has been proffered (Wright, 1994). Reciprocal altruism is "behavior that benefits another organism, not closely related, while being apparently detrimental to the organism performing the behavior" (Trivers, 1971: 35). In certain circumstances, natural selection will favor altruistic behavioral tendencies because they benefit the living being performing the act. Often, there is a time lag between the altruistic act and the return favor.

If altruism is to evolve in our species, Trivers postulated that the cost must be small to the altruist and that there must be regular contact between recipient and provider. Otherwise, altruism would have been selected out long ago since the costs incurred would have eliminated the altruistic organisms, thereby wiping out the trait within the species. According to Trivers, reciprocity turns a single-iteration act (altruism) into long-range cooperative behavior between individuals. Reciprocal altruism is very much a part of the human species. It is ingrained in our behavior and responsible for influencing how we deal with each other in social exchanges of all kinds, including in business organizations. Eons ago it may have started as kin selection but expanded to include others with whom our ancestors came into contact (Blackmore, 1999). Some theorists believe that norms of fairness and justice may be traced to this form of altruism (Ridley, 1996). Certainly, there are ethical implications associated with this contention. I will revisit these possible implications in the coming chapters.

No discussion of reciprocal altruism is complete without mentioning the formal model of how cooperative strategies developed. "Game theory is a branch of mathematics designed for studying situations where individuals have conflicting wants" (Gaulin & McBurney, 2001: 76). Assuming individuals are rationally self-interested, game theoretic models test what strategies people take when faced with distribution of benefits and harms. One of the most famous games,

the Prisoner's Dilemma (Luce & Raiffa, 1957), has been frequently used by evolutionary biologists, economists, and anthropologists to analyze social interactions and selection theory (Bergstrom, 2002). In this game, two players are charged with a crime. They are separated and each told that they are to serve so many years in prison knowing full well that they indeed committed the crime. When arrested they agree to cooperate with each other and not confess to the crime to the police. Three alternative scenarios can happen in this game: the convicts can cooperate with one another by remaining silent to the police, both confess (defect from their prior agreement with one another), or one of them can confess while the other remains silent. If they both cooperate, then the two convicts receive a minimum sentence. If they both confess, then a moderately severe sentence is issued to both men (equally). Finally, if one confesses and the other does not, the confessor gets off without any penalty while the crime partner (who remained silent) will serve a maximum sentence. Obviously, the most rationally self-interested decision on the part of each player in the game is to defect (cheat). "The important point is that a perfectly rational and selfish person will always gain by defecting" (Blackmore, 1999: 150). However, this statement is only true when the likelihood that the players will encounter each other again in the future is low or nonexistent.

In a single-iteration game of this sort, people would rarely have the motivation to cooperate with one another. Cheating on others in social contract exchanges would always benefit a selfish person when those players do not have a chance of interacting in future exchanges. In terms of costs and benefits, a cheater confers no costs but accepts benefits, and a cooperator incurs a cost and confers of fraction of the benefit (Bergstrom, 2002). Only in multiple-iterative games does cooperation evolve over time. In repeated exchanges, cheaters will be avoided and cooperating souls will choose only to engage in social contracts with others who

are willing to cooperate. In other words, cheaters are punished by not having the opportunity to form alliances with others in the future since no one will contract with them again.

Computer modelers have attempted to devise strategies for participants in multi-round games. The most famous strategy, Tit-for-tat (Axelrod, 1984), describes the process of reciprocity in nature and provides insight into how cooperative behavior among "selfish" beings could have evolved through time. Simply, Tit-for-tat mimics the behavior of the other player in the two-person, multi-round game. If one person cooperated, the partner would cooperate; cheat, if the person observed cheating. The evolutionarily stable strategy is the one that spreads through the population and dominates behavior. In the computer models, Tit-for-tat was the only approach that expanded in numbers in the population.

What does this tell us about reciprocally altruistic behavior in societies? For one thing, cooperation evolved as a benefit to individuals or groups. Altruism in this sense is not really altruistic at all in terms of consciously helping others because the underlying motivation is simply to benefit the self (Blackmore, 1999). In the strictest biological sense at the gene level of analysis, altruism is individually instrumental. That is all. Again, by taking the perspective of a higher level of analysis, other explanations begin to appear. Before I describe the neural processes that must be in place to facilitate cooperative behavior in humans, I will briefly discuss another possibility for altruism in human society.

Susan Blackmore (1999) offers an explanation of how helpful, altruistic behavior can proliferate and become desirable in a population. Generous behavior is spread through the population of a species via memes. Her memetic theory of altruism is based on the fact that altruistic people are preferred by others in a group and those altruistic individuals are more likely to be copied or mimicked by others in the group. Memes then become the mechanism by which

altruism is transferred. Since people are able to imitate the behavior of others and since altruistic behavior is desirable for successful social exchanges, the trait is spread. Blackmore suggests that "the possessors of the best memes will have a survival advantage," which (as I have shown earlier in this chapter) will increase the probability that those individuals will sexually reproduce (1999: 159). Ultimately, this implies that genes and memes co-evolve and affect each other. If we are to believe in this high level of interaction of evolutionary variables, then the nature versus nurture debate almost becomes a moot point.

2.4. **Nature-Nurture Debate**

> *"It's time to drop the either-or dichotomy of nature-nurture and to confront just what this fusion of consciousness, cognition, culture, and biology that we call "human" is really all about."—Niles Eldredge, 1995*

Before proceeding to the literature review and theoretical background of evolutionary psychology in Chapter 3, a relevant issue to this project must be addressed. The theory that is advocated and used in this dissertation very much hinges on the outcome of the nature-nurture debate. Unfortunately, it is not a neat and clear-cut argument. The resolution over which has a more significant influence on human behavior and the development of species is a hotly contested issue in the life sciences. Chronically, the social sciences have been plagued by the restrictive idea that human behavior is the result of biology *or* culture (Greenwood & Stini, 1977). Dividing nature and nurture in this manner is an unrealistic way of viewing the influences on our behavior. The common nature-nurture-dichotomy approach to understanding human behavior is inadequate and must be expanded.

This dissertation does not entertain the notion that features of individuals are the result of either a biological factor or a cultural factor. Rather, I argue that there is a high level of gene and

environment interaction contributing to the fit of organisms to their environment (Gaulin & McBurney, 2001). In the earliest stages of human evolution, culture and physical (and, mental) evolution went hand-in-hand (Eldredge, 1995). About two million years ago, culture began to be a significant force over the pure physical and genetic factors governing ancestral human behavior. Later in our species' development, culture began to take on a more profound influence on how we dealt with our ecological environment. Over time, these changes accumulated. As our environment changed through the millennia, certain traits were less useful in adapting to the conditions. Other traits achieved greater success depending on the ecological context as well. Environmental conditions mandated change, which was conferred by our species' culture in addition to its genetic capacities. "Biological and cultural evolution definitely are biased toward the…new, improved version of an existing structure, or cultural artifact, that simply works better than the preexisting version" (Eldredge, 1995: 36).

Biological and cultural evolution operate concurrently on the species; the former progressing by the transfer of heritable traits from generation to generation through sexual reproduction, and the latter through the accumulated database of knowledge passed on through learned experience. Both are powerful agents of change. While biological evolution enables humans (and other species) to adapt to the environment, cultural evolution has become our particular species' mode of adapting to the environment.

To navigate and survive in a world of social interactions, our ancestors needed to adapt mentally to the new world order. In the next chapter, I will outline the theory that explains the psychological mechanisms of human behavior. Human social behavior (the focus of my study) is the product of perceptual cues from the environment and hardwired psychological mechanisms formed by natural selection through evolutionary time (Pierce & White, 1999: 843). It is not a

stretch to claim that the nature and nature controversy is beginning to be resolved. The common ground discovered by both camps is the view that organisms and environment interact to a great degree. Nature and nurture "play a duet rather than one directing the performance of the other" (Plomin, 1994: 40).

3. COSMIDES' SOCIAL CONTRACT ALGORITHM THEORY

The driving theory of this dissertation, Cosmides' social-contract algorithms theory, is presented in this chapter. The chapter begins by describing the approach to psychology on which the theory is based—evolutionary psychology. Generated by the assumptions and propositions of evolutionary biology, links are drawn from evolutionary psychology to the processes of natural selection and adaptation. Then, an overview of the approach is offered before launching into a detailed description of Cosmides and Tooby's theory of social-contract and cheater-detection algorithms on which my study is based. En route to discovering how people came to solve the adaptive problem of social exchange, I will explain how natural selection designed the human mind through an interaction of cultural and biological influences. Alternative views of the mind's design are acknowledged in this chapter as well, in an effort to broaden the perspective on social exchanges in business. This view of evolutionary psychology will be useful to determine its viability as an approach for business ethics.

3.1. **The Integrated Causal Model of the Human Mind**

To focus the remaining discussion on the formation and design of the human mind through evolutionary processes, a good starting point becomes defining the model of mind being advocated here. It is orthodox in the social sciences to view the human brain as an amalgamation of various experiences, that environmental and social forces (i.e., culture) are primarily responsible for all of the content in the brain. Tooby and Cosmides (1992) define this view as the Standard Social Science Model of human cognition. In this view of the workings of the human mind, there exist a few general-purpose brain circuits which are perfectly malleable by content. In other words, the brain is composed of content-independent brain algorithms which

have no specific instructions as to how to accomplish certain tasks. (The content of the brain domains will be discussed later in this chapter.) In terms of the nature-nurture debate, advocates of the Standard Social Science Model side with nurture. To resolve differences in the debate, I utilize the Integrated Causal Model, which seeks unification between the two camps by discovering universality of human behavior at the evolved psychological mechanism level, rather than in explicit cultural behaviors (Cosmides & Tooby, 2000a: 5).

The Integrated Causal Model recognizes that "the human mind consists of a set of evolved information-gathering mechanisms…which are produced by natural selection over evolutionary time in ancestral environments. Many of these mechanisms are functionally specialized to produce behavior that solves particular adaptive problems, such as…cooperation" (Tooby & Cosmides, 1992: 24). Some of the content-specific specifications in the algorithmic design of the brain "generate some of the particular content of human culture, including certain behaviors" (24). "On this view, culture is the manufactured product of evolved psychological mechanisms situated in individuals living in groups" (24).

To understand the evolution of the human mind, the Integrated Causal Model is necessary. The brain is formed by complex functional adaptations to the social environment in which our ancestors lived. "Complex functional adaptations…require multiple genetic features to build a complex interdependent system in the phenotype" (Yudkowsky, 2002**:** 2). Fitness depends greatly on the regularity of both the organism's external environment and the genetic environment. So, adaptations can only occur when a previous adaptation is genetically present consistently and when a certain external environment configuration exists over time. In addition to speaking to the interaction of nature and nurture, this insight also gives the context for evolutionary psychology. During the Pleistocene period, our ancestors were faced with adaptive

challenges involving social interaction. Over eons, this type of external environmental challenge remained largely unchanged allowing any genetic adaptations to spread through the population.

It should be emphasized that the SSSM and the ICM come to two very different conclusions about the formation of the human mind. The former views the mind as a veritable blank slate (Pinker, 2002), where the circuits of the brain simply absorb knowledge accumulated by culture, thereby erasing any specialized mechanisms for dealing with specific problems. Content populates the brain's circuits only through external environmental experiences. The competing ICM view claims that "the neurally based learning capacities of humans include specializations that evolved among our foraging ancestors to solve the specific adaptive problems posed by the statistical and causal structure of the ancestral world" (Lieberman et al, 2002:1). The specializations embedded in the neural architecture of the brain contribute to the generation of culture and that culture will cause a variance from the baseline behavior (Tooby & Cosmides, 1992).

The past explains the present according to evolutionary psychologists. For the kind of cooperation between two individuals described in chapter 2 to evolve and spread in a population, the brain must evolve particular circuits responsible for performing specific tasks related to social exchange. In evolutionary game theory, Tit-for-tat is considered an evolutionarily stable strategy because environmental and genetic conditions persisted long enough for the tendency to cooperate to proliferate throughout the human population.

3.1.1. Revisiting the Level of Analysis Problem

To study human behavior using evolutionary insights, it is critical to resist the urge to draw a direct relationship between evolution and observed behavior. Instead, evolutionary theory should be used "as a heuristic guide for the discovery of innate psychological mechanisms" (Cosmides & Tooby, 1987: 279). Cosmides posits throughout her research that natural selection and evolutionary theory are not useful in drawing a typology of human behaviors. The social sciences, on the other hand, tend to operate at this level of manifested behavior. Thus, there is another way of looking at natural selection, through another level of analysis. In no way does natural selection predict human behavioral outcomes. In fact, natural selection very clearly demonstrates that human behavior will be highly variable. Natural selection would not be possible if variation did not occur in species (Elderedge, 1995). Since this variation occurs at the cognitive level of analysis as well, natural selection can also be observed in human brains. While natural selection does not predict nor define function, it is a process that operates on variations of features, selecting for survival the particular forms that enable adaptations. The variations that are selected out of a species are the ones that became obsolete in aiding the survival of the organisms. So, to be accurate about the model of natural selection and its relationship to evolved behaviors, an extra step needs to be acknowledged. Proximate causation occurs at the psychological mechanism level of analysis (Cosmides & Tooby, 1987). Evolution leads to the formation of psychological mechanisms, which then leads to behavior. Design features are examined by the theory; not specific behavior. Evolutionary psychology is the approach that examines those evolved psychological mechanisms.

3.2. The Evolutionary Psychology Approach: The Design of the Mind

Evolutionary psychology is an approach or way of thinking about any field in the psychology paradigm, so that its basic tenets can be applied to sensation, consciousness, learning, motivation, social behavior, and cognition (Gaulin & McBurney, 2001). It is a branch of biology governed by the principles discussed in the previous chapter. The same natural selection processes that design the physical features of organisms' bodies design the structure of the mind as well. Physical forms evolved from the functions they serve for the organism who possesses them. Essentially, evolutionary psychology is the integration of evolutionary biology, biological anthropology, and cognitive psychology (Tooby & Cosmides, 1992). The insights of evolutionary biology form the foundation of cognitive neuroscience to explain how the structure of the human brain evolved through time. "By providing the functional engineering specifications to which human brains were built to conform, evolutionary biology" can help in understanding the cognitive architecture of the brain (Tooby & Cosmides, 2000: 1186). Essentially, the approach taken by evolutionary cognitive neuroscientists is to reverse-engineer the brain. Since the design features of the brain are evident and available for observation, the strategy for understanding how the brain works comes from an investigation into the functions which the structure serves.

Overall, the evolutionary psychology research program is interested in the broad array of problem-solving devices in the brain, each evolved by natural selection to perform exact tasks. In order to comprehend how these circuits operate and interact with one another, it is necessary to first understand what functions each circuit served our foraging ancestors (Cosmides & Tooby, 1999). The traits and structures we observe today needed to be advantageous to our ancestors for adapting to their environment. Based on this key assumption, the first task of cognitive neuroscientists becomes deducing in what conditions our ancestors lived. Cognitive

neuroscience "is the study of the design of minds that were produced by the evolutionary process" (Cosmides & Tooby, 1995: 1202).

3.3. **How Do Humans Reason?**

An ongoing debate in the psychology field is over how humans reason through dilemmas. More specifically, evolutionary psychologists have been deliberating over how to explain logical reasoning abilities in individuals. Early on in the quest for insight into how people reason, researchers thought that adult individuals reason using formal logic procedures absent of context and deductive in nature (Henle, 1962). Through repeated studies utilizing the Wason selection task (discussed in detail in the following chapter), the ability to reason through abstract formal logic problems have proven to be quite difficult for most individuals (Wason, 1966; Griggs & Cox, 1982). Even with experience, reasoning through abstract, formal logic tasks, individuals cannot consistently perform the tasks with any proficiency (Manktelow & Evans, 1979). Thus, the pursuit of knowledge about humans' reasoning abilities stopped perilously short regarding formal logic procedures.

3.3.1. Pragmatic Reasoning

Emerging out of this failure to account for individuals' reasoning abilities through formal logic procedures and prior experiences, a new theory was offered. While the aforementioned theories were based on deductive reasoning, where generalities are made from inferred knowledge about particular instances, this alternative view is inductive in nature. Cheng and Holyoak (1985) proposed that logical reasoning comes from pragmatic reasoning schemas. They argue that our ancestors had to consistently discover practical solutions to everyday

problems, and that the brain is structured according to the classes of goals that had to be attained for survival. This is significantly different in a qualitative sense from the formal logic view, and also somewhat removed from what Cosmides and Tooby postulate (as we will see in the next section). "The schematic structures that guide everyday reasoning are primarily the products of induction from recurring experience with classes of goal-related situations" (Cheng & Holyoak, 1985: 414). The schemas are made up of general rules sensitive to situational context and are sorted by desirable actions. The set of rules derived from these practical schemas are believed to be useful in predicting outcomes in very specific situations (Markovits & Savary, 1992). How people practically interpret environmental situations or dilemmas forms the basis of reasoning rules in the brain. To survive, humans through evolutionary time had to be able to solve problems facing them, achieve objectives, and comprehend cause-and-effect relationships. The schemas which enable these interpretations are universal to human brain structures. This universality does not exist at the level of human behavior but at the level of phenotypic (i.e., organism) design.

Despite this universality across the species, pragmatic reasoning schemas are not the only type of algorithm responsible for reasoning, according to Cheng and Holyoak. Additional and alternatively primed circuits can be activated within different social groups of people. The authors "invoke content-dependent computational mechanisms to explain reasoning performance that varies across domains" as does Cosmides in her research (Cosmides & Tooby, 2000b: 1266). Cheng and Holyoak argue that human reasoning is a multi-faceted generalized skill that is flexible enough to be useful in a variety of situations. Their only stipulation is that the schemas responsible for this reasoning are governed by the need to be pragmatic rather than abstractly "logical."

This competing theory solicits the belief that social contract rules are actually part of a larger category—permission rules. Permission schemas operate under the premise that actions are dependent on preconditions. According to permission rules, if an action is to be taken, a precondition must be satisfied first. Although social contracts are discussed later, it is worth noting that social contracts are one form of permission rule but not all permission rules are social contracts. Permission schemas reason through a wide class of problems that include social contracts and precaution rules. Precaution rules, which also are a type of permission rule, deal with hazards and precautions. If a certain hazard is present, then a particular caution must be taken. The ability to detect violations of this type of rule certainly was critical to our ancestors' ability to survive, as some hazards can be life threatening.

Pragmatic reasoning schemas "can provide access to patterns of deduction that may…be identical to those required by textbook logical rules" (Markovits & Savary, 1992: 134). In other words, logical reasoning is a side effect in certain instances of the activation of these practical reasoning modules. So, while studies have found that humans do not have an innate ability to reason through rules of formal abstract logic, logical reasoning is often a byproduct of the operation of these schemas. The reason for this is that pragmatic reasoning schemas such as permission rules take the linguistic structure equivalent to a logical conditional. According to Cheng and Holyoak's theory, the activation of permission schemas will provide access to deduction patterns (acquired through experience) that also elicit the logically correct response of affirming the antecedent and falsifying the consequent.

In their research, Cosmides and her colleagues refute the claim that there is a broad-based type of circuit in the brain responsible for all kinds of social exchanges, which simultaneously can account for performance on logical reasoning tasks. Using the Wason instrument (discussed

in the next chapter), Cosmides favors a different theory about human reasoning. She argues that the "human cognitive phenotype has many features that appear to be complexly specialized for solving the adaptive problems that arise in social exchanges" (Cosmides & Tooby, 2000b: 1266). Humans' minds are representative of an orchestra of intermingling circuits each responsible for a different task. The circuits are not general but quite specific in their function. This competing hypothesis is that the functionally specialized inference system includes *distinct* algorithms designed for reasoning about precaution rules.

3.4. **Computational Theory of Social Exchange**

This section describes the process by which the neural modules governing social exchange evolved. The argument is built upon the basic principles of evolutionary psychology, which are outlined first. Then, the discussion narrows to the particular problem of reasoning about social contracts. Cosmides' theory of social-contract algorithms describes the computational architecture in the brain designed to solve the specific adaptive problem of reasoning through social exchange relationships.

3.4.1. Form Follows Function

Through mutation (chance) and natural selection does evolutionary change take place. Natural selection organizes economizing functional features into the phenotype of a species (Dawkins, 1986). Following the same form-follows-function logic of evolutionary biology, "the mind consists of a set of information-processing circuits that were designed by natural selection to solve adaptive problems that our ancestors faced…" (Cosmides & Tooby, 2000b: 1259). To map the form of the neural algorithms in the brain, the specific functions the brain is designed to

perform must be discovered first. The basic explanatory system for cognitive neuroscience was developed by David Marr (1982). He posited that information-processing circuits in the brain are designed to solve adaptive problems by virtue of their structure (Cosmides & Tooby, 1995). The physical structure exists by virtue of the set of programs that were naturally selected to solve a particular dilemma. Thus, the level of analysis for cognitive neuroscientists is the functional level (Cosmides & Tooby, 1997). These devices in the human mind must solve certain biological problems with great efficiency if the individual is to survive. The individual circuits are each functionally designed to solve a particular adaptive problem that arises from the environment.

Natural selection in this sense becomes a feedback system where the most efficient and effective phenotype of the brain will proliferate through the population. One of the greatest debates in all of evolutionary psychology is whether this phenotype is composed of domain-specific circuits designed to solve particular problems, or domain-general ones, capable of solving a variety of tasks. The Cosmides school advocates the former. The argument follows in the next section.

3.4.2. Specificity of Domains

As stated, the environment posed specific challenges for our Ice Age ancestors, all of which compromised their survival abilities. Computational modules in the brain evolved that helped to solve those particular survival problems. These circuits contain inference procedures and underlying assumptions "that embody knowledge specific to a given problem domain" (Cosmides & Tooby, 2000b: 1261). The brain is made up of a great number of special-purpose mechanisms that are, in effect, designed to solve a vast array of problems facing humans

(Chomsky, 1975). Specificity of problem solving domains is advantageous to an individual over domain-independent systems because the more adept an individual is at a particular task, the more quickly and efficiently that individual can solve the problem. Darwin claimed that the more critical the adaptive dilemma facing the individual, the more "intensely selection should have specialized and improved the performance of the mechanism for solving it" (Cosmides, 1989: 193). Different programs are necessary to solve various adaptive problems. In certain domains, a computational mechanism will be activated, while in other domains, that same computational mechanism will remain dormant. The brain will be able to solve more problems if it is encoded with a plethora of specialist reasoning mechanisms for various domains.

Modern behavioral scientists view the modules in the brain differently. Following the Standard Social Science Model, this view holds that reasoning is conducted by content-free circuits that work in a variety of circumstances. "Rational" algorithms are one type of content-independent domain. They "implement formal methods of inductive and deductive reasoning" (Cosmides & Tooby, 2000b: 1261) and reason through any problem across domains.

If this view were true, and humans operated in a rational manner based on these content-free, general purpose algorithms, then human minds would not contain any domain-specialized data that would be useful in some domains but useless in others. The evolutionary psychologists do not discount the existence of inductive-reasoning mechanisms that contain particular rational rules, but they do contend that their activation is domain-specific (Brase, Cosmides, & Tooby, 1998). General purpose rationality is not enough to explain human reasoning.

3.4.3. Social Contracts

The first step toward characterizing the computational makeup of the mind related to social inferences is to formulate the information processing problems related to social exchange. Then, the design evidence for solving these information processing problems must be identified. For social exchanges, we have to figure out what has to happen if social contracts between two individuals are to be successful. "The computational theory of social exchange suggests cognitive processes that govern human reasoning might have a number of design features specialized for reasoning about social exchange" (Cosmides & Tooby, 1995: 1202). The evolutionary psychologists define the rules that compose the social contract from this social exchange logic. "A social contract relates perceived benefits to perceived costs, expressing an exchange in which an individual is required to pay a cost to an individual in order to be eligible to receive a benefit from that individual (or group)" (Cosmides, 1989: 197). From this, we can derive a grammar of social contracts which must be present for the neural modules in the brain to recognize the existence of this type of social exchange.

What properties must a Darwinian algorithm (i.e., neural module) possess to effectively reason about social exchange? The grammar of social contracts is simply the set of rules for forming a social contract with another person. One of the assumptions is that the formulae for social contracts are expressed in terms of costs and benefits. For inclusive fitness, our ancestors needed to calculate the costs and benefits of a particular social agreement to exchange. Potential harms and utility of an exchange had to be accurately assessed in order for successful exchanges to take place (Cosmides, 1985). Cooperation between two individuals can spread through a species as a strategy for solving adaptive problems when the individuals benefit from the

exchange while incurring the lowest possible cost. So, knowing the costs and benefits of the exchange becomes critical (Cosmides & Tooby, 1989).

The neural algorithms responsible for calculating these costs and benefits have to be item-independent as well; that is, they should make these calculations in the context of costs and benefits to the participants for each exchange. The costs and benefits are likely to change from context to context across social exchanges. Before the proposed social contract arrangement takes place, it is also assumed that each contracting party will have certain expectations regarding their future worth and state. Cosmides (1985) calls this the baseline or zero-level utility. A benefit is something which causes a person's utility to rise above the baseline level. For contracts to be accepted the benefit to the person must actually cause the person to be better off than s/he would have been without having entered into the arrangement. On the other hand, costs are defined as any harm which decreases a person's utility below the baseline. To accept the offer, the cost incurred must be less than the benefit earned. A well-formed social contract takes the form "If p then q." As I will demonstrate in the following chapter, Cosmides also demonstrated that logically correct responses only apply to social contracts constructed in a standard "*If p not q"* form. The *p* in this case represents the benefit to the person entering into the agreement, and the *q* is the cost incurred. Cosmides' research lends support to the statement that in a switched social contract structure, in which the "cost paid" is the antecedent of the conditional rule and "benefit received" is the consequent, logical reasoning does not take place. Evolutionarily-formed algorithms must be adept at calculating these costs and benefits for social exchanges to take place (Cosmides, 1989).

The above conditions represent a situation in which a person theoretically would accept an offer from another party. It should be noted that a person would only be willing to make an

offer if they expect not to confer the benefit by any other means. This is a key assumption of Cosmides' social contract theory. The person must believe that s/he will not receive the benefit if s/he does not incur the cost with a potential partner. Moreover, a person will not offer a social contract if they do not expect the benefit to be higher than the cost incurred, thereby raising personal utility above the baseline. Thus, both parties must perceive that they will be better off.

Social exchange is intercontingent in nature. Social exchanges take the form of the conditional rule: *"If person A provides the requested benefit to or meets the requirement of person or group B, then B will provide the rationed benefit to A" (*Cosmides & Tooby, 2000b: 1260). Social contracts in the form "If p then q" document the "ways in which the behavior of one person is contingent upon the behavior of another person" (Cosmides & Tooby, 1989: 82). Social contracts only occur when *both* parties perceive an obligation and an entitlement. Plus, these perceptions of obligations and entitlement are related through reciprocity. One's perception of obligation is equal to another's perception of entitlement. However, there is no mandate for the contracting parties to accept their entitlement. Therefore, social contracts of this nature are not biconditionals (i.e. they do not take the form of "*p if and only if q.")*. When the structure of the rule is in this form, it is considered a social contract.

My dissertation utilizes Cosmides' social-contract algorithm theory and tests its predictions in a business context on a business population. Given the constraints on human evolution caused by social exchange problems, Cosmides and her colleagues posit that the cognitive architecture of the human brain has specialized, expert systems for reasoning about social interactions. Her work in cognitive neuroscience is considered a theory of adaptive problems—the problem being social exchange. For a computational theory of an information-processing problem to be useful, the adaptive problem must be well-defined. Cosmides limits

her theory to the reciprocal exchange of costs and benefits between two contracting partners. She deals with situations that require cooperation for mutual benefit (Cosmides & Tooby, 2000b). Her social contract theory involves a task analysis of what the algorithms actually do when activated and why it is important for those algorithms to exist.

3.4.4. Cosmides' (1989) Social-Contract Algorithm Theory

Cosmides' research challenges one of the primary assumptions of the behavioral sciences. Contrary to the assumption that the brain is comprised of a limited number of domain-general, content-independent circuits, she argues for domain-specific, content-dependent mechanisms designed to solve very specific adaptive problems. Regardless of environmental conditions, the same phenotype of the brain exists in every human that serves the needs of the species. This phenotype includes machinery that enables organisms to reason about social exchange. Through her research stream, Cosmides developed the idea that reasoning about social exchange is controlled by social contract algorithms, which compute the information necessary to engage in and maintain mutually beneficial social relationships.

The research stream advocated by this group involves defining what abilities a person must have to enable social contracting. Using Marr's (1982) computational theory as the logic for their evolutionary analysis of social exchanges, Cosmides' focus is on predicting what features the algorithms must have in order to successfully reason through social interactions. Following the cognitive neuroscience agenda, Cosmides attempts to identify and sort the modules in the brain into functionally specific units. For social exchange, potential contracting partners must have the ability to recognize costs and benefits of the exchange. When presented

with a decision rule, the algorithms assess these harms and gains over the baseline. In essence, they *compute* whether the contract is beneficial to the person overall.

For social exchange to evolve in a species, reciprocity must be the favored strategy (think Tit-for-tat). Algorithms designed to enable individuals to reason about social exchange would then favor relationships that were cooperative. Social contract algorithms would also need a sub-routine mechanism designed to detect defectors from the agreed upon reciprocal arrangement. Individuals who cheat on a contract are distrusted in future social exchange relationships. Thus, "human social contract algorithms must include procedures that allow us to quickly and effectively infer whether someone has cheated, or intends to cheat, on a social contract" (Cosmides & Tooby, 1989: 84). Cheating is simply a violation of the conditional rule of the social contract, either implied or explicit. Cheating involves not paying a cost when the exchanged benefit was taken. From the first-person perspective, an individual has been cheated when s/he pays the cost but does not receive the agreed upon benefit and vice versa.

The cheater detection subroutine operates on an inference procedure for identifying potential cheaters. Evolutionarily speaking, it was important for our Pleistocene ancestors to efficiently and quickly detect cheaters on social exchanges so as to exclude or punish that person in future exchanges. Punitive sentiments toward a cheating party involve not contracting with that party in other encounters (Price, Cosmides, & Tooby, 2002). Those contractors who accepted a benefit would need to be observed to discover if they paid the required cost. By the same token, contractors who did not pay the required cost would need to be observed to see if they unjustly accepted the benefit. A person looking for cheaters from contracting partners can ignore individuals who do not take benefits as well as those who pay the cost because those people are not causing direct harm.

3.4.5. Cosmides' Theory: A Refinement

Another view of human reasoning architecture was offered by Gigerenzer and Hug (1992). These evolutionary psychologists do not refute Cosmides' theory but refine her approach. Gigerenzer and Hug claim that Cosmides did not go far enough to break down the structure of the modules. In her early research, Cosmides claimed that the variance in her findings was caused by the activation of social-contract algorithms alone. Gigerenzer and Hug, on the other hand, posit that cheater-detection reasoning is something different from social-exchange reasoning and the algorithms are distinct. Their position is based on the premise that in social contracts, a person's perspective is important in the ability to detect cheaters (a factor ignored in Cosmides' (1989) theory). When there is a possibility of cheating on a social contract by a person's contracting partner does the algorithm get triggered. It is not enough for a person to recognize a social contract situation to detect a potential cheater. The social-contract algorithms are activated when a social contract arrangement has been entered. But cheater-detection algorithms are separately activated only when the situation warrants the detection of cheaters. The contracting partner must have the opportunity to cheat in order for these circuits to work. Originally, Cosmides thought social contract reasoning in general accounted for the cheater detection effect. Gigerenzer and Hug (1992) empirically studied social contract situations with varying respondent-role perspectives. Only the situations where respondents were asked to place themselves in the perspective of the party that could be cheated did the respondents correctly identify the cheaters. "If a person represents one person in a social contract, and the other party has a cheating option, then a cheater-detection algorithm is activated that searches for information of the kind 'benefit taken and costs not paid' by the other party" (p.

165). This research does not support Cheng and Holyoak's domain-general stance on human reasoning.

In the process of retooling the Cosmides and Tooby approach to human reasoning based on Pleistocene-formed circuits, Gigerenzer and Hug made an unexpected discovery. A group of their research subjects did not use social-contract or cheater-detection reasoning in the Wason selection task. Instead, they used general-purpose formal logic in their reasoning. This group came from a mathematics and natural science educational background and tended to reason using the skills learned in those courses. It appeared that the ancestrally formed modules were moderated by cultural forces, or education in this case. The authors concluded that human reasoning is a hybrid of formal reasoning and domain-specific reasoning. They believed that "there is a continuum between these poles of content-independent formal theories of propositional logic and content-dependent theories such as Darwinian algorithms adapted to specific domains" (p. 169). Our Pleistocene minds play a major role in the way we reason in modern times but do not tell the whole story. As I suggest later, although the structure of our minds was in great part formed during the Pleistocene Era, the cumulative effects of culture through evolutionary time also played a major part in shaping our minds.

3.4.6. Deontic Reasoning

Another factor in our ancestors' survival involved the structure of social groups in which they lived. Evolutionary psychologist Denise Cummins (1998) refined Cosmides' approach even further. Cummins recognized that our forefathers and mothers operated in a social world that was organized on power differentials. Social hierarchies existed even before dawn of "Man." Common to social life among even non-human primates is the formation of dominance

hierarchies (Stone, 1997). Hominid apes demonstrated power-differential relationships. Today, social hierarchies are seen in chimpanzee groups (deWaal, 1996). Dominance evolved in these species because often dominant primates had more success obtaining resources such as food and sexual mates. It is not a stretch to imagine that early humans also had to navigate around a socially differentiated world. Based on this premise, "special reasoning architecture evolved (among apes and humans) to handle problems that are repeatedly encountered by individuals living in dominance hierarchies, problems that directly impact survival rates and reproductive success" (Cummins, 1998: 30). Deontic reasoning involves knowing what you may or may not do in a social arrangement. Permissions and obligations often arise out of rules created by people in positions of power. Those higher up in the hierarchy create conditional rules of acceptable behavior for subordinates.

Cummins argues that group norms develop from these social dominance practices. The norms set by the group (i.e., culture) include the obligation and permission rules set up in the social contracts. To maintain reciprocally altruistic behavior, social order rules developed in various cultures. Cheating behavior would be scorned and punished. The group norms and reciprocity checks essentially protected the group from deviant behavior which would adversely affect the group's ability to propagate. Groups that survived over the years and were able to reproduce realized that their long run best interests were realized if they protected themselves from selfish behavior on the part of a few individuals (Ridley, 1985). None of this is inconsistent with Cosmides' position. In fact, Cosmides acknowledges that in social exchanges, phrases in the conditional rules "should be interpreted deontically" (Cosmides & Tooby, 2000b: 1262).

3.5. **Conclusion**

This chapter has reviewed the alternative views of human reasoning based on the notion that certain modules in the brain evolved to solve adaptive problems efficiently. The extreme foil to this position is that the brain is a blank slate and that "the human mind has no inherent structure and can be inscribed at will by society or ourselves" (Pinker, 2002: 2). This view is generally accepted by social scientists and philosophers. The fact that political philosophers like Locke, Hobbes, and Rousseau believed that humans' behavior can be influenced and changed by a powerful entity made it convenient to believe that peoples' minds are easily manipulated by experience and culture. The blank slate view allows for unencumbered learning, which served as the basis for the belief that society could be changed for the better. For business ethicists, this view is very attractive and promising.

Pinker, however, argues that that view is seriously flawed. His position stands more on middle ground. He believes genes are a factor in the development of culture, that genes are critical in determining our abilities to some extent. "Differences in intelligence, scientific genius, sexual orientation, and impulsive violence are not entirely learned" (Pinker, 2002: 44). The human mind is not a *tabula rasa*. It can be molded and influenced by environmental cues and cultural factors, but the basic neural machinery is common across people in every culture on the planet by virtue of a natural selection process that enabled our species' need to perform specific adaptive functions through evolutionary time.

Cosmides admits that in order for an individual to adapt, that individual's information-processing circuits must be ecologically rational (Cosmides & Tooby, 1997). This means that the neural mechanisms must "embody principles that allow adaptive problems to be solved with reliability, economy, and precision" (p. 138). For this ecological rationality to exist, the brain's slate cannot be blank. Additionally, the more one looks at Cosmides' view of the brain's

evolved architecture, the more easily one can negotiate it with the alternate view (Cheng and Holyoak, 1989). Adaptation meant being able to understand one's environment. This includes being able to understand group norms, cause-and-effect relationships, and social hierarchies. Arguably, these are pragmatic goals. If we begin to picture the brain as an intricate web of interacting neural circuits, evolved so as to operate in concert toward a single goal—survival—then perhaps it is not as difficult to respect the profound dependence nature and nurture have on one another. Both are unavoidable.

Perhaps both evolutionary psychology camps are right. When certain conditions are present, individuals have demonstrated reliable and consistent abilities to reason through social contracts and detect cheaters (as I will show empirically in the next chapter). At the same time, humans can demonstrate this ability across a variety of situations and contexts. Humans are able to ingest environmental cues and decipher the rules in a particular context. Gary Marcus (2004) calls it a paradox. Despite the structural richness of the human mind, there is evidence of an incredible amount of neural flexibility. However, "Not every gene, nor every brain connection, can be modified by experience" (p. 99). Learning is possible through the links between experience and gene expression. What we learn is governed by the gene mechanisms in our minds and by culture.

Now that the concepts from evolutionary psychology have been described, and Cosmides' theory of social contracts has been outlined, it is time to turn attention to the empirical evidence for social exchange reasoning among individuals. In the following chapter, the main instrument used in the field for testing peoples' abilities to reason through conditional rules is presented—the Wason selection task. The empirical studies testing for the presence of social contract algorithms in the brain are presented after the Wason task is described in detail.

4. THE WASON SELECTION TASK

This chapter examines the Wason selection task instrument for use in studies about human reasoning. The method, originally developed in 1966, has been adapted for many uses and analyzed by psychology researchers for decades. While its format has changed significantly from its original intent, the selection task has been validated and proven reliable across many variations. Here the instrument is described and demonstrated in its original form. En route to discussing the validity and reliability of an adaptation or modification of the instrument, various factors that potentially could influence performance on the task are outlined. Then, the relevant adaptations for use in this study are reviewed, focusing mainly on Cosmides and Tooby's utilization of the instrument for identifying the existence of social-contract algorithms. Additionally, alternative explanations are briefly discussed.

4.1. The Original Wason Selection Task

Cognitive psychologist Peter Wason is credited with founding the British school of human reasoning. His interest in language led to his work in inductive reasoning, and with more breadth, in deductive reasoning. Prior to his invention and development of the selection task in 1966, the field relied entirely on syllogistic inference mechanisms for research on deductive reasoning (Wilkins, 1928; Woodworth & Sells, 1935). Since then, his selection task is the single most studied reasoning problem in psychology (Santamaria, Garcia-Madruga, & Carretero, 1996). Initially, he manufactured a logical reasoning test to determine the general ability of humans to recognize violations of abstract rules. The task presents the subject with an *If p, then q* conditional rule. This paper-and-pencil test asks respondents to discover when the rule has been violated over four occasions. For each instance, respondents are given only partial

information. Four cards are then shown with values for *p, not-p, q*, and *not-q*. Each occasion is represented by one of the four cards. On one side of the card, the information tells whether or not the antecedent (*p or not-p*) is true, while the other side gives information about whether or not the consequent (*q or not-q*) is true (Wason, 1966). The respondent can see only one side of the card for each occasion. The task is to ask the subject which card or cards (s)he must turn over to determine whether the conditional rule was violated. Logically speaking, a choice of *p* and *not-q* would be the correct response because only "the combination on the same card of a true antecedent with a false consequent can falsify a conditional rule" (Cosmides, 1989: 197).

The standard Wason selection task is an instrument designed to test an individual's ability to reason logically. In its original form, Wason (1966, 1968) constructed an abstract version where only letters and numbers were presented in the conditional rule and on actual individual cards. Four cards were placed on a table each with a single number or letter visible to the respondents. The other side was hidden. Two letters were visible and two numbers. Specifically, Wason asked respondents to decide which cards needed to be flipped in order to determine whether the conditional rule, "If there is an E on one side of the card, then there is a 4 on the other side" is true or false. Figure 4.1 illustrates Wason's first selection task.

Historically and over multiple iterations over the years, few people ever turn over the logically-correct cards. In this case, the "E" and the "7" are necessary to check the truth of the rule. The "E" needs to be checked in order to determine whether a "4" appears on the other side because any number or character other than a "4" would falsify the conditional rule. It is also necessary to verify the other side of the card with the "7" showing. Respondents should look to find an "E" on the opposite side since that would also falsify the rule. Logically, the rule cannot be disaffirmed by turning over either of the other two cards. In terms of the conditional rule,

there should be no interest in the "D" card because it matters not at all what is on the opposite side since the rule says nothing about cards with a "D" on them. Similarly, choosing the "4" card does not prove or falsify the conditional rule because there could be other conditionals involving a "4" that are unspecified by the rule. Fewer than ten percent of respondents turn over the *p* and *not-q* cards to falsify the rule.

Figure 1 Standard Abstract Logic Structure Wason Task

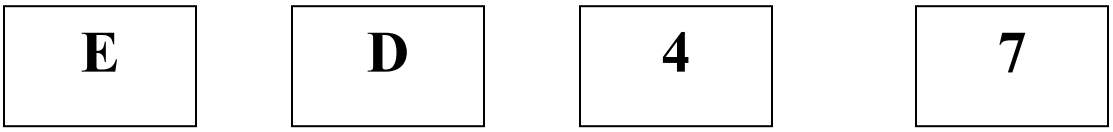
You are given the statement:

"If a card has a vowel on one side, then it has an even number on the other side."

(If *p*, then *q*)

The cards below have a single number on one side and a single letter on the other.

Which of the cards would you need to turn over to test whether the statement is true or false?



Source: Manktelow, 1999

The Wason selection task has been called the most popular experimental task used in the study of reasoning (George, 1991). The reasons for this stem in part from its unpredictability and its many uses. Ever since his original form, researchers in the field were fascinated by people's inability to logically reason through the task. Wason (1966) himself speculated as to why people were having such difficulty with the task. It is found that most people choose the *p* and *q* cards, or only the *p* card (Evans, 1982). This finding began a line of inquiry into the possible reasons for illogical card choices. The next section summarizes some of this research beginning with Wason's own interpretation.

4.2. **Factors and Biases that Affect Card Choices on the Selection Task**

4.2.1. Confirmation Bias

Wason (1966) attempted to account for the performance on his abstract tasks with what he termed the confirmation bias. In this type of bias, subjects tend to search for evidence among the card choices that confirms the rule rather than falsifies the rule. So, for Wason's abstract task in Figure 4.1, respondents influenced primarily by this bias would attempt to find the cards which support the rule, which involves a different card choice. Instead of choosing the "E" and the "7" cards, a subject being influenced by the confirmation bias would still choose the "E," but would select the "4" as well. Thus, the confirmation, or verification, bias causes people to choose the *p* and *q* cards and ignore the card represented by *not-q.* The target, or consequent of the conditional rule (*q),* is sought after to confirm peoples' belief that the rule is true. Wason claimed that individuals tried to prove the conditional rule true, which accounted for the errors on the selection task.

Johnson-Laird and Wason (1970) took this belief that there exists a verification bias and constructed a theory of insight and a formal model of confirmation. Their experiments demonstrated that subjects have a difficult time understanding the need for falsification on selection tasks of a conditional rule. Even when they enlightened subjects that a *p* value on the flip side of a *not-q* card would falsify the rule (insight), people generally still did not select that card. This effect was said to account for people's tendency to ignore the *not-q*. Reich and Ruth (1982) found an interaction effect between thematic content and verification bias. Only in scenarios with thematic content did subjects tend to choose cards which confirmed the rule. When abstract tasks were used, a matching bias was strongly elicited by respondents. This is discussed next.

4.2.2. Matching Bias

Another common type of bias that may affect card choices on abstract and thematic (discussed in the next section) rule content is matching bias. Matching bias was a direct manifestation of research investigating the verification effect on selection task card choices. Evans (1972) first discovered the effect in truth table tasks, but it can be generalized to selection type tasks as well. This phenomenon often occurs in all kinds of reasoning research. In abstract logic tasks, individuals are "more likely to select a card showing a matching item than one showing a mismatching item, irrespective of its logical status (Manktelow, 1999: 69). In other words, this effect basically entails respondents "matching" card choices to variables lexically mentioned in the conditional rule. So, the cards chosen tend to be *p* and *q*. Evans (1972) and Evans and Lynch (1973) tested this bias on Wason tasks by introducing negatives in their conditional statement. Instead of stating the rule as an "If p, then q" format, they changed it to "If p, then not-q." They found that respondents most often selected the *p* and *not-q* cards. Logically speaking, only when the rule was framed as a true antecedent with a false consequent did the matching bias cause correct responses. Incidentally, while both studies showed statistically significant support for the matching bias, the verification bias was not confirmed. The falsifying effect was much stronger when the rule was framed in a negative context. Manktelow and Evans (1979) found that regardless of abstract or thematic content, performance was consistent with the matching bias.

More recent research on matching bias confirms the phenomenon. Oaksford and Stenning (1992) rotated the negative components of the conditional rules on both the antecedent and the consequent. The matching effect was found on their first experiment which replicated Evans (1972). When asked to verify or falsify the rule, Oaksford and Stenning (1992) found a

substantial matching bias, but they were able to essentially eliminate the bias altogether when double-negatives were used in the conditional rule. This contrasting-class construction of the rule (Manktelow, 1999) was thought to be responsible for suppressing the matching effect. They believed that the bias suggested irrationality in human behavior, that the heuristics used to make decisions based on matching leads to systematic error. Evans, Legrenzi, and Girotto (1999) on the other hand, ran two experiments which tested various kinds of propositional rules (i.e., universal statements, disjunctions, and negated conjunctions) and observed the matching bias across every rule type. The effect was most strongly seen when respondents were required to falsify the rule (which is the approach of this dissertation). In earlier work, Evans (1996, 1998) attributed the matching bias effect on Wason tasks to existing heuristic judgments (Kahneman & Tversky, 1972) of relevant information. He also claimed that it interfered with the reasoning process. This explanation reflects Evans' view of the matching bias throughout his career.

In opposition to that view, Johnson-Laird (1995) posited that individuals pay close attention to cards on the selection task that are present in the rule. Then, he claims, people pick the cards that affirm or disaffirm the rule. Evans believes no analytic process is involved when the matching effect occurs, while Johnson-Laird believes that humans "convince themselves that the cards are logically necessary by reasoning" (Evans, Legrenzi, & Girotto, 1999: 191). Yama (2001) also confirmed that the matching effect takes place on selection tasks, but he argued that since matching saves cognitive capacity, this kind of relevance judgment indeed is a form of rationality (p.310).

4.2.3. Instructional Manipulations

Much interest has been taken in facilitating performance on selection tasks of either the abstract or thematic type. While the two aforementioned factors in this chapter generally account for decreased probabilities that logical card choices are made, this section briefly discusses an effect that is known to raise the likelihood that correct card choices are made. Early work by Wason (1966, 1968) asked respondents to determine whether the conditional rule was true or false. The true-false instruction was later believed to have a negative influence on selection task behavior. Yachanin and Tweney (1982) found evidence that performance on abstract selection tasks was enhanced slightly when the instructions asked respondents to choose the cards that *violated* the rule, rather than asking them to determine whether the rule was true or false. Griggs & Cox (1982) did not find this same effect for abstract selection tasks but agreed with Yachanin and Tweney's findings on tasks with thematic material (discussed in the next section). Later studies by Yachanin (1986) confirmed Griggs and Cox's findings.

The language of the tasks can be manipulated in other ways which have historically shown facilitation effects. Possibly the most interesting study of this type was conducted by Margolis (1987). Margolis argued that people have a strong tendency to assume that the contexts of the task scenarios are open. Since Wason selection task scenarios are intended to be closed in nature, this was hypothesized to be a potential source of the problem. Individuals are inclined to think of the card choices as categories rather than specific cases. Margolis' hypotheses were tested by Griggs (1989) and confirmed. A "misinterpretation of the selection task as an open scenario problem" could account for normal card choices of p alone, or p and q (Evans, Newstead, & Byrne, 1993: 106). Finally, Platt and Griggs (1993) found that facilitation on even abstract tasks can be fostered when the implication rule was explicated and when respondents

were asked to find violations of the rule rather than to see if the rule was true or false. Another interesting finding in this study came about on a separate experiment asking subjects to provide reasons for their card choices. The authors found that asking respondents to provide reasons increased their attention to the task at hand and improved logical card selection. Thus, there exists a strong attentional effect on Wason selection task performance.

4.2.4. Other Effects on Selection Task Card Choices

Researchers have paid some attention to intelligence and educational effects on peoples' abilities to reason through Wason selection tasks. Valentine (1975) reported a positive correlation between intelligence measures and selection task performance. Hoch and Tschirgi (1985) also found that level of higher education factored into subjects' ability to choose the correct cards on the tasks. Masters level students were more likely to select the cards necessary to determine violations of the conditional rule than were high school or undergraduate students. In fact, this study also reported an increased matching effect by less educated subjects. Contradictory results were found by Jackson and Griggs (1988) when they examined mathematicians and technical experts, however. Educational levels had no effect on selection task performance in their study. This led researchers in the field to examine whether training specific to logical reasoning would have an effect on individuals' ability to pick the correct cards on these tasks. Cheng, Holyoak, Nisbett and Oliver (1986) found that training in logic had no effect on performance.

Osman and Laming (2001) examined why errors are so often made on the selection task. They proposed that individuals are both incapable of reasoning logically and that they "misunderstand the rule they are asked to test, but thereafter respond in logical accord with the

rule as they understand it" (p. 128). They said that if subjects interpret the rule to be a bi-conditional, rather than unidirectional, then they are more likely to choose all four cards presented to them. The two sources of error they found were: 1) That subjects did not accurately perceive what the task actually consists of, and 2) subjects failed to accurately reason in the wake of that misperception (p.129).

In the same study, Osman and Laming found that the influence of prior experience is significant as well. So, while logic education had no effect on card selection, prior experience with a rule led to "an increased proportion of correct selections" (p.133). This is a critical factor for determining how card choices are made. An individual's perspective based on their understanding and experience can affect card choices on contextual selection tasks. Both of these factors play an important role in this dissertation's use of the Wason test. The content of the selection task scenario is discussed next.

4.2.5. Content Effects on the Wason Selection Task

Since Wason's earliest research on abstract logic tasks, there have been numerous studies focusing on thematic content effects on card selection. To obtain a comprehensive picture of the various competing interpretations of the Wason selection task card choices, it is desirable to provide a short description of this approach. Moreover, it is useful to have this background in order to fully understand Cosmides and Tooby's approach and what it refutes and builds upon. Due to claims that variability in individuals' card choices in part stems from differences in their "experience with different content domains," it became important to understand what kinds of content affected performance (Osman & Laming, 2001: 133). An interesting research venture was to figure out if performance could be facilitated on tasks with the injection of thematic

content. Fittingly enough, the first scholar to undertake such a task was Wason himself. Wason and Shapiro (1971) compared performance on selection tasks between scenarios involving abstract content with those involving thematic content. In its original form, a statement was provided about travel: *Every time I go to Manchester I travel by train.* On the four cards presented to respondents, either the name of a town or a mode of transportation was visible. (The cards displayed were: Manchester, Leeds, Train, Car) In order to find out whether the statement was true or false, subjects were asked to turn over the necessary cards. The falsifying cases (the *p* and *not-q* cards) are the "Manchester" card and the "Car" card. Sixty-three percent of the subjects were able to choose the two cards which would falsify the statement compared with less than ten percent on the abstract logic task.

This manipulation of the original task was a critical point in the study of deduction. In the common abstract tasks, the typical response was to omit the *not-q* card from the decision set of choices. Researchers focused on which manipulations induce "subjects to build explicit models which include the *not-q* card" (Evans, Newstead, & Byrne, 1993: 116). Researchers focused on realistic scenarios from this point forward. The next step was to transform the claim statement into a rule. Johnson-Laird, Legrenzi, & Legrenzi (1972) did exactly that by taking the thematic statement and creating an "If, then" rule based on postal services. In this study, respondents were specifically asked to indicate which envelopes would violate the rule, "If a letter is sealed, then it has a 50-lire stamp on it." About 88% of subjects were able to choose the correct *p* and *not-q* cards. Following this seminal study on the postal rule, reasoning researchers were convinced that a facilitation effect was occurring based on the added content provided in the scenarios; that people were better able to identify the logically correct response when the content was familiar and concrete. Wason and Johnson-Laird commented in their book (1972)

that the conditional in the tasks "takes on the color of its surroundings: its meaning is determined to some extent by the very propositions it connects" (p. 92).

Holes had been poked in the thematic facilitation effect later that decade. The reliability of the thematic content effect was questioned when Manktelow and Evans (1979), Reich and Ruth (1982), and Yachanin and Tweney (1982) were unable to replicate Wason's early results. On these studies, subjects did no better on the content tasks than on the abstract tasks. Not until Griggs and Cox's (1982) research did new insights in the effect emerge. Building on the experiments of Manktelow and Evans (1979), Griggs and Cox believed that facilitation had much to do with long-term memory cues. They administered Johnson-Laird and Wason's (1972) postage problem to their own subjects who had no experience with the British postal system. As they expected, facilitation did not occur because their American subjects' memories were not cued to the falsifying instance (Griggs & Cox, 1982: 414). Also in this famous study, the authors created a drinking age problem that was very familiar to their Florida college students. When presented with a conditional rule, "If a person is drinking beer, then the person must be over 19 years of age", subjects were asked to select the card or cards necessary to determine whether any customers in a bar are violating the rule. They were to imagine that they were the police officer responsible for upholding the rule. Subjects were told that each card had the person's age on one side and what they were drinking on the other. The four cards displayed the following information: "Drinking a Beer," "Drinking a Coke," "16 Years of Age," and "22 Years of Age." (This problem was reproduced and administered to my own subjects in a preliminary stage of my research project. The results are discussed in Chapter 5.) Again, the falsifying (logically correct) responses were the *p* ("Drinking a Beer") and *not-q* ("16 Years of Age") cards. Seventy-four percent of subjects chose the correct cards. The results of this seminal work have

been proved reliable through several replicated studies (Griggs & Cox, 1983; Griggs, 1984; Cosmides, 1989).

The memory-cueing hypothesis is usually categorized under the broader title of availability theories. Availability theories of reasoning are characterized by thematic content, but this approach "places emphasis on prior beliefs and associations which are evoked by the problem content" (Evans, Newstead, & Byrne, 1993: 121). It was suggested by Evans et al. (1993) that individuals may be more motivated to disprove a rule that they already believe to be false. Studies informed by Griggs and Cox's (1982) piece like George (1991), claim that any facilitation on thematic tasks has to do with a person's ability to remember the solution to the problem from past experiences. Ironically enough, the problem with this memory-cueing explanation was that it was illogical. This was demonstrated by D'Andrade (discussed in Evans et al., 1993) when he created a scenario involving a Sears department store sales scheme. The scenario elicited high rates of *p* and *not-q* card choices from respondents, but which could not possibly have been due to a prior real world experience with the specific task.

One of the factors that moderated performance on selection tasks in these thematic content scenarios was the transfer effect. Cox and Griggs (1982) demonstrated that certain content-rich rules, when preceded by the Drinking Age Problem, elicited higher rates of logical card choices than when the other content-rich rules were presented first. Although this did not seem to increase *p* and *not-q* card choices for abstract tasks, a possible transfer of knowledge from the first task given was occurring on within-subjects research designs. This dissertation study avoids this type of moderator by administering a between-subjects design.

While this early research on thematic content effects was not conclusive by itself to prove a general content influence, certain contexts did substantially enhance peoples' abilities to

choose the falsifying cases. When referring to the content effect on the Wason selection task, Cosmides called it unpredictable (1985) and Griggs and Cox (1982) called it "elusive."

My attention to this Wason selection task literature review turns now to the major content-dependent theories that have utilized Wason's instrument as a measure of individuals' reasoning capabilities. The alternative theories discussed in Chapter 3 are revisited here only in terms of their empirical manifestations as a way of showing the sensitive nature of the Wason selection task, as well as its versatility. Another goal of this next section is to demonstrate how the domain-specific reasoning processes (discussed in Chapter 3) emerged from the various empirical studies.

4.3. **Pragmatic Reasoning Schemas in the Wason Selection Task**

Two main approaches to the content effects on reasoning emerged in response to the heuristic and mental model views. The first one, pragmatic reasoning schemas, stands in stark contrast to its main rival, social contract theory (as discussed conceptually in the previous chapter). Popularized by Cheng and Holyoak in 1985, pragmatic reasoning schemas were proposed to account for facilitation effects on the selection tasks. This marked the first major attempt to provide additional insight into the effects of realistic content in selection task scenarios. As mentioned in the previous chapter, schemas "contain generalized abstracted knowledge which has been learnt or induced from experience in particular domains" (Evans et al, 1993: 125). Within these schemas exist rules for reasoning through particular problems reflecting the experience and knowledge obtained in specific contexts.

For Cheng and Holyoak's permission schemas, where a precondition must be met (*q*) before an action is performed (*p*), the card choices necessary to falsify the rule are still *p* and *not-*

q. They ran three experiments in total. The first one was designed to test whether rationale aided in peoples' abilities to identify the falsifying cards. For the postal rule (discussed in the previous section), they added content that described the purpose of the rule (to increase profit of private mail). When they provided this extra information, American students were able to find the proper cards. Their second experiment also manufactured facilitation by transforming an abstract rule into a permission rule. Their new rule, "If one is to take action A, then one must fulfill precondition P" added a permission component to abstract, thematic-neutral content. Over 60 percent of subjects faced with this task were able to select the falsifying cards. On the plain abstract rule, only 19 percent selected those cards.

Other studies followed Cheng and Holyoak's lead with permission schemas and the Wason selection task. Jackson and Griggs (1990) were able to replicate Cheng & Holyoak's work by facilitating their standard abstract problem. Resembling early research on general thematic content tasks (see Johnson-Laird and Wason, 1970), Jackson and Griggs injected the use of negatives into the abstract permission rules. By placing explicit negatives on two of the visible cards ("has not taken action A" and "has not fulfilled precondition Q") performance dropped significantly. Nearly no one was able to choose the correct cards.

Girotto, Mazzocco, and Cherubini (1992) examined these deontic rule effects more closely to find out why respondents chose certain cards on permission conditionals. They concluded that individuals will only choose the seemingly relevant cards visible to them. According to Griggs and Cox's (1993) analysis of Girotto's study, the *not-q* card is avoided because the "implicit negation…does not clearly represent a potential violator" (p. 640). In other words, the negated *q* card is too vague for respondents in this particular kind of context because people did not necessarily interpret the negation to mean the precondition was not satisfied.

Subtle language differences make quite a bit of difference on the Wason task indeed. In their own more recent study, Griggs and Cox (1993) actually concluded that the standard abstract version and the abstract permission schema version are actually different versions altogether. They argued that work should cease on examining pragmatic reasoning schemas in order to understand facilitation on abstract logic tasks. They are two separate ventures.

4.4. **Social Contract Tasks**

Building on this previous research on the content-dependent cognitive processes in the brain, a group of researchers explored the contexts in which thematic content facilitates performance on selection tasks. As illustrated above, prior studies failed to provide replicable, conclusive results of content-dependent effects on task performance. Wason suggested that there were principles dictating how people reason but neglected to discover what precise principles would provide consistent results on his task. In terms of reliability and generalizability of the instrument, evolutionary psychologists Cosmides and Tooby have offered a promising approach that accounts for thematic content task performance consistently. The theory behind this approach is discussed in detail in Chapter 3. Here I merely discuss the intricacies of their version of the Wason selection task.

Cosmides (1985; 1989) adapted the original Wason selection task to reflect social contract conditional rules in order to test for the presence of cheater-detection algorithms in the brain counter to the availability hypotheses and deductive accounts which claim that humans' past experience and logical capabilities account for the detection of cheaters on tasks. The abstract conditional rule was changed to a cost-benefit structure representative of a social contract. "By presenting one term of a conditional rule as a rationed benefit (p), and the other

term as a cost/requirement (*q)*, one can create a Wason selection task that instantiates a social contract" (Cosmides, 1985: 196). She essentially created a social contract scenario by describing a situation where one party is obligated to pay a cost in order to receive a benefit. Cards were changed to indicate "cost paid" or "not paid" and "benefit accepted" or "not accepted". A "look for cheaters" procedure would cause the subject to choose the "cost not paid" card (*not*-q) and the "benefit accepted" card (*p*) to find possible cheaters of the conditional rule (p.198) despite there being incomplete information (See Figure 4.2). While respondents did very poorly (4 to 10% correct selection rates) on choosing the cards necessary to locate a violation of the abstract logical rule (Wason & Johnson-Laird, 1972), individuals have been shown to perform at a rate over 10 times that on social contract context tasks. Cosmides, and later, Cosmides and Tooby, posited that since people perform better on the social contract task than on the abstract logic version, then it can be inferred that people have cognitive adaptations "specialized for detecting cheaters in situations of social exchange" (Cosmides & Tooby, 2000b: 1264).

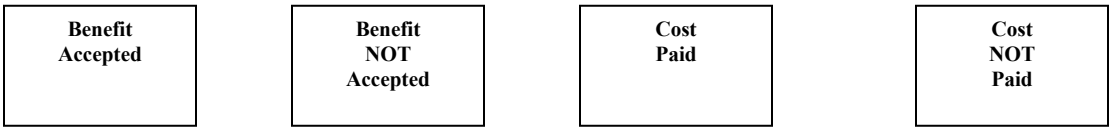
Figure 2 Standard Social Contract Structure Wason Task

It is your job to enforce the following law:

"If you take the benefit, then you pay the cost." (If *p*, then *q*)

The cards below have information about four people. Each card represents one person. One side of a card tells whether a person accepted the benefit and the other side of the card tells whether that person paid the cost.

Indicate only the card or cards you definitely need to turn over to see if any of these people are breaking this law.



Source: Cosmides, 1985: 197

Arguably, social contract rules are a type of permission rule described by Cheng and Holyoak. One is permitted only to accept a benefit when the cost has been paid. Even though not all permission rules are social contracts, Cosmides reconceived certain permission tasks from previous studies as social contract rules and offered an alternative account for how performance is facilitated. Take the Drinking Age Problem (described earlier) for instance. According to Cosmides (1985), this problem constitutes a social contract for American subjects because they "perceive drinking beer as a rationed benefit that can only be had by waiting until they have met an age requirement" (p.45). In different cultures that are not used to this legal code or norm, this rule would not be perceived as a social contract but merely as a descriptive rule. Thus, any social-contract algorithms hypothesized to exist by Cosmides would not be activated in certain contexts. Using American subjects, Cosmides redefined the Drinking Age Problem as a social contract and applied her theory. If we refer back to the section above on the instructional manipulations of the task regarding the search for violators versus determining whether the rule

is true or false, then Cosmides' "cheater detection" scheme is supported. If facilitation on the tasks occurs when respondents are asked to select the necessary cards to determine when the rule was violated, then this supports the notion that cheater detection algorithms exist (Evans, Newstead, & Byrne, 1993). Cosmides (1989) argues that all of Cheng and Holyoak's pragmatic reasoning schema tasks were in fact, social contracts, which accounted for their empirical results.

The social-contract algorithm theory approach to the Wason task has been used on other types of scenarios as well. In an effort to further refute Cheng & Holyoaks' contentions that their studies contradicted availability theory, Cosmides constructed a series of selection tasks involving unfamiliar content to devise a better argument against the availability heuristic. She described a tribe whose members desired cassava root but were permitted only by tribal custom to eat the root if they were married. Other members of the tribe could tell if someone was married if they had a tattoo on their face. The social contract rule she used was, "If a man eats cassava root, then he has a tattoo on his face." Since this was completely unfamiliar to the American subjects to whom she administered the task, the facilitation demonstrated had nothing to do with the availability heuristic. Through several iterations (1989), her results showed rates of cheater-detection comparable to those found on the Drinking Age Problem.

4.4.1. Switched Social Contract Rules

To strengthen her argument that facilitation on the social contract tasks was due to the presence of evolutionary algorithms, she created a switched social contract rule. The switched rule states the conditional rule in the following form: "If you pay the cost then you take the benefit." Further evidence that a social-contract algorithm exists would be obtained if facilitation on the tasks occurred on the switched rule as well. So, while a *p* and *not-q* response

would falsify the rule on the standard social contract, a *not-p* and *q* response would falsify the rule on the switched social contract. People taking these switched versions were able to decipher that violations of the rule took place when the cost was not paid and the benefit was received. Over sixty percent of subjects were able to detect violations of the rule in her 1989 experiments. In the face of logical reasoning, Cosmides (1989) and Cosmides and Tooby (1992) witnessed facilitation on social contract tasks of any kind.

With social contract theory, it seemed that the key element of facilitation on the Wason selection tasks was discovered. Cosmides (1989) ran eight experiments using the social contract hypothesis against Cheng and Holyoak's permission schema theory in both standard and social contract form. All eight studies resulted in facilitation on the social contract tasks. Gigerenzer and Hug (1992) replicated Cosmides' results by creating conditional rules which were not social contracts but permission rules only. Respondents taking these tasks selected the logically falsifying cards at a much lower rate than on tasks framed in a social contract context. Their study also added a perspective change (discussed in Chapter 3) between the parties in the task on problems that involved bilateral conditional rules. For facilitation on the tasks to occur, they believed that respondents had to be cued into the perspective of a party in the social exchange who can be cheated. While they did distinguish between social-contract algorithms and ones responsible for cheater detection, Gigerenzer and Hug supported the social contract hypothesis over three experiments. Politzer and Nguyen-Xuan (1992) replicated these findings in support of Gigerenzer and Hug's version of the social contract facilitation effect.

Platt and Griggs (1993) examined Cosmides' studies and found that when the instructions associated with the task were simpler, facilitation occurred to a greater degree. They also found that when cost and benefit information were removed from the conditional rules, facilitation on

the tasks decreased dramatically as predicted by social contract theory. Cosmides and her associates examined the idea of a cheater-detection subroutine in a recent study on Shiwiar hunter-horticulturalists of Ecuador (Sugiyama, Tooby, and Cosmides: 2002). In this study, the Wason task was adapted once again in order to be understood by non-literate respondents. Using symbols and pictures, the Shiwiar tribe demonstrated facilitation on tasks which involved social contracts with potential cheaters. Cheater-detection rates among the tribal respondents resembled those of Harvard undergraduates (about sixty percent).

All of these studies taken together demonstrate that facilitation on the Wason selection task occurs consistently when conditional rules are framed in terms of a social contract. Regardless of culture or familiarity with a particular rule, people are more likely to identify violations of the rule when it is framed in terms of costs paid and benefits received. Results are generalizable across populations. Multiple studies using the social contract lexicon have replicated the results of Cosmides (1985) in support of the social contract theory. Once considered an elusive effect on the Wason task by Wason himself (Wason & Johnson-Laird: 1972), the thematic content phenomenon appears to consistently facilitate logical card choices only when the content involves a social contract. Thus, reliability of the instrument is achieved when elements of social contracts are included in the conditional rule.

5. HYPOTHESIS DEVELOPMENT

Now that the theoretical groundwork outlining the natural science context of this research project and the detailed description of evolutionary psychology theory as well as its empirical manifestation used in this research project have all been presented in the preceding chapters, the specific hypotheses related to my study are offered. This chapter first describes the underlying assumptions necessary to construct the main effects and interaction effects hypotheses. The independent variables manipulated in the study are discussed individually to build each hypothesis. Then, the logic behind the expected results and posited direction of the hypotheses are offered. Finally, the dissertation's hypotheses are presented in the milieu of three separate categories designed to empirically test the existence of cheater-detection algorithms in a business population.

5.1. **Exposition**

If indeed, natural selection has formed humans' reasoning capabilities "by creating specialized, domain-specific cognitive mechanisms designed to solve discrete adaptive problems by activating reasoning processes appropriate to the domain encountered, then it can be said that the reasoning function in the brain is affected by specific content" (Cosmides, 1989: 190). In other words, the neural circuits capable of solving particular adaptive problems through the development stages of the human brain were formed as distinct functions. Since the form followed the function and one of the functions necessary for our ancestors' survival was entering into social exchange relationships, the human brain requires specific cues from social

interactions to activate these neural mechanisms. The circuits are only useful to human survival if they are activated.

Hamilton's rule (1964) discusses the selection pressures that actually affect the mechanisms that produce behaviors with survival value for an organism. The biologically successful outcome behaviors in these contexts are defined by his rule. "These outcomes often cannot be reached unless specific information is obtained and processed by the organism" (Cosmides & Tooby, 1995: 1205). According to Hamilton's rule, in a simple dyadic relationship between two individuals, cognitive mechanisms will be evolutionarily helpful if they cause an individual to engage in social acts when the costs to the individual are less than the benefits received, more reliably than any other mechanism. Hamilton described costs and benefits in terms of the reproductive benefit to an individual's genes. Mechanisms that follow this rule most closely have the greatest chance of being favored by natural selection.

Dyadic agency relationships represent one kind of social exchange in businesses today. "Delegation of specific tasks to those relatively more suited to perform them leverages…an application of comparative advantage" to the firm (Jacobides & Croson, 2001: 203). Metaphorically, this follows the same logic as the natural formation of social contracts by our Pleistocene ancestors. Tasks that could not be completed individually forced these hominids to group together to give bands a comparative advantage over others. Achieving joint agency value becomes a key task for principals and agents in organizations. In social science, organization theorists say that individuals are often constrained by bounded rationality (Simon, 1982) and suffer from an inability to have complete information about their environments. Without perfect information, both contracting parties to an agency relationship perform inefficiently, creating a situation of moral hazard, "in which the agent can take undesirable actions (e.g., shirk…) that the

principal cannot observe" (Jacobides & Croson, 2001: 203). Evolutionarily speaking, this too is a problem in that if the specific costs and benefits are not recognized by each party in a social exchange, the social-contract/cheater-detection algorithms in the neural circuitry will not be triggered.

5.2. Background Assumptions of Main Effects Hypotheses

Research has shown that a person's perspective in a social exchange relationship is critical for the activation of the brain's cheater-detection algorithms (Gigerenzer & Hug, 1992). As mentioned in Chapter 3, perspective is a key to humans' ability to spot cheaters in social exchanges. In other words, an individual must observe their contracting partner as having an ability to cheat in the relationship. "If a person represents one person in a social contract, and the other party has a cheating option, then a cheater-detection algorithm is activated that searches for information of the kind 'benefit taken and costs not paid' (requirement not met) by the other party" (Gigerenzer & Hug, 1992: 165). Subjects taking the tasks must be cued into a certain party perspective to perceive specific options to be chosen from the point of view of a specified actor on the other side of the contract. The perspective taken by the respondent strongly affects the reasoning elicited and verifies the existence of a cheater-detection algorithm. "The crucial issue about social contracts is the cheating option, which in turn is a function of the perspective" (p.165). Unless a person is cued into a particular role in a dyadic social contract and the other party has a cheating option, the social-contract algorithms do not necessarily get activated. Gigerenzer and Hug posited that a separate cheater-detection algorithm was triggered only when the opportunity to cheat by a particular party in the relationship was described in the Wason

tasks. It was not enough to trigger the algorithms by merely describing a vague social contract relationship without cueing the respondent into a particular role.

Gigerenzer and Hug's research is important to the evolutionary psychology approach because it provides powerful support for the existence of content-laden social-contract algorithms rather than content-free logical reasoning ones. If social contract conditionals activate modules used for noticing violations of logic, then manipulating the perspective taken in a task should not have any effect on ability to solve the task, since perspectives do not play a role in formal logic. Their research asked subjects to detect violations of conditional social contract rules regarding employee pensions. Half of the subjects were given stories that cued them into the employer's role and the other half into the employee's role. In both conditions, the majority of the subjects chose the adaptively correct response based on their perspective regardless of errors in logic. There were no statistically significant differences in cheater detection rates between the two groups.

This dissertation's empirical study respects the importance of perspective for activation of the cheater-detection subroutine. In each of the tasks, perspective is held constant by telling the story in the second person. A principal and agent were presented in each distributed task, but subjects were asked to assume the role of owner in each variation. Thus, in every task, respondents are cued into the role of the principal (owner). The agent was always the one being monitored in the scenarios and is always the person in the task having the opportunity to cheat. This variable was held constant in order to isolate the effects of *intent* and *benefit received by cheating* on cheater detection in the agency relationship. The empirical study did not manipulate which party in the exchange relationship has the ability to cheat because the objective is to observe the main effects of only these two variables.

5.3. **Independent Variables**

5.3.1. Benefit received by cheating

In addition to there being an ability to cheat by one party in the agency relationship, for the evolutionary modules in the brain to be triggered, there must also be a benefit derived by defecting from the conditional rule. Tasks given to respondents must include information about the benefit that the other party in the social contract relationship could receive by not obeying the conditional rule stated. Our Pleistocene brains will not recognize a social contract unless there are clear benefits and costs evident to the contracting parties. I posit that a subject's cheater-detection algorithms are more likely to be triggered when that subject is aware that the contracting partner could receive a benefit by cheating on the social exchange relationship.

5.3.2. Intent to cheat

Closely related to the *benefit derived by cheating* in a relationship is the *intent to cheat*. In the dissertation study this variable is the contractor's clearly stated desire to deviate. It is stated in the evolutionary psychology literature that if a contracting partner either has a reputation for cheating or there is evidence of the intention to cheat, the cheater-detection algorithms are likely to be activated.

In the agency theory literature, it is acknowledged that not all agents who misbehave are intending to do so. Even with the utility maximizing, opportunistic assumptions that drive agency theory, there could be other intrinsic motivations influencing the agent (Pfeffer, 1997). The principal has another problem—honest incompetence of the agent (Hendry, 2002). In this case, the agent is not cheating or violating the principal's rules out of economic self-interest. Rather, the agent is not meeting the principal's objectives because s/he is not qualified to do the job or because an honest mistake is made. In standard principal-agent relationships, honesty is

contrived by the monitoring and compensation mechanisms set in place by the principal. Despite these mechanisms, however, honest ineptitude can still occur. In evolutionary social contract terms, this can present a problem to the principal for knowing when cheating behavior is going on. When there is no clear benefit to the agent for deviant behavior, the social-contract/cheater-detection algorithms are not likely to be activated (Cosmides & Tooby, Working paper). Thus, monitoring for cheaters would prove to be quite difficult.

5.3.3. Agency Relationship

While *intent to cheat* and *benefit derived by cheating* are the two factors identified as affecting the activation of cheater-detection algorithms, a third variable is manipulated in the dissertation that extends the work of Cosmides and Tooby and others. Evolutionary psychology research has not previously examined the effects of an organization hierarchy on the activation of the social-contract/cheater-detection algorithms. Previous research using the Wason selection task to detect cheaters has looked only at direct dyadic social exchanges (Cheng & Holyoak, 1985; Cosmides, 1987; 1989; Cosmides & Tooby, 1992; Gigerenzer & Hug, 1992). On tasks A through D of this dissertation's research, a third party was imposed on the business scenario to resemble a common hierarchical arrangement in organizations—the agency relationship.

5.4. **Cheater-Detection Hypotheses**

The dependent variable in this study is "cheater-detection." This variable is simply an individual's ability to identify cheaters in a social contract arrangement. Proficiency at this task is determined by which cards are turned over. If the *q* and *not-p* documents are uncovered, then the cheaters can be detected. Cheater detection was limited to only these two card choices in my

study. My first stint was to test variations in the rates of cheater detection across the Wason selection tasks that manipulate the two independent variables discussed in the previous section. Taking the entire sample collectively, differences were expected in the ability to detect cheaters across the five tasks. This led to the null hypothesis which states:

> *H0: There will be no significant difference in social-contract/cheater-detection reasoning across the tasks.*

The alternative hypothesis states there is a relationship between the independent variables and the dependent variable in the study at alpha of .05.

> *H1: There will be a significant difference in social-contract/cheater-detection reasoning across the tasks.*

As outlined above, *benefit received by cheating* and *intent to cheat* prior research are necessary for activating the cheater-detection algorithms, which are a subroutine for entering into social contracts. Thus, the main-effect hypotheses focus on cheater-detection in the adapted business context Wason selection tasks, based on the manipulation of these two main independent variables.

Social-contract/cheater-detection reasoning will vary positively with:

> *H2a: content which specifies that a contracting partner derives some benefit by cheating*
>
> *H2b: content which specifies that a contracting partner had the intent to cheat.*

In other words, sensitivity to cheaters will vary as a function of *intent* and *benefit*, operationalized in the agency Wason selection tasks.

5.4.1. Interaction Effect

Since each of the two factors is hypothesized to positively affect social-contract/cheater-detection reasoning, the research also examines interaction effects between the independent and dependent variable. A two-way interaction between the cheater-detection criteria is expected. Based on the grammar of social exchange (Cosmides & Tooby, 1989) and information necessary to activate the cheater-detection algorithms in the brain, performance on the agency Wason tasks should be enhanced when content about cheating intent and content about specific benefits derived by cheating are included in the scenario. Cosmides and Tooby (1989) make no judgment regarding the relative importance of *benefit received by cheating* and *intent to* cheat for the activation of the cheater-detection circuit, but cost-and-benefit and intent must be present. One without the other will not activate the social contract algorithm for participation in social exchange. Thus, an interaction effect was predicted as reflected in Hypothesis 3.

H3: There will be an interaction between intent to cheat and benefit received by cheating on the conditional rule on social-contract/cheater-detection reasoning.

5.5. **Agency Hypothesis**

A separate test was conducted that specifically addresses the agency relationship variable. In business, a typical organizational arrangement involves an owner hiring a manager (or employee) to operate organizational functions (Jensen & Meckling, 1976; Mitnick, 1997). The separation of ownership and control became necessary in business when owners of companies no longer were able to manage all of their company's affairs (Berle & Means, 1932). This kind of hierarchical relationship was not foreign to our Pleistocene ancestors either. Primitive social structures were not necessarily characteristically dyadic. Hierarchies existed in primitive social

group bands and exchanges often involved more than one contracting partner (Beals, Hoijer, & Beals, 1977; Bonner, 1980). Thus, agency-type social group arrangements should not be unfamiliar to our Pleistocene-influenced minds.

Recently, a new conception of the social contract has been developed to counter the purely philosophical, socially a priori negotiation of parties to an exchange for the fair and just distribution of benefits. The implicit social contract derived from natural law has pervaded the political philosophy literature for centuries (Hobbes, 1651; Rousseau, 1762) and also in the business and society literature in modern writings (Donaldson, 1989; Donaldson & Dunfee, 1999). Evolutionary social contract (ESC) is a much different term, with its roots in evolutionary biology, evolutionary psychology, and cognitive neuroscience. It is a naturally developed tool used to create and sustain mutually beneficial cooperative relationships. More specifically, ESCs are "dynamic social exchange relationships and the biological and social processes that produce them, governed by ancestrally shaped neural circuits…keyed to achieve individual and/or group advantage in a context of social reciprocity" (Frederick & Wasieleski, 2002: 290). Social reciprocity moderates self-serving behaviors in social exchanges. "Selection arising out of the advantages and risks of exchanging favors with our fellows has shaped not only our social behavior but also our reasoning abilities" (Gaulin & McBurney, 2001: 166).

It is important to emphasize that at no point do ESCs reject the idea that self-interested behavior occurs in social exchanges. One aspect of human behavior is indeed individualistic. However, it is not the only explanation of human motives. Although it is acknowledged that seemingly altruistic behavior on behalf of one of the contracting parties is partly due to the fear of being penalized for breaching the contract (Binmore, 1994), humans do wish to partake in

social exchanges for long-term mutual benefit. Reciprocal altruism is responsible for regulating and constraining social exchanges (Frederick & Wasieleski, 2002; Trivers, 1971).

Unlike the philosophical notion of the social contract, evolutionary social contracts are real relationships between contracting parties. The traditional philosophic concept of abstract social contracts is replaced by one that is rooted in biologically-driven individual and organizational behavior. ESCs form in response to, and exist within, ecological challenges and are sustained by a need to develop individual and group advantage. One important feature of ESCs is that they exist within a given sociocultural system and the power hierarchies that exist therein. In other words, ESCs can take a variety of forms depending on the cultural origins of a particular social class system. Conceptions of justice and fairness depend greatly on the cultural features of the environment in which the relationship exists.

Principal-agent relationships in business organizations are one such context. The agent acts on behalf of the principal creating a power differential and a context in which social reciprocity (Trivers, 1971) and exchanges take place. The agent's role in each agency relationship is explicitly defined. "Contractual understandings are consciously deliberated, not merely inferred or implied" (Frederick & Wasieleski, 2002: 293). Distributive justice in this context is largely determined by the pragmatic goals outlined by the principal and the society in which the business operates. The obligations of the agent and rules to be followed are originally designed by the practical needs of the principal. Thus, the principal possesses power. The symbiotic-mutualistic impulses are countered by self-seeking, power aggrandizing impulses that are conditioned by the organization's design and prevailing culture. Principal-agent relationships are very much one kind of evolutionary social contract.

This dissertation also examined whether this agency-type arrangement makes a difference in individuals' ability to detect cheaters in a business context by comparing cheater-detection rates on two tasks with both evolutionary factors necessary for cheater detection (*intent to cheat* and *benefit derived by cheating)* present. Since our Pleistocene ancestors were faced with hierarchical social arrangements, I did not expect there to be a difference in cheater detection rates between the task with an agency arrangement and the task that has direct dyadic relationships. Thus, Hypothesis 4 states:

H4: The agency relationship will have no effect on cheater detection rates on the Wason selection tasks.

5.6. **Populations Hypothesis**

This research also tested two main populations of respondents on the adapted Wason selection task: 1) business students enrolled in undergraduate business courses and 2) business managers and employees of corporate firms enrolled in graduate business courses. Prior research has tested diverse populations on their ability to detect cheaters in social contract type scenarios. Cosmides (1989) adapted the original Wason abstract logic task (Wason, 1966) and Cheng and Holyoak's (1985) general permission schema tests to reflect real-life and fictitious social contract scenarios for a population of Harvard University undergraduates. When faced with both regular and switched logic decision rule Wason social-contract tasks, respondents successfully detected cheaters 65-75% of the time across all contexts. Regardless of whether the social contract situation described in the task is consistent with the respondents' past experiences or not, cheater detection rates remain high. As noted, Sugiyama, Tooby, and Cosmides (2002) administered similar tests using the adapted Wason instrument to Shiwiar hunter-horticulturalists of the Ecuadorian Amazon. Their study found that "Shiwiar subjects were as highly proficient at

cheater detection as subjects from developed nations" (Sugiyama et. al: 11537). They discovered that cheater-relevant task choices had an indistinguishable frequency from the Harvard undergraduates. These findings suggest that social-contract/cheater-detection algorithms are deeply-embedded in human brains and that diverse cultural experiences do not significantly affect individuals' success on the tasks.

However, as discussed earlier in this section, role perspective makes a difference in the detection of cheaters. The role people assume for the tasks influences how they make choices. Gigerenzer & Hug (1992) posited that which party to a social contract a person is cued to will determine which cards on the selection task are more likely to be turned over. So, they added an important dimension (perspective) that considers whom a respondent is examining in a social exchange (for cheating). Other important research in the area has examined cross-cultural reasoning patterns in humans (Cosmides, 1985; Cosmides & Tooby, 1992; Hirschfeld & Gelman, 1994; Sugiyama, Tooby, & Cosmides, 2002) to determine whether social-contract reasoning is universal and how local culturally-differentiated environments influence their operation and activation. This research generally posits that "contrary to the general-purpose hypothesis, subjects perform just as well on their very first exposure to culturally unfamiliar social contracts as they do on culturally familiar ones" (Sugiyama, Tooby, & Cosmides, 2002: 11538).

Consistent with these findings, both the undergraduate students and the business practitioner graduate students were expected to be proficient in cheater-detection given the necessary ingredients for a social contract situation. However, their ability to detect cheaters should be affected by any type of work experience or organizational socialization even though the circuits are deeply embedded in the cognitive architecture. The role assumed by the

respondent was thought to have a great influence on the card choices for detecting cheaters. If respondents take the perspective of owner in the tasks, then the adaptively correct answer would be to choose the *Bonus received (q)* and the *Produced less than 1000 units (not-p)* cards. The benefit received and cost-not-paid cards are important to a principal who is seeking to know if s/he is being cheated. On the other hand, respondents taking the perspective of agent (whether it was the manager or the employees) would have made significantly different card choices. Respondents may look for an employee getting cheated and therefore not look for violations of the conditional rule. In this case, a *Bonus not received* (*not-q)* and *Produced 1000 units (p)* were predicted to be the more common choices. Subjects with work experience were expected to reason (variously) through the scenarios. Organizational socialization could affect the activation of the social contract algorithms. More specifically, individuals with full-time work experience in business may be better able to recognize potential cheaters due to their exposure to organizational cultures where rules are specified and enforced.

Psychological contracts are another way of viewing the principal-agent relationship. They are based on the concept of social exchange. The rules of the exchange can be implicit and informal, and exchanges usually take place only when the parties perceive their contract partner to be cooperative rather than defecting. Theoretically, psychological contracts "consist of sets of individual beliefs or perceptions regarding reciprocal obligations" (Robinson, Kraatz, & Rousseau, 1994: 138). In terms of employee/employer relationships, these beliefs are shaped by the organization, which dictates the two parties' agreement (Van Buren, 2000). Both the employer and the employee believe the other is obligated implicitly to act on behalf of the other in their relationship. The agreement, however, need not be a written, formal contract. On the contrary, it is cognitive and perceptual in nature, and may be quite informal. Each party

cognitively perceives the other's obligations in the relationship based on what was agreed upon when the relationship was formed. Despite the fact that this contract is perceptual, "individuals act in accordance with what they believe themselves to have agreed to" (Van Buren, 2000: 208). Thus, it influences an individual's behavior. From the employee's point of view, the psychological contract dictates what they feel they owe to their employer, and what they feel that is owed to them by their employer (Robinson, Kraatz, & Rousseau, 1994).

Psychological contracts add a critical piece to the social exchange puzzle that goes beyond the evolutionary psychologists' discovery that humans' minds are evolved to detect cheaters, thus facilitating social exchange. Cheater detection cannot be explained by cognitive neuroscience alone. The triggering of cheater-detection algorithms is conditioned and moderated by individual perceptions of the environmental context. In business, this environment is the organization, which embodies a culture, functional design hierarchies, and standards of behavior of its own. Since the business environment is changing at such a rapid pace with constantly evolving technologies at the helm, perceptions of mutuality in terms of the psychological contract are hard to foster and tend "to be fleeting and ephemeral" (Frederick & Wasieleski, 2002: 298).

Cosmides and Tooby (in press) admit that this problem exists and attribute it to agency relationships. They recognize that a perceived benefit to the company is not necessarily going to be perceived as a benefit to one of the contracting parties to a social exchange. "Agents who do not see the company's costs and benefits as such are unlikely to spontaneously attend to potential cases of cheating by employees or clients" (p.19).

Thus, it was reasonable in the present study to posit that a respondent's place in the organization would affect perceptions of social contracts and obligations to an organization. The

knowledge individuals possess and the perspective taken may moderate the cheater-detection subroutine of the social contract algorithms. Hypothesis 5 follows:

H5: When presented with a conditional reasoning test in a business context, business practitioners will demonstrate higher rates of cheater detection than will undergraduate business students.

5.7. **Expected Results**

As previously discussed, social exchange theory from evolutionary psychology predicts that a conditional rule framed as a social contract will elicit rates of cheater detection of approximately 65-75% when both *intent* and *benefit received* are present in the scenario. These expected rates are based on direct dyadic social contract situations, rather than ones with an agency relationship. According to the theory, it should matter little that the scenarios are framed in a business context (Cosmides, 1989; Gigerenzer & Hug, 1992), although no empirical studies have been performed on business *agency* arrangements. Thus, it was not a stretch to predict rates of cheater detection in this study of 65-75% for task E. Any other results are speculative. Since no study has ever tried to test the agency arrangement, I was limited by the lack of findings from previous research. However, if both independent variables are present and the conditional rule is framed as a social contract, the theory holds that humans are hardwired to detect cheaters despite an agency arrangement. So, I expected cheater detection rates to be as high for task A as for task E. The theory predicts that cheater detection rates should drop by about 20% for each removed independent variable (Barrett, 1999). So, tasks B and C (with one of the two independent variables included in the text) should have elicited rates of cheater detection of about 45-55%. Task D (with neither independent variable present—the control scenario) should have elicited the

lowest rates (an expected 25-35%) because it did not have the makeup of a social contract in evolutionary psychology terms.

It is also important to realize that there is much variation on rates of *p* and *not-q* responses, historically. To replicate Cosmides' findings from her earlier work, one must strive for rates exceeding 67 percent. Gigerenzer and Hug (1992) achieved rates of over 90 percent across four experiments in their study. Other studies have reported significantly lower rates. Barrett (1999) achieved a rate of 63 percent on his social contract task with all cheater conditions (intent, benefit, and ability to cheat) present. Other work by Cosmides (1992) has reported cheater-detection rates of around 60 percent on social contract tasks for undergraduate samples. While these results may appear to be inconsistent, each of the studies consistently demonstrated that rates of "benefit taken" and "cost not paid" cards were higher for social contract tasks than other types of scenarios. Not one study has shown otherwise. The differences in rates are what each study sought to highlight.

A preliminary study for this research project was run in the spring of 2002, where a group of Masters of Business students was surveyed at Carnegie Mellon University. A convenience sample of 61 students in a classroom setting were asked to answer two Wason selection tasks—both from Cosmides (1989). The one task, the abstract logic task originally was created by Wason in 1966. The second task, the Drinking Age Problem (see Appendix), was originally written by Griggs and Cox (1982). Only 4 students out of the 61 (.065 percent) correctly identified the *p* and *not*-q cards on the abstract logic task, which is consistent with previous research (Wason, 1966; Cosmides, 1989). The Drinking Age Problem—framed as a social contract—elicited rates of *p* and *not-q* card choices among 65 percent of the students sampled, which again, is consistent with previous research (Cosmides, 1985; 1989). This preliminary

study was part of a pretest that was used to construct an adapted business scenario selection task. It also served a purpose to determine the expected rates of cheater detection on social contract tasks. By applying these published tasks to a business sample, I felt more comfortable predicting similar rates for tasks that included the same independent variables (intent and benefit on social contract tasks).

5.8. **Toward an Evolutionary Psychology Theory of Organizational Social Contracts**

Verification of the aforementioned hypothesized relationships among variables and differences between groups may provide insight into why social exchange relationships—particularly social contracts between two or more individuals in business—are breached. This study is potentially an early major step in understanding what affects the activation of cheater-detection algorithms in the minds of employees in a business organization.

The dissertation takes a strong stance that social-contract algorithms and their cheater-detection subroutine mechanisms are part of the evolved set of neural circuits present in the neural architecture of the modern brain. This implies that someone has much experience in a business setting as a manager or an employee has no bearing on the position that these circuits exist and are active in negotiating social contract relationships in business. Since today's humans are products of an evolutionary past, it is plausible that these structures regulate to some degree how social contracts in business today are managed. The only question remaining regards what factors influence their activation or suppression in modern business environments.

Due in large part to the highly interactive relationship of nature and nurture (i.e. biology and culture), the precise sensitivity of these algorithms in modern business minds is somewhat unclear or uncertain. The current organizational conditions facing managers may indeed affect

the activation of the algorithms. Hierarchical relationships in business corporations with power conferred to certain positions and relinquished in other job descriptions should manipulate the sensitivity of the neural circuits to the trigger variables of intent to cheat and benefit received by cheating. Since this dissertation is the first to empirically examine the brain's evolutionary social contract modules in business, the insights from these various tests will inform a potential theory of evolutionary social contracts in organizations.

Before discussing the results of the hypotheses tests, the following chapter carefully describes the methodology and research design used in the dissertation study.

6. RESEARCH DESIGN AND METHODOLOGY

In this chapter, the research design and methodology for testing the hypotheses are described in detail. First, the adapted version of the Wason selection task used in this project is discussed. Two pilot studies were conducted to aid in the construction of the instrument. Those studies are discussed in this section to show how knowledge obtained through their results informed the modification of the instrument and the operationalization of the variables. Then, the rationale behind the determination of the sample size for each cell in the study is outlined. From this, the study's research design is shown as well as a presentation of the process for obtaining the respondents and the data for the final study. Finally, the data collection and analysis techniques are identified and justified for the final iteration of the study (results of which are given in the next chapter).

6.1. Adapted Wason Selection Task and Test Statistic Development: Pilot Studies

This dissertation study utilized a *switched* social contract form of the conditional rule. As explained in detail in Chapter 4, this type of configuration reverses the antecedent and the consequent of the conditional rule to *If q, then p.* Thus, the cost that must be paid is framed as the antecedent, and the benefit received if that cost is paid becomes the consequent. The switched conditional rule structure was used to eliminate the possibility that logical reasoning procedures explain the results, rather than the intended evolutionarily-stable elucidation.

Specifically, a single Wason selection task was constructed and varied it five ways. From Cosmides and Tooby's adaptations (see Chapter 3), this study goes one step further by taking the social contract scenarios that involve two contracting parties and injecting a hierarchical three-party arrangement that is common in modern organizations. Also, the scenario itself describes a

business context. The agency arrangement tasks all deal with the owner of a manufacturing firm (the principal) who hires a manager (the agent) to manage the salaries of four employees. Their compensation is based on the social contract conditional rule: *If an employee produces more than 1000 units in a week, then that employee receives a pay bonus.* Two dichotomous independent variables are manipulated in the tasks—*intent to cheat* and *benefit received by cheating.* Respondents are told that they are to determine if the manager is breaking the owner's conditional rule by examining four cards each representing one employee. One side of the card shows whether or not a bonus was received and the other tells how much the employee produced. The adaptively correct response in the tasks remains the same for all five—*q and not-p*. For this, the *q* is *Bonus received*, and the *not-p* is *Produced less than 1000 units*. If the conditional rule is to be obeyed, it is necessary to turn over the card that says, *Bonus received,* because as the person monitoring the actions of the agent, the respondent to the task would wish to see if someone falsely accepted a bonus without producing the required units. Likewise, one monitoring the actions of the agent would also need to turn over the card that says, *Produced less than 1000 units,* because the respondent would wish to see if the employee who didn't meet the production quota undeservedly received a bonus.

6.1.1. Pilot Study A: First Iteration

Two pilot studies were conducted from the fall 2003 through the winter of 2004. These studies provided preliminary results that were efficacious in determining the wording of the final instrument. Those studies are reported in this section.

In the fall semester 2003, five separate classes of students were surveyed at the University of Pittsburgh and Duquesne University to determine if social contract reasoning with

a cheater-detection subroutine was elicited from a business student population. Seventy undergraduate business students and fifty-nine business practitioners (taken from a Master of Business Administration student sample) participated in the experiment. Each subject was given one task as part of a three-page packet including instructions and a demographic survey. Tasks were distributed randomly and counterbalanced to assure that the respondents had a chance of receiving any of the tasks. The instructions requested that the participants read the scenario on the second page carefully and answer the question pertaining to the cards at the bottom of the page. Students were told to take as much time as they needed to complete the task but not to return to the task once they had reached the survey on page three. Most respondents completed the experiment and survey in about 5 minutes. The average age of the undergraduate business students was 21.2, and was 31.6 for the business practitioner group. Thirty-two of the seventy undergraduate business students were female, while twenty out of the fifty-nine business practitioner students were female.

6.1.2. Test Statistics and Procedures for Data Analysis

For consistency, the pilot studies tested the same hypotheses as described in Chapter 5. Data for both pilot studies and the final study were entered into a Microsoft Excel for Windows XP spreadsheet for sorting and documentation purposes. Answers from every subject were logged and sorted by class. Information regarding gender, work experience, natural country of origin, and age were entered into the spreadsheet along with a detailed description of which cards were chosen on each task. Instead of simply coding for information regarding the adaptively correct response, this additional detail provided richer descriptive information on subjects' thought processes. Thus, coding was supplied for responses of *p, not-p, q*, and *not-q.*

To determine statistical significance, the statistical software package, StatGraphics, was used to test the hypotheses of the main and interaction effects. Percentages of adaptively correct responses on each of the five tasks were calculated for both populations of subjects—the undergraduate students and the MBA business practitioners. Then, the cheater-detection responses were compared to one another to determine statistical significance. Thus, each cell in the 2 x 2 factorial between-subjects design was compared on the percentage of successful cheater detection. Since this study deals with categorical data rather than quantitative data, a chi-square test was applicable to test for "comparing observed frequencies with theoretically predicted frequencies" (Howell, 1999: 373). This goodness-of-fit test is useful in determining whether there is a reasonable fit between the data reflecting observed frequencies of a response (cheater-detection) and the theoretical frequencies of a response. Chi-square statistics are often used "to find whether the observed proportions in two or more categories differ significantly from a priori or theoretically expected proportions" (Glass & Hopkins, 1996: 330). A chi-square is a test of significance for "the degree of agreement between the data actually obtained and that expected under the null hypothesis" (Rosenthal & Rosnow, 1991: 54-55). Before I examined which cells in the design are statistically different based on the dependent variable, it was necessary to test whether cheater-detection was independent from the distributed tasks in order to test the null hypothesis. It was desirable to establish whether the dependent variable used in the studies was autonomous from the tasks. Thus, a chi-square test was used to assess the possibility that the dependent variable is independent from the tasks administered in the pilot study.

Any test for this purpose is acceptable and other methods exist which are interchangeable and equally valid. Previous studies using the Wason selection task in evolutionary psychology have used a two-tailed analysis of variance (ANOVA) to test the null hypothesis (Cosmides,

1985; Cosmides, 1989; Gigerenzer & Hug, 1992). ANOVAs are one of the most "widely-used statistics in behavioral studies research" (Miller, 1998: 151). It is useful for testing hypothesized relationships of equality of two or more independent groups. Thus, the analysis of variance seeks to determine whether there is a variance between the groups in a 2 x 2 factorial design. In order to discover whether the difference among the means of the cells in the study is larger than anticipated from random error, an ANOVA is performed (Glass & Hopkins, 1996). In this study, the five tasks were evaluated against the dependent variable, cheater detection, to see if any such variance exists in the sample. Any variance that was detected by the ANOVA test statistic mandated that a more detailed data analysis is needed to pinpoint from where the variation is originating.

Since this study examines dichotomous variables and percentages of a particular response, it compared the difference between the rates of cheater-detection responses rather than the mean of a response. In order to test for the significance between rates of cheater detection on independent samples, a z-test was performed between all the cells in the factorial design (Andrews et. al, 1981; Glass & Hopkins, 1999). With the use of the z-test, it was possible to examine whether social-contract/cheater-detection reasoning on the tasks varies positively with the manipulation of the two independent variables, as stated in the hypotheses. Previous research using the Wason selection task for social-contract/cheater-detection reasoning has used this type of data analysis to determine if rates of cheater detection were significantly different on varied types of task problems (Cosmides, 1985; Cosmides, 1989; Gigerenzer & Hug, 1992). The present study uses this test statistic to examine differences between cells on observed results and also to examine differences between expected results and observed results. The z-test is used to

determine whether there are significant differences between the undergraduate sample and the business practitioner sample on the cheater-detection dependent variable, as hypothesized.

To further evaluate where the variance is coming from, comparisons between the rates of cheater-detection on each task was necessary. This is accomplished by running a z-test on the percentages of cheater-detection. Decisions regarding acceptance of hypotheses 2 through 5 of this dissertation are based on the probability that sampling error was the reason for the observed difference in rates between the tasks if the null hypothesis were true (Glass & Hopkins, 1996). P-values of less than .05 indicate between which tasks the variance exists. Z-tests for proportions are calculated using the following formula:

$$\mathbf{z = \rho - \pi / \sigma} \text{ at } \alpha = .05.$$

Since this study looked at proportions rather than means, t-statistics were less appropriate and were not used (Andrews et al., 1981).

6.1.3. Pilot Study A: Instrument

In the preliminary stages of this research project, multiple tasks were designed to reflect the perspective of each party in the agency relationship—the owner, the manager, and the employees. Soon after, in the pretest period of instrument development, it was decided to hold the perspective constant so as to isolate only the effects of the manipulation of the two independent variables. Never before in the evolutionary psychology literature had perspective been changed in the same study. The perspective in which respondents were cued always remained the same for repeated iterations of the same basic task (Cosmides, 1989). Since this study was designed to be an extension of that research stream, the perspective was not varied.

In the first round of data collection, five tasks were constructed to reflect the manipulation of *intent to cheat* and *benefit derived by cheating* in the same business scenario. All five tasks were placed in a manufacturing, social contract context. The context involved a manufacturer of widgets in each task. The owner of the firm hired a Human Resources manager to manage compensation of the employees of the company. Because of a serious financial situation, the owner instructed the manager to award bonuses only to highly productive employees, defined by the number of units produced. All of the tasks were gender neutral and all were told in the third person. While this context did not change from task to task, the terms of the scenario did. The chart below (Table 6.1) illustrates which key statements were manipulated from task to task. Everything else in the tasks, including the card choices and rationale for the conditional rule, are held constant.

Table 1 Manipulation of Independent Variable in Pilot Study A: Operationalization

ID Variable	Task A	Task B	Task C	Task D
Intent to Cheat	"The owner suspects the manager is breaking the rule…"	"The owner suspects the manager is breaking the rule to undercut the owner's approach."	"This manager is a good team player and would do nothing to intentionally harm the owner. Lately, the manager has been making mistakes."	"The manager is a good team player and would do nothing to intentionally harm the owner. Lately, the manager has been making mistakes."
Benefit	"…accepting kickbacks from the employees for doing so."	"…disagrees with the rule and believes it is unfair to employees."	"Whenever the manager gives an employee a bonus, the manager benefits by receiving a percentage of it."	*No text is written to reflect the benefit derived from cheating.*
Presence of Variable	Intent and Benefit	Intent; no benefit	No intent; benefit	No intent; no benefit

Additionally, each task included a statement of emphasis immediately before the question was asked of the respondents. In the final paragraph, the tasks included the sentences displayed below:

Task A: "The manager may be receiving kickbacks for breaking the rule."
Task B: "The manager may be breaking the rule because the manager thinks it is unfair to employees."
Task C: The distracted manager may have been breaking the rule by mistake, and inadvertently benefiting from it."
Task D: "The distracted manager may have been breaking the rule by mistake."

Task E manipulated the wording of the variables as well as the context of the scenario. First of all, to reflect a situation where the manager deals directly with the employees of the manufacturing plant, the text omitted any description of the presence of a Human Resources manager altogether. Secondly, the independent variables were described as such: "When it comes to reporting how many units they produced, the employees are on an honor system." (This statement indicates that some benefit can accrue to the employees.) "The owner suspects that some employees may be breaking the rule." (Indicating that there is an intent to cheat.) In the final paragraph before the respondent was asked to turn over the cards, the following statement was added: "Some of the employees may be cheating."

As the first iteration of the instrument toward final study development, the results were unexpected. The results of Pilot Study A are discussed in the next section.

6.1.4. Pilot Study A: Results

If mechanisms specialized for cheater detection are universal features of the human brain, applicable to a business population, then the expected card choice on the tasks to detect cheaters would be *benefit received* and *cost-not-paid*, or *q* and *not-p*. All the tasks tested for an individual's ability to detect cheaters of the identical conditional rule even though the

independent variables were manipulated. This means that the same card choices were necessary for cheater detection on all iterations of the tasks.

Table 6.2 shows the percentage of individuals choosing *q* and *not-p* exclusively in the pilot study. Results in the table indicate the percentage of respondents who chose the adaptively correct response to the tasks and are broken down by task and by population (undergraduate business students and MBA business practitioners).The results are lower than expected based on the predicted values (Please refer back to Chapter 5.) for tasks A and E, the tasks with *intent* and benefit *received from cheating*, although the results are in the predicted direction. When evaluating the results, it must be kept in mind that sample sizes were lower than recommended by previous studies and by my calculations.

Table 2 Pilot Study A Results: Percentage of Subjects Choosing q and not-p

	Task A	**Task B**	**Task C**	**Task D**	**Task E**
ALL	52.2 n=23	38.1 n=21	36.4 n=22	32.0 N=25	52.6 N=38
Undergrad	63.6 n=11	45.5 n=11	33.3 n=12	38.5 N=13	47.8 N=23
Graduate	41.2 n=12	30.0 n=10	40.0 n=10	25.0 N=12	60.0 N=15
Predicted	65-75%	45-55%	45-55%	25-35%	65-75%

In the first pilot study, I chose a chi-square statistic. For the entire sample of the first pilot study, a chi-square value of 4.05 with 4 degrees of freedom was calculated (p=.3999). The p-value is greater than .05, which means I could not reject the null hypothesis that cheater-detection is independent from the tasks. This indicated that the observed number of cheater-detection responses may have no relationship to the manipulation of the tasks themselves.

It was predicted that even on agency-type tasks, subjects would demonstrate high rates (65-75%) of cheater-detection when *intent* and *benefit* are present in the scenarios leading to the task. Recall that this rate of choosing the adaptively correct response, *q* and *not-p,* is based on the dyadic social contract rates from previous research. For each necessary variable extracted from the scenarios leading to the task, a .20 drop in cheater-detection is expected (Barrett, 1999). The variance in cheater-detection was less than this hypothesized difference.

As stated, to determine whether the percentages between the tasks were significant, a z-test was performed to compare observed rates between cells and to compare expected rates with observed rates. Since the sample sizes were so low, and because the chi-square statistic was so high, no significant differences between cells was expected at first glance. Thus, I compared only the differences in cheater-detection rates between the two extremes—task A and task D. Logically, if this difference showed no significant results, then the remaining pairings would reveal nothing significant either. When the agency social contract task (with *intent to cheat* and *benefit received from cheating)* was compared to the agency social contract task *(*with *no intent* and *no benefit received)*, a z-value of 1.41806 was calculated (p=.156174). Since this p-value was above the alpha of .05, Hypotheses 2a and 2b stating that social-contract/cheater-detection reasoning will vary positively with scenarios including *intent to cheat* and *benefit received from cheating)* were rejected. The same comparison of tasks A and D was repeated individually for the undergraduate sample and the graduate sample. The z-statistic for the undergraduates was 1.22537 (p=.220436). For the graduate sample, the z-test was .843264 (p=.399079). Neither group revealed a statistically significant result. These results also provided no statistical support for Hypothesis 3, which states, *there will be an interaction between intent to cheat and benefit received by cheating on the conditional rule of agency social contract tasks*, since cheater-

detection rates on the task with both independent variables was not significantly higher than the task without either variable.

To test against the direct social contract task E (Hypothesis 4), which describes a direct social contract relationship between owner and employee, rates of cheater detection on task A were compared with rates of cheater detection on task E. Both tasks contained information regarding an *intent to cheat* by one party and *benefit received by cheating* for the same party. It is no surprise that this pilot study revealed no significant differences in cheater detection between the subjects taking task A versus those taking task E ($z=.182237$; $p=.92991$).

Finally, the undergraduate sample was compared to the graduate practitioner sample for overall cheater detection in order to test for significant differences as predicted by Hypothesis 5. The undergraduates chose the adaptively correct response 45.7% of the time, while the graduates chose *q* and *not-p* only at a rate of 40.7%. No statistically significant differences were found in this case either as $z=.38185$ ($p=.63512$).

Two manipulation checks for the independent variables were added to the survey on the last page for the pilot study to make certain respondents were recognizing the independent variables being manipulated. The first manipulation check asked the students to what extent they interpreted there being *intent to cheat* present in the task they read and completed on the previous page. The second manipulation check asked the students to what extent they interpreted there being *benefit received by cheating* in the task they read and completed on the previous page. For tasks A through D, the manipulation check asked the respondents about perceived *intent* and *benefit* related to the manager of the scenario. The direct social contract scenario, however, does not contain a manager, so the manipulation check asked the respondents about *intent* and *benefit* related to the employees in the scenario. Internal manipulation checks of this kind are useful to

determine "the effectiveness of experimental treatments" (Rosenthal & Rosnow, 1991: 622). The instructions requested that subjects not return to the scenario once they had reached the anonymous survey page of their packets. This was to prevent the respondents from learning what independent variables are being manipulated and then using that information to correctly solve the tasks.

The manipulation checks (See Appendix A) utilized a 7-point Likert scale, where a "1" indicates "Definitely No" and a "7" indicates "Definitely Yes" in terms of there being intent and benefit received in the scenario. Subjects were able to choose a "4" to indicate that they were "Not sure" if there was intent or benefit received in the scenario. To determine whether respondents performing the tasks were choosing the necessary cards to detect violations of the conditional rule (cheaters) due to the presence or absence of the independent variables, a t-test was run on each variable in each of the tasks for both populations. In other words, the t-test was run to see if there were statistically significant differences in cheater detection based on respondents' perceptions of the existence of each independent variable. So, it was important to determine if the respondents who successfully detected the cheaters also perceived there being *intent* and *benefit* in the scenario when it was indeed there. The Likert scale means of the two manipulation checks were compared on tasks that actually contained the variables to see if the differences in cheater detection were related to perceptions of the presence of those independent variables.

There are two possible reasons for the unexpected results. Even though sample sizes were smaller than recommended and the instrument was distributed during finals (period when attention may be elsewhere), the focus was then turned to the empirical instrument. Since the results were statistically insignificant, either the theory was wrong or the instrument was flawed.

At the time of these pilot studies, there was little evidence that the problem rested with the theory. Multiple studies have replicated results of cheater detection rates exceeding 65% on social contract tasks. (Please see Chapter 4 for a discussion of those studies.) Based on this empirical support, the theory states that individuals are able to choose the adaptively correct response on violations of conditional rules framed as a social contract. This indicates there is evidence that a content-dependent neural circuit exists, which tempers reasoning about social exchange.

On the survey page of the packet distributed to students performing the tasks, two manipulation checks for the independent variables, *intent to cheat* and *benefit received by cheating* were administered. The data analysis of these manipulation checks was quite revealing. On the variable, *benefit received by cheating,* a t-test was run comparing the means of detected benefit on tasks containing the benefit variable in the scenario with the means of detected benefit on tasks without the benefit variable included. The mean of the former group was μ=4.96296, +/- .414331 (S.D.= 4.54863, 5.37729), and the mean of the latter group was μ=3.97826, +/- .474685 (S.D.= 3.50358, 4.45295). The t-statistic calculated by comparing these values was 2.99712 (p=.0032). The p-value was well below the recommended alpha of .05. Thus, there was a significant difference between the means indicating that subjects were indeed detecting the *benefit received by cheating* when it was included in the task.

Turning to the *intent to cheat* variable, a very different result was tallied, telling a much different story. When the means of detected intent on the tasks containing the intent variable in the scenario were compared to the means of detected intent on the tasks without the intent variable included, no significance was found. The mean of the former group was 3.63415, +/- .279455 (3.35469, 3.9136), and the mean of the latter group was 3.40426, +/- .344478 (3.05978,

3.74873). The t-statistic was 1.01578 (p=.311665). The extremely high value for alpha indicates that subjects are not detecting the intent variable in the tasks.

I concluded from this data analysis on the first pilot study that the tasks including the variable *intent to cheat* needed to be revised (tasks A, B, and E) to make the variable more obvious to respondents. One possible problem with this set of data was that each task told a different context in order to manipulate *intent to cheat* and *benefit received by cheating.* Thus, additional variables were being imposed which could have confused the results. Rather than trying to critique the theory driving the empirical research, it made logical sense to revise the instrument and run another study.

6.1.5. Pilot Study B

In this round of data collection, which served as my second pilot study for the dissertation project, the language on the tasks was tightened by making the manipulations consistent. Instead of using entirely different scenarios to illustrate *intent* and *benefit*, and the lack thereof, this round used the same context of "monitoring for employee bonuses" across all five tasks. But still, the reasons for intent and benefit varied from task to task. In the agency arrangement task with *intent* and *benefit* for instance, the manager could receive kickbacks as the benefit, but in the direct social contract task (task E), s/he was trying to curry favor with the employees. The conditional rule remained the same for all tasks: "If an employee produces more than 1000 units in a week, then that employee receives a pay bonus." Yet, the reasons for *intent* and *benefit* did vary across the tasks.

As was true in Pilot Study A, Pilot Study B's scenarios were told in the third person, with the respondent not cued into either role.

It was believed that the unexpected results in the first pilot study were due in part to a lack of clarity in the text about what the respondent was supposed to do. Thus, additional rhetoric was included in the independent variable paragraph after the conditional rule. On each of the tasks, the statement, "You want to find out if the manager breaks the rule" was added to enhance the clarity of the respondent's task. However, none of the statements in the final paragraph before the task question were changed from Pilot Study A.

Task E was revised to a greater extent. Generally, additional context and rationale were injected after the conditional rule to explain the presence of the two independent variables. Moreover, content was changed to maintain consistency with the conditional rule. One of the potential problems with task E from Pilot Study A was the confounding of the conditional rule with the explanation of the independent variables. The rule presented the "cost paid" variable as the antecedent and the "benefit received" as the consequent (a switched rule). However, in Pilot Study A, the explanation of the independent variable, *benefit received by cheating*, simply stated that the employees operate on an honor system by reporting their production. Essentially, by putting it this way, respondents to the task were drawn to look for cards dealing with production, rather than the bonus received. This second pilot study also changed the card choices from the first pilot. Instead of saying, "Bonus requested," the new tasks say, "Bonus received." It was surmised that the bonus request imposed an additional variable in the study needlessly. The conditional rule is broken when an employee receives a bonus without having earned that compensation. This compensation was based on actual number of units produced, not reported. Thus, I believe the task had been confusing to respondents.

The text on task E of Pilot Study B added the following passage to the paragraph after the conditional rule: "Employees are to request a pay bonus only when their production exceeds

1000 units in a week. Requests are automatically granted. Lately however, there's talk that some employees may be deliberately breaking the rule in order to receive extra money." The last sentence describes *intent to cheat*. The first two give the rationale for a *benefit received by cheating.* Table 6.3 summarizes the other changes (shown in boldface font) to the operationalized independent variables.

This time, a convenience sample of 169 undergraduate business students from the University of Pittsburgh's College of Business Administration (with fewer than three years of work experience), and 139 business practitioners with more than three years of work experience was obtained from graduate business classes at Duquesne University. Pilot Study B's data was collected from March 2004 through April 2004. Although the tasks were more consistent in their scenario context and in the perspective taken by the respondents, the results were again unexpected. Rates are summarized in Table 6.4.

Table 3 Manipulation of Independent Variable in Pilot Study B: Operationalization

ID Variable	Task A	Task B	Task C	Task D
Intent to Cheat	"The owner suspects that the manager is **deliberately** breaking the rule…"	"**There's talk that** the manager is breaking the rule to undercut the owner's approach."	"This manager is a good team player and would do nothing to intentionally harm the owner. Lately, the manager has been **distracted from the job due to family problems at home and has been** making mistakes."	"The manager is a good team player and would do nothing to intentionally harm the owner." Lately, the manager has been **distracted from the job due to family problems at home and has been** making mistakes."
Benefit	"…accepting kickbacks from the employees for doing so."	"…disagrees with the rule and believes it is unfair to employees."	"Whenever the manager gives an employee a bonus, the manager benefits by receiving a percentage of it."	*No text is written to reflect the benefit derived from cheating.*
Presence of Variable	Intent and Benefit	Intent; no benefit	No intent; benefit	No intent; no benefit

In some cases, this set of cheater-detection rates was lower than the first round of data collection. While the direction of the cheater detection among graduate practitioner students was in line with the theory, few substantive differences were found. A significant difference was found between cheater-detection rates on tasks A and D ($z = 1.7794$; $p = .0376$) in the graduate sample. Nevertheless, the cheater detection percentages were lower than the theory predicts. The undergraduates with fewer than three years of work experience detected cheaters much more effectively than did the more experienced graduate students, although no statistically significant differences were detected between any of the cheater-detection rates in the tasks. Unusually, performance (cheater detection) peaked on task C for the undergraduate business students. Statistically significant results were also found between the two populations on tasks A and E

only for Hypothesis 5. On task A, a z-score of 2.23413 (p=.04782) was calculated and on task E, a z-score of 3.8371 (p=.01963) was calculated.

Table 4 Pilot Study B Results: Percentage of Subjects Choosing q and not-p

	Task A	Task B	Task C	Task D	Task E
Undergrad	59% n=27	45% n=22	58% n=31	42% N=33	61% n=56
Graduate	41% n=22	36% n=25	35% n=23	21% N=24	33% n=45
Predicted	65-75%	45-55%	45-55%	25-35%	65-75%

In the development of the final version of the instrument, the reasons for the unexpected results in the second pilot study were analyzed. Since evolutionary psychology theory has been validated in numerous studies (see Chapter 3), and since those studies often used student populations, my focus remained on the instrument. Nothing appeared to be wrong with the theory or with the population. It is still more likely that the problem rested with the instrument. The second iteration of the instrument focused on the clarity of the independent variables that are responsible for triggering the cheater-detection circuits. The final iteration was sensitive to the fact that respondents may be imposing their own perspectives on the completion of the task. In other words, a respondent was placed in a role where s/he was the one who could potentially be cheated. From this cued viewpoint, the respondents of the study were opposite a person or persons with a cheating option. In response, the final version of the tasks removed that ambiguity in addition to making the independent variables more direct. Although the theory does not spurn such a venture, no study in evolutionary psychology has attempted to keep

perspective neutral. Gigerenzer and Hug (1992) claim that without cueing a subject into a particular perspective, cheater detection algorithms are unlikely to be activated. Perspective did matter to our Pleistocene ancestors when they engaged in social exchanges. When they calculated the costs and benefits of entering into a particular exchange, a perspective (their own) had to be taken. Otherwise, reasons for each of the other card choices could always be made. This may be the reason that the second iteration did not support the theory.

6.2. **Main Study Methods**

6.2.1. Operationalization of Variables: Main Study

This section describes instrument changes from the pilot studies as the last stage in the evolution of the methodology for the main study. (Appendix C displays the adapted Wason selection task instrument for this dissertation's main study.) Once again, the language in the tasks was tightened and revised to emphasize the potential violations of the conditional rule. The rule itself, the context, and the card choices remained unchanged. The independent variable paragraph immediately following the conditional rule was altered, as well as the rationale behind the scenario. Each task is broken down below and the operationalized variables are summarized in Table 6.5.

Perspective

As in the pilot studies, there are three main perspectives presented across the five selection tasks—owner, employee, and manager. The principal in the tasks is represented by the owner of the company. The agent for the four agency tasks is the manager, who reports directly to the owner. For the fifth scenario, however, the agent is represented by the employee. In this task, four employees individually report directly to the owner. Respondents are told that the

owner (principal) is concerned that the manager (tasks A through D) or the employees (task E) are cheating. In each case, an opportunity to cheat by the other party in the social contract agency relationship was clearly stated. In other words, the owner in each task was faced with the problem of moral hazard in that the contracting partner cannot be monitored until after the task has been performed. The role taken by the subject was not manipulated. In each case, respondents were cued into the perspective of the owner who is to check up on the manager (tasks A through D) or the employees (task E). The purpose here was to isolate who is in charge of enforcing the rule and to set up the conditions necessary for a social contract to be recognized by the neural mechanisms in the brain.

Benefit received by cheating

Participants were given content in the tasks that either clearly explained the benefit to be received by breaking the conditional rule, or omitted such information. In one scenario the *benefit received from cheating* takes the form of the contracting partner (the manager) getting a percentage of bonuses paid to the employees (task A), while another stated that that same manager unintentionally receives a percentage of the bonus (task C), even though s/he would never consciously do anything to harm the owner. In the direct dyadic relationship scenario (task E), *benefit received by cheating* was described as the employees taking an undeserved pay bonus. (Please see the Appendix for the tasks.) Tasks B and D, the ones without this independent variable, had no information regarding possible benefit to the agent for cheating. The specific manipulation of these variables is displayed in Table 6.5.

Intent to cheat

Two variations of intent are demonstrated in the adapted selection tasks. One scenario explains the other contracting party's intention to cheat in order to receive a monetary benefit.

The *intent to cheat* in task A, for instance, is identified by the statement, "you fear the manager is deliberately awarding bonuses to employees who have not earned them …;" task B also refers to the manager's objective of breaking the rule with the same statement as in task A. Task E claims the employees wish to break the rule in order to receive the pay bonus. Honest incompetence is ascribed to a person who has no intent to break the conditional rule but rather does not possess the skills to do the job properly. This will be treated as a *no intent* situation since it does not demonstrate a misalignment of interests, but rather a mistake. In tasks C and D, the manager is simply "making mistakes."

6.3. **Main Instrument**

The main change from Pilot Study B to the final instrument used for data collection in the main study was that perspective was injected into the text of the scenarios. Instead of keeping the respondent's perspective constant as a third-party observer, the revised instrument cues the respondents into the owner perspective for all five tasks. Perhaps the third-party view was too nebulous and led to varied card choices. It should be reemphasized that no Wason instruments in the literature had ever used the third-party approach, although no objections to that approach had ever been raised in the evolutionary psychology literature. Since this dissertation claims that the activation of cheater-detection algorithms in the brain is moderated by cultural experiences, it is logical to deduce that respondents' backgrounds may influence card choices. Therefore it was decided to keep the perspective constant in all the tasks by cueing respondents into the owner (principal) role. As a result, the final tasks do not tell the scenario in the third person, but rather the second person. In each task, respondents are told, "You are the owner of DMW Company."

In task A, with scenario content reflecting both *intent* and *benefit,* an additional statement was included to clarify the rationale behind the rule. To highlight the fact that the manager is paid on a commission basis, the following statement was added immediately before the conditional rule: "The manager earns a percentage of each bonus paid." This statement was designed to increase the salience of the independent variable, *benefit received by cheating.* Because there is no *benefit* included in the text of tasks B and D, that statement was omitted from those tasks. Task C, with *benefit* but no *intent,* also describes this compensation arrangement with the manager.

In the paragraph following the conditional rule, the rest of the manipulation of the operationalized independent variables was presented to respondents. As with all Wason selection tasks, card choices are expected to be influenced by the presence or absence of information regarding the independent variables. Table 6.5 describes the difference in detail.

Table 5 Manipulation of Independent Variable in Final Study: Operationalization

ID Variable	Task A	Task B	Task C	Task D
Intent to Cheat	"Now however, you fear the manager is deliberately awarding bonuses to employees who have not earned them…"	"Now however, you fear your manager is deliberately awarding bonuses to employees who have not earned them."	"You do not believe the manager would deliberately award unjustified bonuses, but could make an honest mistake."	"You do not believe the manager would deliberately award unjustified bonuses, but could make an honest mistake."
Benefit	"…in order to get unjustified additional compensation."	*No text is written to reflect the benefit derived from cheating.*	"As owner, you want to check to see if the manager is breaking the rule and thus earning more than the manager deserves."	*No text is written to reflect the benefit derived from cheating.*
Presence of Variable	Intent and Benefit	Intent; no benefit	No intent; benefit	No intent; no benefit

Task A specifically describes the owner's fear that bonuses are being awarded by the manager to employees who have not earned them (*intent*). As shown in the chart, it also specifies *benefit* by claiming that additional compensation can be achieved by cheating. Task B omits text regarding *benefit received by cheating* completely, but still conveys the owner's fear that the manager is awarding bonuses to employees who have not earned them. Tasks C and D do not include *intent to cheat* and claim that the manager may be capable of making honest mistakes. Using honest incompetence as a means to describe the manager's unwillingness to knowingly cheat the owner was designed to show respondents that no *intent* exists. However, on task C, the manager can still unwittingly receive a benefit by breaching the conditional rule as described in the owner's fear that the manager is earning more than deserved. The control task D has neither variable and omits any language describing *benefit.* Lack of *intent to cheat* is described in the same manner as in task C. While consistency in the operationalization of the

independent variables is achieved to a fuller extent in the final iteration of the instrument, full consistency is not critical for the validity of the instrument in general (see Chapter 4 for a discussion of this issue). The independent variables can be described in any way as long as they indicate *intent to cheat* and *benefit received by cheating* by one party in the social exchange relationship.

For the final hypothesis, task E was adjusted to make the presence of the two independent variables more apparent. Before the conditional rule, text describing the context of the relationship between the owner and the four employees is included. Employees are to receive a pay bonus when they self-report that their personal production exceeded 1000 units of production in one week. After the rule it is suggested that the owner (the role in which the respondent is cued) is concerned that some employees may be deliberately over-reporting their production in order to receive extra money. No longer is it ambiguous about the employees' intention, nor the owner's concern. Placing respondents into the role of owner would also make it more clear as to what they are to be looking for in terms of actions that would break the conditional rule.

6.4. **Sample Size Determination**

Previous studies using social contract Wason selection tasks have used sample sizes of 30 per condition (Evans, 1996; Fiddick, Cosmides, & Tooby, 2000). Using a conventional and recommended alpha level of .05 (Christensen, 2001) and a recommended power level of .8 (Cohen, 1988), a medium effect size requires a sample size of 28 per treatment (Christensen, 2001: 311).

Because cheater-detection rates on dyadic social contract Wason selection tasks are well-documented and similar across replicated studies (Cosmides, 1985; Cosmides, 1989; Gigerenzer & Hug, 1992; Barrett, 1999; Sugiyama, Tooby, & Cosmides, 2002), only one direct social contract scenario was used in this study, the direct social exchange scenario (Task E). To increase statistical power for this group, sample size was doubled (Rosenthal & Rosnow, 1991). With the same number of respondents for the direct social contract group, there was risk that the test might incorrectly conclude that the difference between cheater detection on the agency task with *intent* and *benefit received by cheating* (task A) and the cheater detection on task E was not significant (Shadish, Cook, & Campbell, 2002), thereby increasing Type 1 error (Christensen, 2001).

Another approach for determining the proper and appropriate sample size for this study is based on a formula of predicted values for each condition. The rule, n x 100-p >= 5, provides verification that the number of subjects required in each cell for a recommended alpha level of .05 does not need to be greater than 28. (Please refer back to Chapter 5 for expected rates of cheater detection based on previous research and my own preliminary study.) As illustrated by Table 6.6, a sample size of 28 is acceptable at p = .05 (level of significance) when the predicted rate of cheater detection exceeds 18%. The probability in column 3 is based on values obtained from prior research predictions on normal social contract tasks (Tooby & Cosmides, 2000; Barrett, 1999) Since the number in the final column exceeds five in each treatment, a sample size of twenty-eight is sufficient.

Table 6 Verification of Sample Size per Treatment

Task	N	P	100-p	>=5
A	28	.65	.35	9.24
B	28	.45	.55	14.84
C	28	.45	.55	14.84
D	28	.25	.75	20.44
Control E	56	.65	.35	18.48

Source: Keller & Warrack, 2000: 374

6.5. **Research Design**

Subjects were randomly assigned to each condition mandating an experimental research design rather than a quasi-experimental design (Spector, 1981). A quasi-experimental design typically matches particular subjects to specific conditions (Shadish, Cook, & Campbell, 2002). Since the purpose of this empirical project was to study only the effects of the manipulation of the independent variables on cheater detection, it qualified as an experiment.

A between-subjects research design was used in this experiment. This type of research design has each participant "exposed to only one level…" of the independent variable (Martin, 2000: 152). So, each subject provided data about one level of each independent variable in the study. The reason for this choice of design was to avoid any transfer effects and contamination that may result from respondents seeing all variations of the independent variables. Prior studies using versions of the Wason selection task have utilized this similar design (Cosmides, 1985; 1989; Sugiyama, Tooby, & Cosmides, 2002) and give the present study face validity. (See the complete discussion of validity and reliability of the Wason selection task in Chapter 4.) Within-

subjects designs in which participants are "exposed to all levels of the independent variables" were not desirable here because of the risk of learning effects on the dependent variable from repeated iterations of the same scenario (Martin, 2000: 352). This threat to internal validity was minimized by using a between-subjects design (Shadish, Cook, & Campbell, 2002). While between-participants designs provide a less sensitive test of the independent variables in the study, an unconfounded measure of the effects of each independent variable was most desirable (Christensen, 2001). To most accurately test for the existence of social-contract/cheater-detection algorithms in the brain, one task per participant was used.

More specifically, a 2 x 2 factorial design was used. In this simple kind of design, "every level of one independent variable is crossed or associated with every level of the other" (Spector, 1981: 54). For Hypotheses 1 through 4, there are four main treatments or cells within the agency context that vary the two other independent variables—*intent to cheat* and *benefit derived from cheating*. This design allowed me to display the joint effects of the independent variables in one cell, as well as their independent effects. (Please see Table 6.7.) Task D involves an agency social contract relationship in a business context with neither *intent to cheat* nor *benefit derived by cheating* present in the scenario. The direct scenario, task E, involves "no intent" and "no benefit" in a normal dyadic social contract form. This task was compared against cheater detection for task A to specifically test for the effects of the agency arrangement.

Table 7 2 x 2 Factorial Design for Agency Tasks

	Intent to Cheat	**No Intent to Cheat**
Benefit Derived from Cheating	Task A	Task C
No Benefit Derived from Cheating	Task B	Task D

6.6. **Subjects and Data Collection**

Student convenience samples were used for this phase of the research project. Previous research using the Wason selection task used student convenience samples for testing the existence of content-dependent algorithms (Cosmides, 1985; Cosmides, 1989**;** Gigerenzer & Hug, 1992; Price, Cosmides, & Tooby, 2002). As an extension of that research stream, it was appropriate to use a student population for the empirical test. Moreover, since social-contract algorithms with a cheater-detection subroutine are thought to be universally hardwired in the species (Cosmides & Tooby, 2000b), type of population matters little.

Since a between-subjects research design was used, large numbers of respondents were needed to achieve the desired number of subjects in each cell. Given that the pilot studies sampled MBA students at three universities in Pittsburgh (Carnegie Mellon University, Duquesne University, and the University of Pittsburgh) data had to be found elsewhere. Permission was granted by member of the Social Issues in Management Division at the Academy of Management to sample their MBA students. Packages with the instrument were shipped via FedEx with instructions and disclaimers included. All classes were in the Management divisions of the business schools. For the sample of undergraduates with no work experience, two classes in Business Ethics at Duquesne University were sampled.

The order of the tasks was counterbalanced and distributed to students so as to avoid possible differences in performance based on classroom factors, which is one of the main disadvantages of using a between-subjects experimental design (Martin, 2000). Counterbalancing the order of the tasks distributed to the students randomizes the samples so that each student in the room has an equal chance of receiving a task. The class size was entered into the following algebraic formula to calculate the number of tasks to be mailed per condition:

$$\mathbf{x + x + x + x + 2x = number\ of\ students\ in\ a\ class}$$

Although no cash incentive was offered to subjects for their participation in the study, both undergraduate and graduate students were given the option not to participate. Instructors of each of the courses who gave consent to use their students during class time read a disclaimer aloud to assure students that their participation was completely voluntary and would not affect their grade in the course (See Appendix B). The statement also promised the students that their responses were to be kept anonymous and that their performance on the tasks was not to be tracked or traced back to them. Table 6.8 lists how many business practitioners came from each university sampled, as well as the rates of usable tasks.

Table 8 Sample Demographic: Business Practitioner Sample (Final Study)

Institution	Surveys Returned	Usable Surveys	Usability Rate
Boston College	35	26	74%
Carnegie Mellon University	14	11	79%
Eastern Connecticut State	40	36	90%
Northwestern University	105	52	50%
Suffolk University	89	67	75%
University of Central Florida	21	18	86%
University of Delaware	31	21	68%
University of Minnesota	121	99	82%
University of New Mexico	35	31	89%
Virginia Polytechnic	22	17	77%
Winthrop University	33	25	76%

For the business practitioner population, 72 percent (393) of the surveys returned were usable for this study ranging from fifty to ninety percent across the schools. The business practitioners had varied and diverse work experience ranging from military service to business ownership. Typically, their experience was that of middle- to upper-level managers. The average age was 31.3 years. Thirty-eight percent of this group were female (n= 149), and a large majority were American (79%). Years of full-time work experience ranged from three years (the

minimum accepted for this study) to thirty years, with the average being 8.76 years. The average number of years of full-time business work experience at their current job was 3.93.

For the undergraduate business student group, 189 respondents' tasks were usable out of the 212 distributed (89%). The average age of the usable sample was 20.1 years, with the majority being male (59%) and from the United States (92%). The average number of years of full-time professional work experience was about 1 year. Average time spent at their current place of employment was also about 1 year.

6.6.1. Materials and Procedure

Respondents were given a pencil-and-paper version of the adapted Wason selection task. The first page of their booklet provided the students with instructions about the task. The second page presented the business scenario and selection task to the subjects. Students were asked to circle the boxes that are necessary for detecting violators of the conditional rule. On the last page of the packet, subjects were asked to provide demographic information regarding their age, gender, and work experience (Please see Appendix C for complete final instrument). The manipulation check was omitted from the final version of the instrument because it potentially risked having students refer back to the task and change their answer, thus compromising the validity of the final results. Subjects were given as much time as they need to complete the task, but took approximately 5 to 6 minutes on average. Instructors of each class in which data was obtained were told to read a disclosure script (see Appendix B) assuring students of their confidentiality and explaining the task at-hand.

The results of the experiment in this dissertation project are presented in the next chapter. The data analysis and evaluation of the hypotheses are laid out in detail.

7. DATA ANALYSIS AND RESULTS

This dissertation research project was executed in three phases. Two pilot studies were conducted prior to the main study. The results of the pilot studies (reported in the preceding chapter) were useful in refining the instrument and informing the main study. Three separate studies with independent datasets were conducted in order to verify the differences in cheater-detection rates across tasks and between populations. The results of the main study are reported in the next section.

7.1. Test Results for Cheater-Detection Hypotheses

As described in Chapter 5, this dissertation tested variables necessary for the activation of cheater-detection algorithms in business social contract scenarios. Rates of cheater-detection were expected to vary across the four agency-type arrangement tasks. To assess the rates of cheater-detection in each of the tasks, a percentage of the subjects who chose the *not-q* and *p* cards only was calculated (See Table 7.1). (Remember that these are switched social contracts. Therefore, the cheater-detection choices are reversed.) Once the percentages were determined, tests for statistical significance of differences between the rates of cheater-detection within and between the groups were performed.

Table 9 Cheater-Detection Rates for Agency-Type Tasks

(Percentage of not-p & q responses)

	Task A	**Task B**	**Task C**	**Task D**
All subjects n= 389	*48.1%* 50/104	***54.3%*** **51/94**	*42.3%* 41/97	***28.7%*** **27/94**
Undergraduates n= 120	*46.9%* 15/32	***45.2%*** **14/31**	***48.4%*** **15/31**	*42.3%* 11/26
Business Practitioners n= 269	*48.6%* 35/72	*58.7%* 37/63	*39.4%* 26/66	*23.5%* 16/68
Expected	*65-75%*	*45-55%*	*45-55%*	*25-35%*

(Note: Boldfacing indicates values that fall within the predicted range.)

Hypothesis 1, the alternate hypothesis, states that there is a relationship between the independent and dependent variables in the tasks. Thus, as the independent variables (*intent to cheat* and *benefit received by cheating*) are manipulated, the dependent variable (*cheater detection*) is predicted to be affected. First, a one-way analysis of variance was run on the entire sample to determine whether there are statistically significant differences among the means in the tasks. The rates of cheater-detection are easily translated into decimal mean scores since the dependent variable is dichotomous. Table 7.2 illustrates the analysis of variance for the sample at a 95% confidence level and 4 degrees of freedom. The F-test (F= 5.21), a ratio of the between-groups estimate to the within-groups estimated yielded a p-value of .0004, which is well under the recommended alpha of .05. Thus, Hypothesis 1 is supported by the data. Cheater detection was indeed affected by the independent variables manipulated across the tasks.

Table 10 One-way Analysis of Variance for Entire Sample

Source	Sum of Squares	Df	Mean Square	F-ratio	P-value
Between groups	4.81126	4	1.20281	5.20805	.0004
Within groups	89.1478	386	.230953		
Total	93.9591	390			

In order to isolate the source of the variance indicated by the ANOVA, cheater-detection rates for each task were obtained between the groups and within the groups. Table 7.1 illustrates that there is indeed a difference in cheater-detection rates across the agency tasks as proposed by Hypothesis 1. The boldface font in the boxes for tasks B, C, and D indicates that the percentages fell within the expected theoretical range of cheater detection. To check for significance between the rates, a series of z-tests were used to compare the four percentages in both samples. The results, shown in Tables 7.3a-c, provide partial support for the hypothesis. The boldface font in tasks C and D boxes indicates statistically significant differences at $\alpha = .05$ between the agency-arrangement tasks.

Table 11 Significant Differences in Cheater-Detection Rates—Entire Sample (n= 389)

Task	A	B	C	D
A compared with		*z = -.8684* *p = .8074*	*z = .8268* *p = .2042*	***z = 2.7900*** ***p = .0026***
B compared with	*z = .8684* *p =.1926*		***z = 1.6576*** ***p = .0487***	***z = 3.5526*** ***p = .0002***
C compared with	*z = -.8268* *p = .7958*	*z = -.1.6576* *p =.9513*		***z = 1.9545*** ***p = .0253***
D compared with	*z =-2.7900* *p =.9974*	*z =-3.5526* *p = .9998*	*z = -1.9545* *p = .9747*	

Table 12 Significant Differences in Cheater-Detection Rates—
Business Practitioner Sample (n= 269)

Task	A	B	C	D
A compared with		*z = -1.1757* *p = .8802*	*z = 1.0891* *p = .13806*	***z = 3.0822*** ***p = .00102***
B compared with	*z = 1.1757* *p = .1199*		**z = 2.1962** **p = .0140**	***z = 4.1014*** ***p = .0001***
C compared with	*z = -1.0891* *p = .8619*	*z = -2.1962* *p = .9860*		***z = 1.9792*** ***p =.0239***
D compared with	*z = -3.0822* *p =.9990*	*z = -4.1014* *p = .9999*	*z = -1.9792* *p = .9761*	

Table 13 Significant Differences in Cheater-Detection Rates—
Undergraduate Business Student Sample (n= 120)

Task	A	B	C	D
A compared with		*z = .1364* *p = .4457*	*z = -.1201* *p = .5478*	*z = .3478* *p = .3640*
B compared with	*z = -.1364* *p = .5543*		*z =-.2545* *p = .6005*	*z = .2162* *p = .4144*
C compared with	*z =.1201* *p = .4522*	*z = .2545* *p = .3995*		*z = .4590* *p = .3231*
D compared with	*z =-3478* *p =.6360*	*z =-.2162* *p =.5856*	*z = -.4590* *p = .1107*	

When the entire sample of both business practitioners and undergraduate business students was combined (see Table 7.3a), statistically significant differences in cheater detection were found to exist between tasks A and D (z = 2.7900; p = .0026), B and D (z = 3.5526; p = .0002), and, C and D (z = 1.9545; p = .0253). A statistically significant difference was also found between tasks B and C (z = 2.1962; p = .0487), although this is not predicted by the theory. No difference was expected between tasks each containing one independent variable necessary for activation of the cheater-detection algorithms. *There appears to be a weak relationship between the independent variables and the dependent variable across the agency tasks for the entire population.*

The results look slightly different when the sample is broken down by group (see Table 7.3b). For the MBA business practitioner group, at $\alpha = .05$ (two-tailed), significant differences in cheater-detection rates were found between tasks A and D (z = 3.0822; p = .00102), B and D

(z = 4.1014; p = .0001), and C and D (z = 1.9792; p = .02390). These statistically significant results were in the predicted direction as well. In addition, a statistically significant difference was found in cheater detection between tasks B and C (z = 2.1962; p = .0140), but this was not predicted by the hypothesis. Since tasks B and C each possess one of the independent variables manipulated in this test, expected rates of cheater-detection are not proposed to vary between these two tasks. *Within this sample of MBA business practitioners, there appears to be a slight relationship between the independent variables and the dependent variable.*

A much different result is found when the significant differences in cheater detection between the tasks are tallied for undergraduate business students only (Table 7.3c). When cheater-detection rates are compared across all four agency tasks, no statistically significant differences occurred. The undergraduate business student sample performed at a relatively consistent rate across all those tasks. Within this sample of undergraduate students, there appears to be no relationship between the independent variables and the dependent variable. *Thus, any variation in cheater detection across the agency tasks is influenced only by the business practitioner group.* The implications and possible explanations for these results will be discussed in detail in the next chapter.

Hypothesis 2 states that social-contract/cheater-detection reasoning will vary positively with task content that specifies *intent to cheat* and *benefit received by cheating* (the two independent variables). In other words, the activation of the algorithms will be affected by the presence of these two independent variables. Social-contract/cheater-detection reasoning should be greatest for tasks specifying content with both independent variables. The activation of the circuits for the cheater-detection subroutine should decrease as independent variables are removed. Thus, this is a directional hypothesis. Cheater-detection reasoning should be lowest

for tasks specifying neither independent variable in the content of the scenario according to the hypothesis. To determine if social-contract/cheater-detection reasoning did indeed vary positively with the presence of *intent to cheat* and *benefit received by cheating*, we refer back to Tables 7.3a-c. Detection of cheaters was highest in task B, which contains *intent* but no *benefit*. Despite this unexpected result, no statistically significant difference exists between task A and task B across the entire population.

Since both tasks B and C contain only one independent variable in the text of the scenarios, it is reasonable to collapse cheater-detection rates for the two tasks. In the single independent variable condition, cheater-detection rates fall within the predicted range. Table 7.4 shows the comparison of cheater-detection rates between the three conditions. As illustrated, when the results of tasks B and C are combined, both samples fall on the low end of the predicted theoretical range of cheater-detection values. Values appearing in boldface indicate rates that fall within the predicted range of cheater detection. Tables 7.5a-c exhibit the statistical significance tests of cheater-detection rate comparisons when the tasks are broken down by presence or absence of the independent variables. Boldface values indicate statistical significance. A similar story is told when the single variable tasks are combined. Significant differences were found when the single independent variable tasks were compared with task D ($z = 3.1294$; $p = .0008$) for the entire sample. No statistical significance was found for the undergraduate business student group, however. The variance appears to be originating from the business practitioner sample between the single independent variable tasks and the task containing neither independent variable ($z = 3.4457$; $p = .0003$). Even though for the entire population there is a statistically significant variation in cheater-detection rates between tasks A (containing content describing both independent variables) and D (containing content describing

neither independent variable), none was found when considering only the undergraduate business student sample. *Thus, only weak support for Hypothesis 2 was found.*

Table 14 Cheater-detection Rates by Presence or Absence of Independent Variables

	Task with both independent variables (A)	**Tasks with 1 independent variable (B & C)**	**Task with no independent variables (D)**
All subjects N= 389	*48.1%* 50/104	***48.2%*** ***92/191***	***28.7%*** **27/94**
Undergraduates N= 120	*46.9%* 15/32	***46.8%*** ***29/62***	*42.3%* 11/26
Business Practitioners N= 269	*48.6%* 35/72	***48.8%*** ***63/129***	*23.5%* 16/68
Expected	*65-75%*	*45-55%*	*25-35%*

Table 15 Significant Differences in Cheater-Detection Rates—Entire Sample (n= 389)

	A	**D**
B & C compared with	z = .0149 p = .4941	**z = 3.1294** **p = .0008**

Table 16 Significant Differences in Cheater-Detection Rates—
Undergraduate Business Students (n= 120)

	A	**D**
B & C compared with	z = -.0093 p = .5037	z =.3839 p = .3505

Table 17 Significant Differences in Cheater-Detection Rates—
Business Practitioners (n= 269)

	A	**D**
B & C compared with	z = .0307 p = .4877	**z = 3.4457** **p = .0003**

Similarly, no support was found for Hypothesis 3, which proposes an interaction effect between the two independent variables. An interaction effect means there should be higher rates of cheater-detection when both variables are present in the content of the scenarios. Translated to the tasks, this suggests that task A should elicit higher rates of cheater-detection than any of the other tasks. This clearly was not the case (See Table 7.1). Task A only elicited 48.1% of *not-q* and p responses for the entire population. (Business practitioners detected cheaters on this task 48.6% of the time, while undergraduate business students chose *not-p* and *q* 46.9% of the time.) Compared with rates of choosing *p* and *not-q* on the other tasks, this rate is second-highest among the four agency tasks, with only a significant difference found with task D (containing content specifying neither independent variable) ($z = 2.7900$; $p = .0026$). Moreover, task B (containing content specifying only *intent to cheat*) elicited the highest rate of cheater-detection for the entire population (54.3%). This was significantly higher than task C ($z = 1.6576$; $p = .0487$) and task D ($z = 3.5526$; $p = .0002$). *Therefore, Hypothesis 3 cannot be supported by these results.*

7.2. **Test Results on Agency Hypothesis**

The second empirical test involves comparing the rate of cheater-detection on tasks with content specifying an agency-type organizational arrangement against tasks with content specifying only a dyadic social contract relationship with no hierarchical relationship described. This is the agency hypothesis which states that there should be no difference in cheater-detection rates due to the agency variable. In this part of the study, only tasks A and E were compared because they contain content that specifies both *intent to cheat* and *benefit received by cheating*.

To run statistical tests on the other tasks would not have served much purpose since one or both variables were omitted in tasks B, C, and D.

Table 18 Comparison of Cheater-Detection Rates--Manipulating Agency Variable

	Entire Population	**Undergraduate Students**	**Business Practitioners**
Task A Cheater Detection	*48.1%* *50/104*	*46.9%* *15/32*	*48.6%* *35/72*
Task E Cheater Detection	*37.1%* *66/178*	*39.0%* *23/59*	*36.1%* *43/119*
Task A Compared with Task E	**z = 1.8109** **p = .0351**	z = .7289 p = .2330	**z = 1.7000** **p = .0446**

Table 7.6 shows the rates of cheater-detection (rows 2 and 3) and the corresponding z-tests for this part of the study (row 4). The boldface font in the boxes indicates statistically significant results at $\alpha = .05$ (one-tailed). Hypothesis 4 posits that there should not be a statistically significant difference in cheater-detection rates between tasks containing content that describes an agency relationship and tasks containing content that describes a direct dyadic social contract relationship (with both *intent* and *benefit*) present. This was true only for the undergraduate business student population ($z = .7289$; $p = .2330$). The entire population yielded statistically significant results at $\alpha = .05$ ($z = 1.8109$; $p = .0351$). The MBA business practitioner group also demonstrated a statistically significant difference on cheater detection between the tasks ($z = 1.7000$; $p = .0446$). These significant results were not predicted by the theory. *Thus, only partial support could be given for Hypothesis 4.* It should also be noted that the rates of cheater-detection on the direct dyadic social contract task (E) were below the predicted levels by the theory (65-75%) for both groups. The implications for this unexpected result are discussed in the next chapter.

7.3. **Test Results on Populations Hypothesis**

The final hypothesis in this study compared the ability to detect cheaters across populations. A significant difference in ability to choose the *not-p* and *q* documents between the undergraduate business student population and the MBA business practitioner population was proposed by Hypothesis 5. More specifically, the practitioner group was hypothesized to detect cheaters more often than the undergraduate group.

Table 19 Comparison of Cheater-detection Rates between Populations

	Task A	**Task B**	**Task C**	**Task D**	**Task E**	**All Tasks**
Undergraduate Students	46.9%	45.2%	48.4%	42.3%	39.0%	*43.6%* *78/179*
Business Practitioners	48.6%	54.3%	42.3%	28.7%	36.1%	*40.5%* *157/388*
Significance Test	z = .1636 p = .4350	z = 1.2415 p = .1072	z = .8361 p = .2015	**z = 1.8000 p = .0359**	z = .3704 p = .3555	*z =.6990* *p =.2423*

As illustrated in Table 7.7 above, the MBA business practitioner group detected cheaters at a higher rate than the undergraduate business students only on tasks A and B. On the remaining tasks, the undergraduate students chose *not-p* and *q* more often than the business practitioners. Substantively, however, the z-tests yielded no significant results at $\alpha = .05$ (single-tailed) on these two tasks (A and B). The only statistically significant result was found on task D ($z = 1.8000$; $p = .0359$), but this was the opposite of the predicted direction. Overall, across all five tasks, there was no significant difference in cheater-detection rates between the two populations (either direction*). Therefore, Hypothesis 5 is rejected.*

7.4. **Summary**

The results of the hypothesis tests in the main study of this dissertation project provided some verification of the hypotheses.

- Hypothesis 1 was supported when tests of statistical significance were run. Therefore, cheater-detection rates did vary from task to task when the two independent variables were manipulated. Most of the statistical variance was caused by the business practitioner sample.
- Hypothesis 2, however, was not supported. Cheater detection did not vary positively with the presence of the two independent variables in the text of the scenarios in this study.
- Hypothesis 3, proposing an interaction effect between the independent variables was rejected. The variables *intent to cheat* and *benefit derived by cheating* together did not lead significantly to the activation of the cheater-detection algorithm.
- The statistical tests of significance yielded partial support for Hypothesis 4. This hypothesis compared cheater-detection rates for the agency task with both independent variables included in the text of the scenario with the dyadic social contract task with both cheater-detection variables included in the text of the scenario. The variance originated in the business practitioner group.
- Finally, Hypothesis 5, which compared the cheater-detection rates between the two populations was not supported.

To understand the meaning of the results described in this chapter, a closer examination of document choices within the tasks and possible influences upon the social-contract/cheater-detection algorithms for both populations is warranted. This additional analysis is conducted in

the following chapter, which sheds light on some interesting patterns from which to make important conclusions.

Given the unexpected results from the dissertation's main study discussed in this chapter, additional efforts were made to gain insight into the findings. One more study was conducted as a way of further verifying the main study's validity. This final empirical test was not originally planned and thus is considered a follow-up study. So as not to confuse the findings of the main study the description and results of the follow-up study are reported in the subsequent chapter. The added study is presented within the context of my interpretation of the broader consequences stemming from the dissertation's main study. Although any data results would typically appear with the other findings, the follow-up study's data analysis gains greater significance when discussed within the context of the dissertation's theoretical contributions to evolutionary psychology and social exchange behavior in corporations. Therefore, in order to interpret and understand the findings of the main study, the follow-up study is included in the discussion and implications chapter.

8. DISCUSSION AND IMPLICATIONS

In this final chapter, the results of the main study testing the main effects and interaction effect hypotheses are discussed in detail. Here lessons are deduced from the empirical study, and implications for the Cosmides-Tooby approach to evolutionary psychology and its usefulness in the business paradigm are presented. From this line of enquiry, future directions for research in business using evolutionary psychology are identified.

The chapter is organized as follows: The academic reasons and possible explanations for my results are outlined and classified into three categories: explanations centering around the theory, the methodology, and the population. A follow-up study is presented that replicates the tasks administered by Cosmides in previous research in order to determine whether similar rates of cheater-detection can be achieved with a business sample. As mentioned in the previous chapter, reporting of the additional empirical test was saved for this chapter because it was conducted solely for the purpose of gaining insight into the main study's major findings. It makes more sense to include the results within a discussion of the validity of the evolutionary psychology approach to social contracts in business. Finally, suggestions consistent with the evolutionary psychology approach are offered, which are used to reconcile the nature-nurture debate and to bridge the fields of business ethics and evolutionary psychology together.

This dissertation expands on the existing assumptions of human behavior from the social sciences by integrating insights from the natural sciences and evolutionary theory to increase understanding of managerial behavior in business social contract situations. By bridging disciplines, this study is a positive step toward comprehending how culture and biology may interact to influence managers' abilities to recognize business social contracts and detect cheaters in an organizational setting.

The main study described earlier yielded statistically significant support for Hypothesis 1 and partial support for Hypothesis 4 but none for the other hypotheses. At first glance, these results do not present a healthy diagnosis for Cosmides' theory of social contract reasoning in a business context. However, a closer look is warranted and yields a much brighter prognosis for the usefulness of the evolutionary psychology approach in organizational theory and business ethics. To understand why evolutionary psychology is a promising endeavor for the business and society field, further investigation into the reasoning tendencies of the research subjects and into the possible factors influencing their decisions was conducted.

8.1. **Analysis of Main Study Results**

As stated in the previous chapter, Hypothesis 1 stating that "there will be a significant difference in social-contract/cheater-detection reasoning across the tasks" was supported by my empirical study. This finding means that the independent variables, *intent to cheat* and *benefit received by cheating,* do have an effect on performance on the adapted Wason selection task. It is critical to be careful about the language used here, however. As stated in chapters 2 and 3, the driving theory utilized in this study does not operate at the level of analysis of displayed behaviors. Rather, it operates at the level of cognitive machinery. By supporting Hypothesis 1, this dissertation demonstrates that among business students and MBA business practitioners, manipulation of the independent variables affects the activation of the cheater-detection algorithms as a subroutine of the larger set of social-contract circuits. Thus, Cosmides' theory of social-contract reasoning is applicable to a business population. Granted, support for this hypothesis was not as robust as previous studies conducted by Cosmides and her colleagues. There may be several reasons for this. It is possible that my adapted Wason selection task

instrument did not replicate ancestral conditions of a social contract as previous studies had done. Another possible reason for the variation between my results and previous results is located in the population itself. Perhaps there is something about the culture of a business-oriented group of adults that affects the sensitivity of the cheater-detection algorithms. Finally, the theory itself will have to be examined as well to see if its assumptions and predictions are relevant to a business population. I begin with a discussion of the theory.

8.1.1. Re-Examining the Theory

This dissertation research project involved three iterations (2 pilot studies and the main study) of data collection and analysis. Each time though, the instrument used to obtain the data was a version of my adapted Wason selection task. Each task given to subjects described a business context. Since the rates of cheater-detection across both populations of subjects did not match the predicted levels of Cosmides' studies, it was desirable to isolate the business context variable from the social contract tasks. Toward this end, I replicated their social contract tasks from Cosmides' research and gave them to undergraduate business students and business practitioner MBA students. If rates of cheater-detection similar to Cosmides' studies were achieved, then further support would be gathered for social-contract algorithm theory and the existence of cheater-detection modules in the brain. If such rates were not approximately achieved, then the focus of my investigation would need to shift to the characteristics of the population. Thus, to narrow the range of possible explanations for the data results, this further study was conducted to gain insight into whether the population was responsible for the variation from previous evolutionary psychology research results.

Follow-Up Study

In November, 2004, I conducted one additional empirical study to further certify the results of the main study. Twenty-eight undergraduate business students enrolled in a required accounting course at Duquesne University in Pittsburgh were surveyed. Additionally, thirty-eight business practitioners enrolled in two Master of Business Administration courses (a required business ethics course and a required public affairs management course) at Duquesne University were surveyed. The same criteria for determining the demographics of each group were used in this follow-up study as for the pilot studies and the main study. The business practitioner sample required a minimum of three years of full-time work experience in business from each person, while only undergraduate students with fewer than three years of full-time work experience in business were tested. Twenty-four undergraduate students met this qualification, and twenty-one MBAs were counted in the business practitioner sample. The average age of the undergraduate sample was 20.4 years (14 females and 10 males), and the average age of the business practitioners was 32.3 years (11 females and 10 males).

The tasks used for this follow-up study were taken from Cosmides (1985 and 1989). In those studies, Cosmides compared performance on social contract tasks with performance on abstract tasks, permission rules, and descriptive problems. She gave subjects four tasks at a time across her experiments (in a within-subjects approach) and included just one social contract-type scenario in each group. My follow-up study replicated the social contract tasks she used but did not replicate the order of the tasks. My study does not test *p* and *not-q* card choices for descriptive rules or permission rules. Since I am only concerned with social contract tasks, I chose only those tasks from Cosmides' research that dealt with social exchange scenarios. However, I did include an abstract logic scenario in each subject's task packet.

Specifically, I selected two standard social contract tasks and one switched social contract task (For the complete tasks used in this final experiment, please consult Appendix F.). The first standard social contract task is the drinking age problem, originally conceived by Griggs and Cox (1982), but used by Cosmides (1985; 1989). Consistently, subjects taking this task have performed quite successfully in terms of "benefit-accepted" and "cost-not-paid" card choices. Cosmides' studies demonstrated cheater-detection rates exceeding 60% across multiple experiments. The conditional rule and scenario in this case describes an underage drinking law from which it is specified that individuals at a bar drinking beer must be over age 21. Respondents are cued into the perspective of the owner of the bar enforcing this rule. This context is thought to be familiar to subjects taking the task because it resembles laws in our own culture. The task is also framed as a social contract because individuals described in the task must be 21 years of age or older (cost paid) in order to legally receive the benefit—drinking beer. The conditional rule is in the form of *If p, then q.* In other words, the benefit can be taken (drinking beer) only when the cost is paid (exceed age 21). Thus, the scenario is believed to be a familiar standard social contract.

The second social contract task from Cosmides' research (Cosmides wrote this task) is also in the standard form, but it is framed in an unfamiliar context. Respondents taking the task are cued into the role of a third-party anthropologist observing the propensity to obey laws in an African hunter-gatherer tribe. The conditional rule is still framed in the standard, *If p, then q* form, but the content is nothing with which anyone taking the task would necessarily be familiar since it is fictitious. As part of a ritual ceremony, members of the tribe must find an ostrich shell in order to eat duiker meat (a form of antelope). The benefit, eating duiker meat, is to be granted only when tribespeople find an ostrich shell. Cosmides constructed this task to determine

whether the familiarity of the context in the task facilitated correct card choices for detecting cheaters on the conditional rule. Repeatedly, Cosmides found that undergraduates at Harvard were able to choose the *p* and *not-q* cards over 60% of the time.

The final task that Cosmides wrote for her dissertation (1985) is a social contract framed in an unfamiliar context and presented in the form of a switched conditional rule. Here the story is told about a fictitious Polynesian warring band of people. Again, subjects taking the task are cued into an observing role of anthropologist. But this time a very desirable sustaining food, the cassava root, is awarded only to those people in the band who get a tattoo printed on their face. The tattoo is the cost to be paid for the benefit of the cassava root. The main difference in this task is the order of the conditional rule. The cost is presented first. The rule is in the form of *If q, then p.* In other words, if the cost is paid, then the tribespeople will receive the benefit. Cosmides added this task to see if respondents were able to find the falsifying responses to the rule (*not-p* and *q).* Her social contract predictions (much like my predictions in this dissertation) were that respondents having social contract algorithms should ignore cards that describe cost-paid and benefit-not-accepted actions. She found in her research that subjects still selected the cards which falsified the rule at a much higher rate than on tasks which did not reflect a social contract (over 60%) although the rates were lower on this type of task than on standard social contract forms.

For the follow-up replication study of Cosmides' previous work, I utilized a within-subjects research design (for a description, please see Chapter 6). Although a between-subjects design is more desirable because of a possible learning effect when more than one task is given per subject, within-subjects designs are common in work with the Wason selection task. Moreover, in the study I wished to replicate, Cosmides (1989), a within-subjects design was

used. To limit the transfer effects of the within-subjects design, the tasks were counterbalanced using a balanced Latin Square method. Table 8.1 illustrates the Latin Square order used for the replication study. The balanced Latin Square method (Christensen, 2001) switches the order of the tasks given to students so that no task precedes one of the other tasks more than a quarter of the time. This method is considered a complete counterbalancing effort (Martin, 2000). There was an equal chance that a respondent received one of the four orders illustrated in Table 8.1. Thus, the effect that one task had on teaching respondents to correctly choose cards on the other tasks were minimized.

Table 20: Balanced Latin Square Order used for Follow-Up Study

A	**B**	**C**	**D**
B	**D**	**A**	**C**
D	**C**	**B**	**A**
C	**A**	**D**	**B**

Source: Christensen, 2001

Otherwise, the convenience samples of respondents were administered the tasks in the same manner that all other subjects were sampled from the previous studies in this dissertation project. Students were asked to volunteer to take the survey and were given no cash incentive or extra credit to participate. Everyone was given as much time as they needed to complete the packet of tasks, but most subjects finished in about 11 minutes. Subjects were told not to refer back to any task upon completion. Following the four tasks, respondents were asked to answer six demographic questions, which were taken verbatim from the main study's instrument. Responses were numbered and coded afterward.

The results of the replication study are illustrated in Table 8.2. As shown, once again, the undergraduate business student population correctly chose the "benefit- accepted" and "cost-not-paid" cards at a higher rate than the business practitioners on each of the three social contract tasks from Cosmides' previous research. While the unfamiliar standard social contract task (duiker meat) yielded the only statistically significant result ($z = 1.9166$; $p = .0276$), there was a substantive difference in cheater detection on all three social contract tasks. In fact, for undergraduates, on both standard social contract tasks, rates of cheater detection resembled rates achieved in previous research. Only on the familiar standard social contract task (drinking age problem) did the rates of cheater detection resemble those from previous research for the business practitioner sample. Statistical significance likely would have been achieved with a larger sample of both groups. Statistical power increases with greater sample size (Rosenthal & Rosnow, 1991). Sample sizes for each group were smaller than in my main study.

Table 21 Follow-Up Study Results (Replication Study)

	Abstract		**Familiar Standard Social Contract**	**Unfamiliar Standard SC**	**Unfamiliar Switched SC**
Content	*Logic*		*Drinking Age*	*Duiker Meat*	*Tattoo*
Undergraduate	0/24= 0%		15/24= 63%	16/24= 67%	12/24= 50%
Graduate	0/21= 0%		13/21= 61%	8/21= 38%	7/21= 33%
Predicted	*4-10%*		*65-75%*	*65-75%*	*65-75%*

The follow-up study's results show that cheater-detection algorithms are activated at nearly the rate achieved by Cosmides for undergraduate students only. This further verifies that indeed the cheater-detection subroutine mechanism is present within a business population. The findings indicate that undergraduate business students are not adept at choosing the logically

correct response on abstract, formal logic tasks but are able to choose the cards that violate the conditional rule in social contract-type scenarios. Therefore, for this group of individuals, a content-effect is definitely present when the context of the tasks and conditional rules is switched to a social contract. A content effect is even evident for the MBA business practitioner group when performance on the social contract tasks is compared with the abstract logic task ($z = 2.898$; $p = 0.00187$ for switched social contract task rate versus the abstract logic task rate). But even though statistical significance was found between the social contract task performance and the abstract logic task performance for the business practitioner group, substantively, the rates were much lower on my sample compared with Cosmides' sample.

The replication study also adds emphasis to my consistent findings that MBA business practitioners detect cheaters in social contract situations at a lower rate than inexperienced, undergraduate business students. Had the business practitioner group elicited rates of cheater-detection statistically similar to the rates elicited from the undergraduate student group, the adapted selection task instrument could possibly be flawed.

Sensitivity to Independent Variables

Hypothesis 2 states that social-contract/cheater-detection reasoning will vary positively with content which specifies that a contracting partner derives some benefit by

cheating and with content which specifies that a contracting partner had the intent to cheat. Although rates of cheater-detection fell within the predicted range when one independent variable was removed (tasks B and C), no statistical significance was found. Barrett (1999) suggests that perhaps the neural algorithms are incrementally activated, meaning that the cheater-detection algorithms do not simply get turned on and off but can be partially activated. Barrett's research describes the algorithmic activation process as a kind of dimmer switch. He considers

the possibility that the circuits are not necessarily turned on and off but could be activated at varying degrees. Recall that when rates of cheater-detection on tasks B and C (combined) are compared with task D, there is a statistically significant difference. This means that a higher percentage of respondents correctly identified the cheaters on the tasks with one independent variable than with neither variable. Since Hypothesis 3, predicting an interaction effect between the two manipulated independent variables in my main study was also not supported, the presence of **both** *intent to cheat* and *benefit received by cheating* does not seem to raise the ability to detect cheaters significantly. When the data are examined more closely, it was apparent that the business practitioners elicited the highest rate of cheater-detection on task B, which had *intent* but omitted *benefit.* Compared with the percentage of cheater-detection on task C, the business practitioners substantially (but not significantly) did better at detecting cheaters when *intent* was present than on the task when only *benefit* was present (59% to 39% respectively). The difference was not very pronounced for the undergraduate student population, where cheater-detection rates were flat across all tasks (agency and dyadic).

The variables which are theoretically necessary for algorithm activation appear to have an effect on the ability to detect cheaters but not to the extent predicted. It is reasonable to consider the possibility that incremental activation was taking place in my study but that other factors may be intervening that mitigate *full* activation. Activation of cheater detection mechanisms can be incremental rather than absolute (Barrett, 1999). I will revisit this possibility later in the chapter.

8.1.2. Research Design and Methodology

Chapter 4 provides an in-depth account of the various facilitation effects that have been studied on multiple versions of the Wason selection task over the years. It is important to revisit the possible factors that have been shown to affect performance on these tasks and acknowledge that this may be a source of variation in my samples. My purpose in this dissertation has been to extend Cosmides and Tooby's research to the business sector. Perhaps only the spirit of their research was extended.

While all of her subjects were undergraduate students, Cosmides did use paid volunteers for her studies. Because I was using a between-subjects design this was not an option for me due to the extremely high number of total subjects obtained in my study. What effect would paying the subjects have on task performance? Platt and Griggs (1993) concluded that an attentional effect exists. They found performance to rise on tasks that were succeeded by follow-up probe questions. This is a key finding and one that I will return to later on in this chapter. It seems to make a difference in selecting the necessary cards on the task when subjects exercised greater care on the test. Although time spent on the actual task does not appear to have a significant effect on performance (Feeney & Handley, 2000), the amount of care people take to answer the task may be noteworthy. Perhaps students paid to take the test were more inclined to read the scenario more carefully and notice the independent variable manipulation.

Another factor in Cosmides' (1985, 1989) research design which could have had an effect on card selections involved her instruction sheet for respondents. My instruction sheet (see Appendix C) simply asks respondents to read the scenario on the next page of the packet and answer the question at the end of the page. Cosmides went further into detail by actually giving subjects an example of how to perform a selection task. This additional type of instruction,

while time consuming, may have led to facilitation on her tasks compared to my tasks. Osman and Laming (2001) posited that incorrect card choices on selection tasks (in their case it involved a type of permission rule) could be caused in part by the respondents' misinterpretation of the actual task-at-hand. If subjects do not clearly know what is being asked of them, then they may not perform as well as would be expected. So, understanding the conditional rule and the question is important in facilitation on this instrument. Out of respect for the instructors' class time, I kept the instructions short and simple. Had I walked respondents through an example, my results may have been different.

Clarity of task can be achieved on the actual scenario page, however. A pretest was administered early in the main study's design, using various business context versions of the scenarios. The instrument was given to several doctoral students at the University of Pittsburgh who were asked to rate the clarity of the question at the end of the task. All respondents rated clarity of task very high. In a follow-up interview, none claimed they had any trouble deciphering what it was they were asked to do. Moreover, in the paragraph immediately following the conditional rule on the selection task (see Appendix C), the purpose of the task is emphasized with the statement: "As owner, you want to check to see if the manager is breaking the rule." Then, they are asked which document(s) they have to uncover to find out who is breaking the conditional rule. The conditional rule is repeated in the question for additional clarity. These precautions should have been sufficient to overcome the effect that Osman and Laming (2001) discovered.

One of the other factors that is cited in the literature on the Wason selection task as having an effect on card choice is the matching bias (as discussed in Chapter 4). There is evidence that the subjects from my main study did choose the cards that were stated in the

conditional rule ("produced more than 1000 units" and "bonus received"). For the undergraduate student group, 18% chose the *q and p* cards (and, nothing else) across all tasks. Twenty-four percent of respondents chose the matching item cards on task E alone. The graduate student business practitioner group chose the lexically mentioned cards 14% of the time overall but 24% on task E. This bias, which has been acknowledged in the psychology literature (Evans, 1972; Oaksford & Stenning, 1992), could be responsible for a part of the variance in my study.

This dissertation tested the hypothesis that the agency relationship will have no effect on cheater detection rates on the Wason selection tasks (Hypothesis 4). This prediction was refuted because a strongly significant difference was found on cheater-detection rates between the agency task (A) with both independent variables present and the dyadic task (E) with both independent variables present. The variance can be accounted for by the business practitioner group. The undergraduate students did not demonstrate any differences in social-contract reasoning between the two types of task, but the MBA students with significant work experience were greatly more adept at detecting the cheaters on the agency-type arrangement. While there may be theoretical reasons for this, which are discussed in the final section, there could be methodological reasons for it too.

When examining the card choice tendencies of the business practitioner sample, a very interesting discovery was made. I compared the card choices of this group on tasks A and E, on which the fourth hypothesis is based. The rates of single card selection between these tasks was statistically similar for the "*not-q*," "*p*," and "*not-p*." In other words, the percentage of respondents choosing those three cards was not different between tasks A and E when evaluated with a test statistic. There was, however, a statistically significant difference in the percentage of respondents who chose "*q*" between the tasks. Over thirty-nine percent (47 out of 119 business

practitioners) of subjects taking task E chose the "*Produced more than 1000 units"* card, and only twenty-five percent (18 out of 72 business practitioners) of subjects taking task A chose that card ($z = 2.0490$; $p = .0202$). The undergraduate business student population demonstrated the same tendency to choose the "cost-paid" card at a higher rate on task E than on task A. The rate was just less pronounced (37% on task E versus 31% on task A). No statistically significant difference was found, although that could have been a function of the sample size of the undergraduate group. For some reason, the MBA-student business practitioners were drawn to the "cost-paid" card.

It is quite plausible that the attraction of the "*q"* card to the business practitioners was due to the wording of the scenario that accompanied the conditional rule in task E. The sentence immediately following the rule (see Appendix C) says, "Now however, you think that some employees are deliberately over-reporting their production to get a pay bonus." By highlighting the fact that employees (represented by the documents at the end of the task) are motivated to over-report their units of production, respondents may be looking for specific cases where production exceeds the 1000 unit threshold. Essentially, this phenomenon resembles the verification bias (Reich & Ruth, 1982) in that respondents may look for information in the cards that confirms the information provided in the scenario. Previous research defined the verification bias in terms of confirming information in the conditional rule, but since this information is supplementary to the rule, it is not difficult to believe subjects may be verifying that additional information.

By running the replication study, another interesting piece of information surfaced that sheds some light on the possible reasons for the lower rates of cheater-detection. Both groups achieved the lowest rates of cheater-detection for social contract tasks on the tasks that had

switched conditional rules. Cosmides (1989) reports rates that are statistically as high on the switched social contract rules as on the standard social contract rules regardless of familiarity. But although these rates are statistically similar to the rates on the standard tasks, they were lower in every experiment in Cosmides' study. She reported rates at least 8 percentage points lower for the switched content. This is an important discovery because all five of the social contract tasks from my main study are in the switched form. Can some of the variance between the rates of cheater-detection on my tasks and the ones achieved from Cosmides' tasks be accounted for by virtue of the structure of the conditional rule?

This possibility warrants a further look. When a z-test is run between rates of cheater-detection on the direct social contract task from my study (Task E—see Appendix C) and the switched unfamiliar social contract from the Cosmides (1989) replication study, no statistically significant differences are found at the alpha .05 level. So, on tasks both dealing with a switched direct social contract relationship between two parties, the cheater-detection rates were similar. Recall that standard social contracts take the form, "*If p, then q.*" Switched social contracts take the opposite form, "*If q, then p.*" On standard contracts, a violation occurs when the antecedent (*p)* is provided but the consequent (*q)* is not. Selecting cards that show the *cost-not-paid* and *benefit-accepted* are necessary to see if the rule was violated. This happens also to be the logically correct response. On switched social contract rules, the cards or documents that reflect *cost-paid* and *benefit-not-accepted* need to be selected in order to detect violations of the rule. This is NOT logically correct. Were subjects choosing the logically correct response instead?

When the actual card choices from my main study are examined, subjects are not choosing the logically correct response of *cost-not-paid* and *benefit-accepted.* Tables 8.3 and 8.4 illustrate the rate of card choices on each of the five tasks in my main study. As is shown,

neither the MBA business practitioner group nor the undergraduate business student group chose the cards that would lead to the logically correct response very often. In fact, the most common response from both groups of respondents on ALL of the tasks was the "*not-q* and *p*" response. Under no circumstance in my tasks are any of my subjects adept at logical reasoning.

Table 22 MBA Business Practitioner Frequency of Card Choices on Main Study (n=269)

	Q	not-q	P	not-p	q and not-p
Task A	18	48	57	8	1
Task B	12	44	55	6	1
Task C	19	41	49	10	2
Task D	35	41	50	24	3
Task E	47	54	102	13	1

Table 23 Undergraduate Frequency of Card Choices on Main Study (n=120)

	Q	not-q	P	not-p	q and not-p
Task A	10	23	28	9	0
Task B	7	22	22	3	1
Task C	8	19	25	4	0
Task D	9	17	20	6	0
Task E	22	31	50	6	1

Regardless of other card choices, the "*p*" card (*received a bonus)* was the most popularly chosen card in BOTH groups. This means that respondents were drawn toward the "benefit received" card when trying to detect cheaters. Less often, the *"not-q"* card (*did not produce more than 1000 units)* was selected.

These are possible explanations for the significant difference in card preferences of the business practitioner subjects on tasks A and E. If the follow-up study supports the notion that social-contract/cheater-detection algorithms in the brain exist in a business population, thereby lending support to the Cosmides theory, then attention must be given to the population itself. What makes my sample of respondents different from those sampled by Cosmides and her colleagues? My remaining discussion concentrates on the two sampled groups in my main study and what could be influencing the activation of their evolutionary algorithms and thus suppressing their ability to detect cheaters in social contract situations.

8.2. **Organizational Factors on Cheater Detection in a Business Population**

It is particularly interesting and perhaps significant that undergraduate business students with little or no full-time work experience consistently demonstrated higher rates of cheater-detection than the business practitioner MBAs. Hypothesis 5 predicted that "when presented with a conditional reasoning test in a business context, business practitioners will demonstrate higher rates of cheater detection than will undergraduate business students." As the results demonstrate, quite the opposite occurred.

Why do the business practitioners not seem to be as sensitive to the variables that activate the cheater-detection algorithms as the undergraduate students? The next step in searching for the answer is to investigate what factors are influencing the activation of the algorithms in this population.

8.2.1. Revisiting Social-Contract Algorithm Theory

A plausible reason for the difference in cheater detection between the two samples in the main study lies within the nature-nurture debate. Recall from Chapter 3 the Integrated Causal Model (ICM) of the human mind. The phenotypic design features of the brain gradually evolved as a product of genetic variation *and* cultural influences. An organism's genes determine, in part, the effective environment of the organism "by establishing the way in which external physical systems become incorporated into actions" (Lewontin, 2000: 64). An organism's environment is transformed by the organisms that live within its boundaries. But the environmental conditions also transform the organism. Together, they are "both causes and effects in a coevolutionary process" (p. 126). Behavior is the outcome of the interaction between an organism's embedded programs for interpreting its surroundings and the physical conditions that act upon those genetically formed programs.

This view is consistent with Cosmides' conception of the ICM in which culture is part of the environment. Cosmides' theory hypothesizes that social-contract algorithms are present in every person in every culture on the planet. At the same time, her theory acknowledges that cultural institutions exist and accumulate and change over time. These cultural institutions coexist and coevolve with the brain's algorithms (Cosmides & Tooby, 2004). Naturally formed cultural conventions create the rules and conditions by which we perceive cheating and unethical behavior. This profound influence of culture may be partially responsible for the lack of replication of Cosmides' results in the dissertation's main study. Since Cosmides' theory of social-contract algorithms does not appear to work in a business population, some key aspects of culture in business firms are identified as a possible pathway for future research in the next section.

8.2.2. Future Research Avenues

In business firms, organizational culture is "the pattern of basic assumptions that a given group has invented, discovered, or developed in learning to cope with its problems of external adaptation and internal integration…"(Schein, 1985: 9). These assumptions are taught to other members of the cultural group as the way the environment should be perceived. The conditional rules of the group—deontic and permission—are generated by culture. Beliefs and values are learned from the group and spread to all the new members of the group. Over time these norms are passed down, as memes (Blackmore, 1999). The culture of an organization affects the perceptions of reality of its members. In Jones' (1991) ethical decision-making model, the organization's culture has a profound influence on how people make ethical decisions in the workplace. Cheating on social contracts in any context is an ethical issue. How employees of an organization are socialized to perceive the ethical issue greatly influences behavior.

Schein described three levels of cultural depth that can be witnessed in all cultures including collectivities like organizations. These three levels include the artifacts (i.e., rituals), values, and basic assumptions of the culture (1985). Each one of these levels is critical to the full understanding of how a culture operates. He admits that among the critical aspects of any organization's culture is the perception of who can be trusted within the group.

One potential problem with studying culture in organizations becomes understanding the boundaries of overlapping cultures (Martin, 2002). Individuals participate in various collectivities that overlap and interact to influence behavior. In which culture individuals perceive themselves to be placed at a given moment can influence perceptions of a particular situation (p. 335). Martin claims that the boundary-spanning of cultures permits exchanges of information among cultures. Crossing boundaries from one culture to another is to be expected

in the modern-day business environment but this can often blur the perceived culture by the individual. For instance, an MBA business practitioner asked to perform a Wason selection task in a classroom setting after having spent the day at their business firm could potentially be mixing cultures. Future research on the Wason selection task using business practitioners may gain insights from testing a population that is not involved in a university institutional culture.

Organizational culture also influences how employers and employees perceive their role with each other in the organizational relationship. "Socialization events…can have pervasive effects over time on beliefs that a worker holds about employment relationships" (Rousseau, 2004: 124). Employees in a corporation have their own perceptions about the nature of their contractual relationship with their managers (Barnett & Schubert, 2002). These perceptions relate to the entitlements felt by either party. Thus, despite the social contract rules set by the employer, both parties to an exchange relationship in an organization may perceive their rights and obligations to be different than what is explicitly stated. This could have significant implications on the reasoning process for social contracts. If what constitutes cheating varies from organizational culture to organizational culture, then perhaps the way the MBA business practitioner sample was socialized in their corporations moderated the activation of their cheater-detection algorithms.

Organizational culture affects perceptions of relationships and the assumptions about reality and human nature (Schein, 1985). The shared perceptions of how to deal with an ethical issue like cheating on social contracts has a moderating influence on behavior. The MBA business practitioner sample in this dissertation's main study had a significant amount of full-time business work experience. According to the corporate culture literature, organizations socialize their employees to deal with problems in a particular way. It is possible that the reason

for the variation of cheater-detection rates between the undergraduate business students and the business practitioners was due to the influence of company culture on the way each group perceived the conditional rule in my instrument.

Future studies using the adapted business Wason selection task should also ask follow-up probe questions of all the respondents regarding their perceptions of the issue in the scenario. Since social-contract algorithm activation is reliant on perceptions of contextual cues, an exit interview may be desirable to understand what the respondents are actually perceiving in the scenarios. Moral intensity involves the degree to which individuals perceive an issue as a moral imperative (Jones, 1991). Jones breaks down the moral intensity construct into six characteristics of a moral dilemma. The perceived severity of an issue is dependent on these characteristics. For instance, one of the characteristics of an ethical issue according to Jones is social consensus. Social consensus is the degree to which there is cultural agreement that a proposed act is evil or good (Jones, 1991). The higher the degree of social consensus that the behavior is unacceptable, the higher degree of perceived moral intensity of the issue (all other factors being equal). Perceptions are very sensitive to organizational influences. Thus, if the organizational culture advocates and enforces the norm that cheating is unacceptable, then cheating would be viewed by the people in that corporate culture as being a more morally intense issue (all other factors being held constant).

Is it possible that these culturally created perceptions of the severity of the moral issue will actually affect whether or not the social-contract/cheater-detection algorithms in the brain are activated? Barrett (1999) offers the possibility that the cheater detection mechanism accepts "as input the output of other mechanisms, or the other mechanisms could merely be increasing or decreasing the 'level of activation' of the cheater detection mechanism" (p.8). The evolutionary

psychologists posit that the brain is composed of an interlinked web of neural circuits, each responsible for a particular adaptive function (Cosmides & Tooby, 2000b). A person who views cheating in the scenario to be a moral imperative may be better at detecting cheaters on the tasks. The levels of vigilance for cheating will vary based on an individual's perception. Perhaps the business practitioners in my sample detected cheaters at a lower rate than expected because of their culturally formed perceptions of the intensity of the issue, thus warranting future research.

The agency hypothesis addresses another cultural influence on Pleistocene circuits. As stated in Chapter 3, hierarchical relationships should be familiar to our minds since social groups were organized along power lines back in our hunter-gatherer days. Corporations are organized in terms of agency-type relationships, where one person acts on another's behalf. Cosmides and Tooby (2004) acknowledge that even though these hierarchical relationships are familiar to our anciently formed minds, the agency relationship in particular may suppress the triggering of the cheater-detection algorithms because who is being cheated is often not clear. Agents "who do not see the company's costs and benefits as such are unlikely to spontaneously attend to potential cases of cheating by employees or clients" (p. 108).

The social structure of the corporation may be a possible factor affecting the cheater detection. Reciprocity in evolutionary theory is typically analyzed in terms of equitable relationships. Kin selection (Trivers, 1971) is usually not thought of in terms of social status. Cosmides' evolved algorithms for reciprocity do not take into account the true context of an agency relationship—one based on a difference in power and social status. Recall that the respondents in the main study were all cued into the perspective of the owner of the manufacturing firm. This owner has the power to award bonuses and was the person responsible for constructing the social contract conditional rule, on which the exchange relationship is based.

Future studies should attempt to cue respondents into the subordinate role to examine whether the change of perspective has an effect on cheater detection.

The social norms discussed above are a part of corporate culture that often constrains the behavior of individuals. Cummins (1999) proposed a deontic theory of reasoning called, dominance theory. She posits that social regulations and differences in rank in social groups affected the evolution of cognitive functions in the brain. Her deontic reasoning theory "reflects the operation of primitive cognitive functions involved in monitoring compliance with social norms" (Fiddick & Cummins, 2001: 153). The social norms include the structuring of social groups along power and dominance lines. "Augmenting and preserving the power of individual managers" are central goals of a corporate culture (Frederick, 1995: 92). Due to the highly interactive nature of the neural algorithms, Fiddick and Cummins (2001) studied whether individuals in a position of power would perceive cheating to be a less severe issue than individuals who do not possess power. In a ledger task, they cued respondents into roles of boss or subordinate (but did not use a business population) and evaluated their tolerance to cheating. They found that people cued to the higher rank were more tolerant of cheating than people cued to a lower rank. Individuals in the higher ranking role even felt that they are more fairly treated than the individuals cued to the lower-ranking role.

This finding certainly provides some insight into why psychological contracts deteriorate over time, but what does it tell us about cheater detection? Future research in this evolutionary psychology field should test these findings against Barrett's (1999) claim that the cheater-detection algorithms are activated incrementally. If there is an interaction among different circuits in the brain and that these circuits are influenced by cultural factors, then the effects of

perceptions of role power differentials on the activation of cheater-detection mechanisms need to be examined.

8.3. **Concluding Remarks**

This dissertation is based on the notion of consilience of the natural and social sciences. For a "united system of knowledge" to form, a select number of natural laws need to be identified and drawn upon to construct an understanding of phenomena (Wilson, 1998: 298). I suggest that the point at which this interdependence of nature and nurture exists is at the level of evolved psychological mechanisms in the brain. The Cosmides-Tooby social contract algorithm theory is a useful tool for business research on ethical breaches of social contracts. The social-contract/cheater detection algorithms examined in this study operate in business organizations but are vulnerable to social and cultural forces which may moderate their activation. When the brain is viewed as a symphony of interacting brain circuits subject to perceptions of environmental cues and cultural forces, insights into human behavior can be fostered. Business ethicists should embrace the insights from evolutionary psychology about the mind's design. Explanations of human behavior must begin at the genetically based algorithm level of analysis. Knowing that the cheater-detection brain circuits are active in the corporate mind is an important early step in the understanding unethical behavior in the workplace. If ethical rules in organizations can be reframed with respect to the natural capabilities of the human mind, then perhaps social contracts are more likely to be honored.

APPENDIX A
Manipulation Check Questions for Pilot Study

1) Without going back to the scenario on the previous page, please indicate if you think the manager intended to violate the rule (A "1" indicates "Definitely no". "7" indicates "Definitely yes". "4" indicates "Not sure".)?

1	2	3	4	5	6	7
Definitely No			**Not Sure**			**Definitely Yes**

2) Without going back to the scenario on the previous page, please indicate if you think the manager could benefit by violating the rule (A "1" indicates "Definitely no". "7" indicates "Definitely yes". "4" indicates "Not sure".)?

1	2	3	4	5	6	7
Definitely No			**Not Sure**			**Definitely Yes**

APPENDIX B
Institutional Review Board Script for Administering Instrument

Script for David Wasieleski

The purpose of this research study is to assess individual's ability to detect cheaters in business situations. To accomplish that goal, please read the scenario in front of you and answer the question asked at the end of the text. Following the case, please turn the page and answer a few demographic questions. But please do not indicate your name.

There are no foreseeable risks associated with this project, but completion of the task is completely voluntary anyway. Results are to be kept completely anonymous and will not be tracked, so your responses will not be identifiable in any way. This study is being conducted by David Wasieleski, Ph.D. candidate at the University of Pittsburgh. He can be reached at 412-661-2581 if you have any questions.

APPENDIX C
Adapted Social Contract Wason Selection Task Instrument: Main Study

Exercise

Please read the scenario on the next page first. Then choose among the documents presented. Indicate your choice by circling the appropriate document or documents. Take as much time as you need to complete this task. When you are finished, please turn to the last page and fill out the anonymous survey form. Please do not go back or re-read the scenario in filling out the survey.

Thank you very much for your participation.

(Note: Respondents received only one task with headings omitted.)

Task A: Intent and Benefit (Agency)

You are the owner of DMW Company, a manufacturer of cell phones. Your company's financial situation is dire and you are on the edge of going out of business. You hired a manager to keep production up. To attain that goal, you and the manager agreed to pay bonuses to highly productive employees. The manager earns a percentage of each bonus paid.

So, you and the manager agreed to the following rule:

If an employee produces more than 1000 units in a week, then that employee receives a pay bonus.

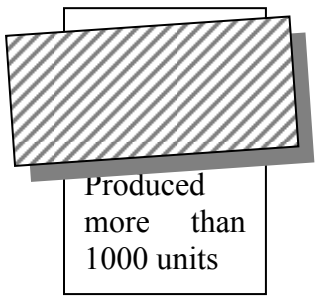
Now however, you fear the manager is deliberately awarding bonuses to employees who have not earned them in order to get unjustified additional compensation. As owner, you want to check to see if the manager is breaking the rule.

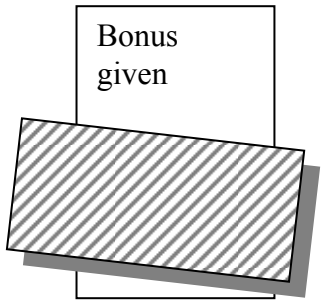
The documents below tell about four workers in DMW's plant. But some papers fell on top of them, so you can only see half of each document.

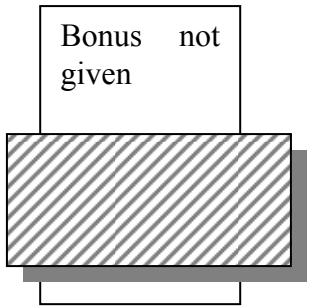
Each document tells about one person. The top tells whether or not the manager gave that person a bonus, and the bottom tells how much that employee actually produced.

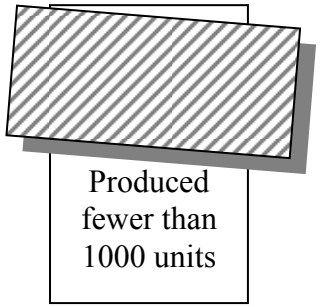
Which document(s) would you, as owner, definitely need to uncover to find out if your manager has broken the rule: "*If an employee produces more than 1000 units in a week, then that employee receives a pay bonus.*"? (Don't choose any more documents than are absolutely necessary.)

Answer by circling your choice or choices below.









Task B: Intent; No benefit (Agency)

You are the owner of DMW Company, a manufacturer of cell phones. Your company's financial situation is dire and you are on the edge of going out of business. You hired a manager to keep production up. To attain that goal, you and the manager agreed to pay bonuses to highly productive employees.

So, you and the manager agreed to the following rule:

If an employee produces more than 1000 units in a week, then that employee receives a pay bonus.

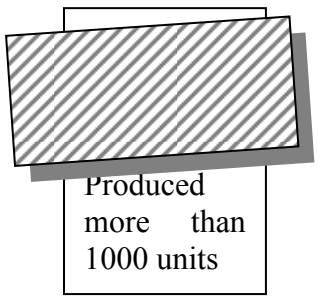
Now however, you fear your manager is deliberately awarding bonuses to employees who have not earned them. As owner, you want to check to see if the manager is breaking the rule.

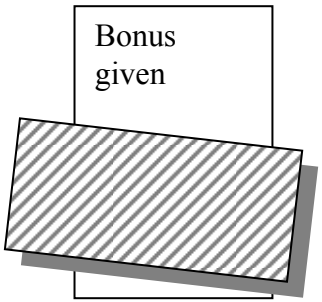
The documents below tell about four workers in DMW's plant. But some papers fell on top of them, so you can only see half of each document.

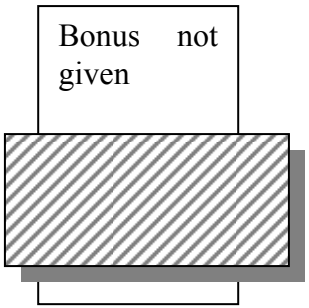
Each document tells about one person. The top tells whether or not the manager gave that person a bonus, and the bottom tells how much that employee actually produced.

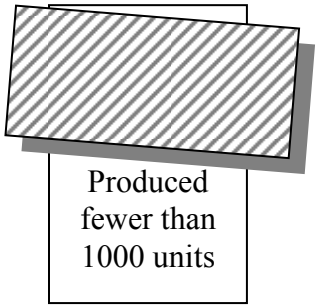
Which document(s) would you, as owner, definitely need to uncover to find out if the manager has broken the rule: "*If an employee produces more than 1000 units in a week, then that employee receives a pay bonus.*"? (Don't choose any more documents than are absolutely necessary.)

Answer by circling your choice or choices below.









Task C: No intent; Benefit (Agency)

You are the owner of DMW Company, a manufacturer of cell phones. Your company's financial situation is dire and you are on the edge of going out of business. You hired a manager to keep production up. To attain that goal, you and the manager agreed to pay bonuses to highly productive employees. The manager earns a percentage of each bonus paid.

So, you and the manager agreed to the following rule:

If an employee produces more than 1000 units in a week, then that employee receives a pay bonus.

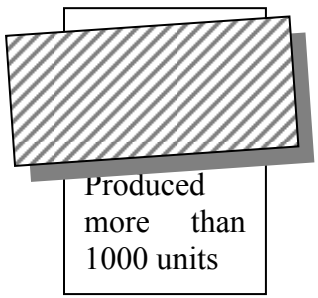
You do not believe the manager would deliberately award unjustified bonuses, but could make an honest mistake. As owner, you want to check to see if the manager is breaking the rule and thus earning more than the manager deserves.

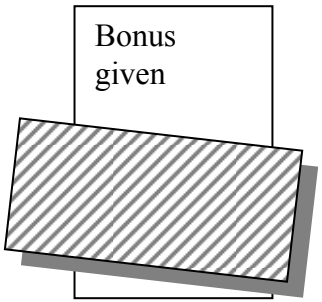
The documents below tell about four workers in DMW's plant. But some papers fell on top of them, so you can only see half of each document.

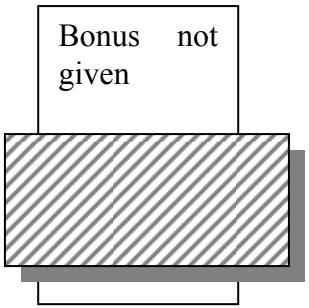
Each document tells about one person. The top tells whether or not the manager gave that person a bonus, and the bottom tells how much that employee actually produced.

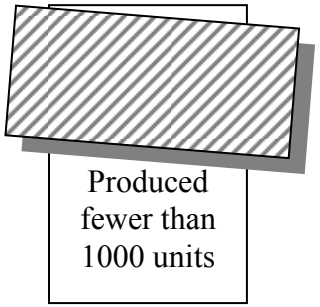
Which document(s) would you, as owner, definitely need to uncover to find out if the manager has broken the rule: "*If an employee produces more than 1000 units in a week, then that employee receives a pay bonus.*"? (Don't choose any more documents than are absolutely necessary.)

Answer by circling your choice or choices below.









Task D: No intent; No benefit (Agency)
You are the owner of DMW Company, a manufacturer of cell phones. Your company's financial situation is dire and you are on the edge of going out of business. You hired a manager to keep production up. To attain that goal, you and the manager agreed to pay bonuses to highly productive employees.

So, you and the manager agreed to the following rule:

If an employee produces more than 1000 units in a week, then that employee receives a pay bonus.

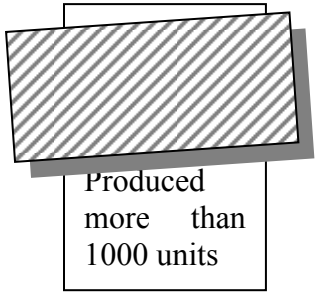
You do not believe the manager would deliberately award unjustified bonuses, but could make an honest mistake. As owner, you want to check to see if this has happened.

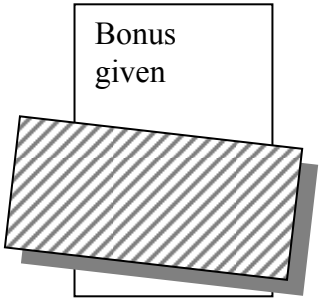
The documents below tell about four workers in DMW's plant. But some papers fell on top of them, so you can only see half of each document.

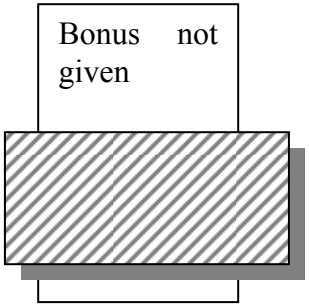
Each document tells about one person. The top tells whether or not the manager gave that person a bonus, and the bottom tells how much that employee actually produced.

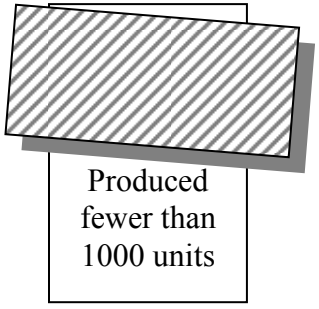
Which document(s) would you, as owner, definitely need to uncover to find out if the manager has broken the rule: "*If an employee produces more than 1000 units in a week, then that employee receives a pay bonus.*"? (Don't choose any more documents than are absolutely necessary.)

Answer by circling your choice or choices below.









Task E: Intent and Benefit (Dyadic)

You are the owner of DMW Company, a manufacturer of cell phones. Your company's financial situation is dire and you are on the edge of going out of business. To encourage production in your plant, you agreed to award pay bonuses to highly productive employees. Employees receive a bonus when they self-report that their production exceeds 1000 units in a week.

So, you and the employees agreed to the following rule:

If an employee produces more than 1000 units in a week, then that employee receives a pay bonus.

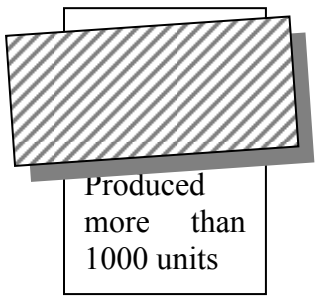
Now however, you think that some employees are deliberately over-reporting their production to get a pay bonus. As owner, you want to check to see if the employees are breaking the rule.

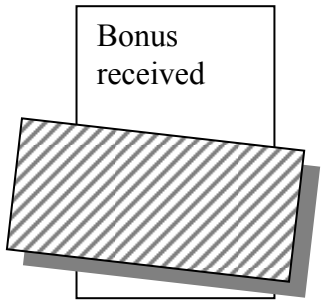
The documents below tell about four workers in DMW's plant. But some papers fell on top of them, so you can only see half of each document.

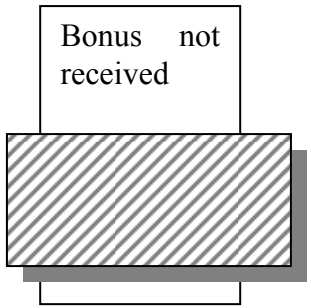
Each document tells about one person. The top tells whether or not that person received a bonus, and the bottom tells how much that employee actually produced.

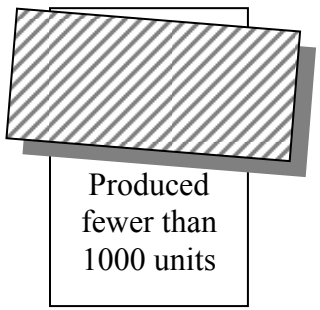
Which document(s) would you, as owner, definitely need to uncover to find out if any of your employees are breaking the rule: "*If an employee produces more than 1000 units in a week, then that employee receives a pay bonus.*"? (Don't choose any more documents than are absolutely necessary.)

Answer by circling your choice or choices below.









Anonymous Survey

1) What is your age? _____

2) Please indicate your gender. **M** **F**

3) What is your natural country of origin? _____

4) What is your current or most recent job title or job function? _____

5) How many years of full-time work experience in business do you have? _____

6) How many years of full-time work experience in business do you have at your current or most recent job title or job function?

_____

APPENDIX D
Follow-up Study Tasks

From: Cosmides (1985, 1989)

Familiar Standard Social Contract
In its crackdown against drunk drivers, Pennsylvania law enforcement officials are revoking liquor licenses left and right. You are a bouncer in a Boston bar, and you'll lose your license unless you enforce the following law:

If a person is drinking beer, then he must be over 21 years old.

The cards below have information about four people sitting at a table in your bar. Each card represents one person. One side of a card tells what a person is drinking and the other side tells that person's age.

Indicate only those card(s) you definitely need to turn over to see if any of these people are breaking this law.

drinking beer	**drinking coke**	**25 years old**	**16 years old**

Abstract Problem
Part of your new clerical job at the local high school is to make sure that student documents have been processed correctly. Your job is to make sure the documents conform to the following alphanumeric rule:

If a person has a "D" rating, then his documents must be marked code "3."

You suspect the secretary you replaced did not categorize the students' documents correctly. The cards below have information about the documents of four people who are enrolled at this high school. Each card represents one person. One side of a card tells a person's letter rating and the other side of the card tells that person's number code.

Indicate only those card(s) you definitely need to turn over to see if the documents of any of these people violate the rule.

D	**F**	**3**	**7**

Unfamiliar Standard Social Contract

You are an anthropologist studying the Namka, a hunter-gatherer culture living in the deserts of southwest Africa. You are particularly interested in whether Namka boys obey the laws of their people.

Every full moon there is a special feast in which a duiker—a small antelope—is slaughtered and eaten. Duiker meat is quite scarce and delicious—a real treat. Eating duiker meat is a privilege that must be earned.

For boys, this privilege is governed by the following law:

If you eat duiker meat, then you have found an ostrich eggshell.

Finding ostrich eggshells is a sophisticated and difficult task which takes a boy years to learn. Having found an ostrich eggshell on your own is therefore a sign that you have mastered the most difficult skills of hunting. For the Namka, it represents a boy's transition into manhood.

You wonder if Namka boys cheat on this law when nobody is looking. You decide to hide behind some bushes and watch. During the course of the feast of the full moon, you see four different boys approach the roasted duiker while no one else is looking.

The cards below have information about these four boys. Each card represents one boy. One side of a card tells whether a boy has ever found an ostrich eggshell and the other side tells whether that boy took any of the roasted duiker meat.

The smell of the roasting duiker is truly tempting to the boys. You want to know if any of them cheated on the law. Indicate only those card(s) you definitely need to turn over to see if any of these boys have broken the law.

eats some duiker meat	**has never found an ostrich eggshell**	**does not eat any duiker meat**	**has found an ostrich eggshell**

Unfamiliar Switched Social Contract

You are an anthropologist studying the Kaluame, a Polynesian people who live in small, warring bands on Maku Island in the Pacific. You are interested in how Kaluame "big men"—chieftains—wield power.

"Big Kiku" is a Kaluame big man who is known for his ruthlessness. As a sign of loyalty, he makes his own "subject" put a tattoo on their face. Members of other Kaluame bands never have facial tattoos. Big Kiku has made so many enemies in other Kaluame bands, that being caught in another village with a facial tattoo is, quite literally, the kiss of death.

Four men from different bands stumble into Big Kiku's village, starving and desperate. They have been kicked out of their respective villages for various misdeeds, and have come to Big Kiku because they need food badly. Big Kiku offers each of them the following deal:

If you get a tattoo on your face, then I'll give you cassava root.

Cassava root is a very sustaining food which Big Kiku's people cultivate. The four men are very hungry, so they agree to Big Kiku's deal. Big Kiku says that the tattoos must be in place tonight, but that the cassava root will not be available until the following morning.

You learn that Big Kiku hates some of these men for betraying him to his enemies. You suspect he will cheat and betray some of them. Thus, this is a perfect opportunity for you to see first hand how Big Kiku wields his power. The cards below have information about the fates of the four men. Each card represents one man. One side of a card tells whether or not the man went through with the facial tattoo that evening and the other side of the card tells whether or not Big Kiku gave that man cassava root the next day.

Did Big Kiku get away with cheating any of these four men? Indicate only those card(s) you definitely need to turn over to see if Big Kiku has broken his word to any of these four men.

got the tattoo	**Big Kiku gave him nothing**	**no tattoo**	**Big Kiku gave his cassava root**

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