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AN INVESTIGATION INTO THE EVOLUTIONARY LINK BETWEEN RESOURCE CONTEXT AND SOCIAL STRUCTURE

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Graduate Program
In
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Submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

Faculty of Graduate Studies
The University of Western Ontario
London, Ontario

April 2000

THE UNIVERSITY OF WESTERN ONTARIO
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ABSTRACT

This research uses an evolutionary lens to study the phenomena of cooperation and social structure. It seeks to understand why cooperation exists and what factors contribute to the emergence of different forms of social structure.

A theory was developed using research on non-human primates. If, members of a group perceive needed resources to be concentrated, predictable, highly visible and consumption of them is delayed then an agonic (hierarchical) social structure will emerge. Alternatively, if, they believe resources to be scattered, unpredictable, hidden and consumption of them is more immediate, then the hedonic (egalitarian) pattern is more likely. The explanation proposed for this relationship is found in evolutionary biology. Various resource contexts presented our ancestors with serious problems for group living. Social structure is a group level adaptation that enables individuals to solve these problems by balancing the tension between self-interest and group interest and thereby sustaining cöoperative behavior.

A laboratory experiment was designed to investigate the effect of resource context on social structure. Groups of students completed a task in the form of a game. Half the subjects played the game in a contest resource context and the other half in a forage context. Measurements were taken to determine if the contest context evoked an agonic social structure and the forage context the hedonic form.

The statistical analysis of the agonic and hedonic scales did not uncover a significant difference between the scores of those who played in the contest context and those who played in the forage context. Analysis of responses on a third dependent measure, the active agonic scale, did show a significant difference between the means of the two groups. However, the effects of gender attenuated this difference. As well, those who played the game in the forage context were more likely to indicate that they worked with everyone in the group than those who played in the contest context. However, this difference became non-significant when gender was considered. While statistical significance could not be established for many of the measures, the number of times in which a measured difference was in the predicted direction was significantly greater than would be expected by chance.

While empirical findings were not strong, future refinements to the theory and research approaches were suggested and further investigation encouraged.

Keywords: cooperation, social structure, resource context, evolutionary theory, informal organization

DEDICATION

For my husband Blair who often queried when ...
but never questioned why.

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A work of this magnitude is not completed without the influence and support of a number of people.

First and foremost I would like to acknowledge the considerable contributions of my advisor Rod White. Much of my thinking in this area and parts of my dissertation were the direct result of the work that Rod and I did leading up to our Academy of Management Review publication: The evolution of social structure: Why biology matters. I'm not sure he knew what he was getting into when he first shared with me the story of the monkeys and the feeding stations. It has been a long and winding path but his intellectual curiosity and scholarly enthusiasm have been inspiring and our work together personally and intellectually rewarding.

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CHAPTER 1

INTRODUCTION

"Nature is often hidden, sometimes overcome, seldom extinguished"
Sir Francis Bacon[1]

One of the earliest writers to identify the importance of cöoperation for the achievement of organizational goals was the thoughtful practitioner of the executive arts, Chester Barnard. Organizations are nothing more than "associations of cöoperative effort" (Barnard, 1938:5) — individuals working together to achieve a common purpose. In his view the function of cöoperation is to allow individuals to work together to overcome the physical, biological or social barriers that stand in the way of them accomplishing their goals. Cöoperation is the solution to overcoming otherwise insurmountable problems. Barnard insightfully went on to note however, that when cöoperation fails, lack of cöoperation becomes the limitation to achieving success (1938:25). Understanding the nature of cöoperation, or more fundamentally why people cöoperate, must therefore be considered an essential building block in the construction of management theory.

Barnard believed that people choose to cöoperate; that is, the choice to provide assistance to another person is a reasoned decision made in the here and now.

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[1] As quoted in Hamer & Copeland 1998

It is rooted in a rational appreciation of need for group action and in an emotional attachment to a desirable common purpose.

1. We really want to accomplish this goal.
2. Physical, biological or social forces limit us.
3. Therefore, we need to cöoperate with one another to achieve our objective.

In Barnard's view, cöoperation is the logical outcome of a form of self-interested calculus. This perspective is entirely consistent with a well accepted view in modern economics that people are rational actors and their behaviour reflects choices about what will maximize their individual utility (Jensen & Meckling, 1994). While I share Barnard's belief in the centrality of cöoperation to organizational effort, I wish to pursue an alternative view of the origins of cöoperative behaviour — one less rational, one less calculated.

To do so I intend to depart from the traditional research base of management and economic theory and draw instead on a body of literature originating in the natural sciences. I join with the evolutionary psychologists who have been highly critical of the well-accepted economic assumptions of rational human behaviour. Tooby and Cosmides express this concern by suggesting that "at present economics hovers, scientifically unsupported and isolated in mid-air theoretically levitating on the assumption of rationality" (1994:328). This new stream of research into the

origins of human behaviour has pursued a radically different approach to investigating the foundations of human behaviour (Barkow, Cosmides, & Tooby, 1992; Buss & Malamuth, 1996; Cosmides & Tooby, 1987; Lumsden & Wilson, 1981; Pinker, 1997). Evolutionary psychologists believe that "the human mind is not a general-purpose rational computer nor is it a blank slate written upon by our parents, our schools and our culture. Instead, members of our species are born possessing a large repertoire of genetically encoded psychological mechanisms that are the foundation of human behavioral responses" (Pierce & White, 1999:843[2]). Evolutionary psychologists believe that, just as certain of our physical characteristics evolved (Darwin, 1859) in response to the problems of survival in ancestral environments, so to did psychological characteristics in the form of psychological mechanisms (Daly & Wilson, 1996). Generations of natural selection have produced robust solutions to "adaptive" problems some physical, some psychological and these solutions have been encoded into the genetic make-up of our species.

Psychological mechanisms are not pre-programmed behaviours; rather, they are domain-specific information processing programs that trigger behaviour when activated by relevant environmental information. Thus, human behaviour is the outcome of an interplay between innate psychological mechanisms and perceived environmental cues (Studd, 1996). Through the process of natural selection, psychological mechanisms that solved the survival problems of our hunter/forager

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[2] portions of the Introduction and Chapter 3 have been previously published in Pierce & White (1999)

ancestors became genetically encoded and continue to influence the behaviour of our species in contemporary settings.

The intent of moving so far afield is to develop a convincing case that cöoperation is deeply rooted in humankind's fundamental biology not just in its formidable brainpower. This thesis develops the argument that cöoperation is a universal human trait shaped by evolution. If exploring the biological roots of cöoperative behaviour were the extent of this dissertation's accomplishments, it would be reasonable to challenge its potential contribution to management thought and practice. But cöoperation does not exist in a vacuum. An individual must cöoperate with another individual or within a group of individuals. A relationship of this nature that persists over time will eventually exist within a fairly stable pattern of roles and relationships considered by social scientists to be a social structure (Blau, 1974; Nadel, 1957). Social structure is a manifestation of our sociability and gives form to our social behaviour. This thesis returns to the realm of management by extending our understanding of cöoperation into an investigation of the origins of organizational social structure.

OVERVIEW

This thesis begins by drawing on the natural science fields of evolutionary biology and sociobiology to understand the origin and nature of cöoperative behaviour. It concludes that cöoperation has evolved to become a universal human

trait. It then extends this thinking into the fields of ethology and socioecology to develop a theory as to the origin and nature of cöoperation's group level manifestation — social structure. It concludes that social structure is also a product of evolutionary processes. Social structure is a behavioural adaptation that allows individuals to cöoperate and in so doing, enables them to overcome problems that threaten the stability of communal life. There are strong reasons why it is to our advantage as a species to come together and cöoperate with each other but there are equally compelling reasons why communal living is difficult to sustain. One significant threat to collective life arises from the nature of a group's resource context. The social structure that emerges within a group will vary depending in the nature of its resource context, specifically the way in which resources are configured in its environment. If needed resources are configured in such a way that members must fight among themselves to acquire them then a form of social structure is needed that will ameliorate the negative consequences of aggressive confrontation. Alternatively if resources are configured so that members of a group must disperse and forage to acquire them then a social structure is required that will bring individuals together to form a cohesive communal unit.

This thesis presents the view that cöoperation is a universal human trait shaped by evolution. Further that the informal social structures are group level adaptations that enable individuals to cöoperate and thereby overcome the problems that threaten the stability of communal living. The theory developed in this thesis proposes that different resource contexts require different resource acquisition tactics.

In turn, these acquisition tactics (competition and foraging) create different problems for social groupings. In both cases, social structures emerge that provide a solution to problems of group formation and sustained cohesion.

CONTRIBUTIONS OF THE RESEARCH

In this complex world of modern organizations, managers are encouraged to design structures that support strategic goals (Chandler, 1962; Miles & Snow, 1984; Rumelt, 1974). However, since the time of Elton Mayo and his studies of workers at Western Electric's Hawthorne Works (Homans, 1950; Roethlisberger & Dickson, 1939), managers have been aware that even the best designed structures are subject to continual adjustment and alteration by the very people who populate them. In every organization "social" structures develop that play an important role in determining the behaviour of those in the firm: who talks with whom and what is said; what is noticed and what is ignored; which members lead and which members follow. The need to bring people together to achieve organizational purpose creates opportunity for social interaction (Barnard, 1938) and social interaction is the process through which social structures are negotiated and find their form (Chase, 1980). Good design is seldom sufficient to ensure that structure operates in the way intended by management.

The existence of an informal social structure among people who work together on an ongoing basis is an unavoidable feature of organizational life. However unlike formal organizational structure, which is designed and

institutionalized in artifacts such as position charts and job descriptions, social structure is an emergent phenomena best described as self organizing; that is, order emerges without the intervention of an external supervising agent (Dalenoort, 1989). As much as managers would like to mold the development of informal social structures they cannot be directly controlled. This is why an understanding of social structure based in the deep evolutionary history of our species may prove beneficial. While we cannot directly control social behaviour, from our study of the past we may learn which factors contribute to the emergence of particular forms of social structure. While it is true that managers can do little to change human genetics, those with the understanding that human behaviour is shaped by evolutionary influences can achieve desired outcomes by cultivating a context compatible with the type of structure they desire.

This is a particularly important insight for managers who wish to have an influence on their organization's culture since social structure is one of culture's fundamental underpinnings (Geertz, 1973). A number of authors have identified the need to align culture and strategy to achieve organizational goals (Batelaan, 1993; Bates, Amundson, Schroeder & Morris, 1995; Knights & Willmott, 1987; Schwartz & Davis, 1981) as well as the importance of organizational culture to firm performance (Barney, 1986; Denison, 1990; Fiol, 1991; Kotter & Haskett, 1992). While managers are encouraged to manage an organization's culture (Sathe, 1985; Sherriton & Stern, 1997) they are given few tools or concrete suggestions on how to accomplish this task. Organizational culture appears to be a deep structure that is

annoyingly resistant to change and attempts to make anything more than minor adjustments have been inconsistently successful at best (Lundberg, 1985; Thackery, 1986; Tunstall, 1983; Wilkins & Patterson, 1985). Thus, research that investigates the deep foundations of culture may shed light on more appropriate approaches to its management.

As well, this thesis introduces the reader to disciplines that are unfamiliar to most organizational theorists. With few exceptions (genetics: Arvey & Bouchard, 1994; Arvey, Bouchard, Segal & Abrahams, 1989; and sociobiology: Glassman, 1984) management researchers have not employed evolution as anything more than an intriguing metaphor (Morgan, 1997). Looking back to ancestral forms of social organization to understand and improve management practice has generated some interest (Hurst, 1991; Jay, 1972; Nicholson, 1997; 1998) but has produced little theoretical work or systematic empirical investigation in the organization sciences. Wilson (1978), the founder of sociobiology, argued strongly for the synthesis of natural and social sciences. "By a judicious extension of the methods and ideas of neurobiology, ethology and sociobiology a proper foundation can be laid for the social sciences and the discontinuity still separating the natural sciences on the one hand and the social sciences and humanities on the other, might be erased" (1978:195). This thesis will illustrate how bringing socio-evolutionary thinking to organizational theorizing can make such a connection. The potential implications for both the organizational sciences and management practice are considerable.

OUTLINE OF THE THESIS

This thesis is divided into two complementary sections. The first is theory development; the second is theory testing. Theory development begins in Chapter 2, which addresses the question of cöoperative behaviour. Naive evolutionary theory would suggest that cöoperative behaviour is not an evolutionarily stable strategy since it reduces the fitness of those who behave cöoperatively and puts them at a disadvantage in the struggle for survival. Because of this, cöoperative people, and consequently cöoperative behaviour, would become a smaller proportion of each successive generation and eventually die out. Chapter 2 counters this naiveté and presents strong arguments that support not only the existence but also the robustness of cöoperative behaviour. Once the biological validity of cöoperation is established, the thesis moves to consider cöoperation's role in the development of social structure. Chapter 3 proposes a model of social structure derived from an investigation of the extensive literature on the social interaction of non-human primates. This chapter identifies the patterns of social structure that emerge in groups of monkeys and apes and connects these patterns to salient characteristics of a group's environment. It then goes on to develop an evolutionary explanation for the observed relationship. In Chapter 4 the model is applied to our understanding of human social interaction. A wide range of literature on pre-history humanity, modern traditional societies and modern organizations is reviewed to see if the patterns observed among non-human primate groups are evident in the way human groups form and construct their social relationships. Prior evidence strongly supports this dissertation's theory. In Chapters

5 and 6 the dissertation moves to theory testing with the development and empirical investigation of hypotheses derived from the theory. As is traditional the dissertation ends with a discussion of the findings.

CHAPTER 2

FALLEN HEROS LEAVE NO CHILDREN

"Man should be willing to accept hardships for himself in order that others may enjoy wealth; he should enjoy trouble for himself that others may enjoy happiness and well-being. This is the attribute of man ... He who is so cold hearted only to think of his own comfort, such a one will not be called a man... Man is he who forgets his interest for the sake of others."

Abdu'l Baha[3]

Aesop tells the story of a certain father who had a family of sons who were forever quarreling among themselves. No words he could say did the least good so he cast about in his mind for some striking example that would make them see that discord would lead them to misfortune. One day when the quarreling had been much more violent than usual he asked one of them to bring him a bundle of sticks. Then handing the bundle to each of his sons, he asked them to try to break it. Although each one tried his best, none was able to what his father had asked. The father then untied the bundle and gave the sticks to his sons to break one by one. This they did very easily. "My sons," said the father, "do you not see how certain it is that if you agree with each other and help each other, it will be impossible for your enemies to injure you? But if you are divided among yourselves, you will be no stronger than a stick in a bundle." In unity, there is strength. (adapted from Aesop, 1919).

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[3] Foundations of World Unity

The powerful wisdom of this classic myth is that cöoperation is essential for survival. People who join together (even if it means personal inconvenience) present a more formidable opponent to those who would do them harm. However, evolutionary theory makes a compelling argument for an alternative view. In a competitive world where survival is paramount, it is the strongest individual who will thrive. The battle cry of evolution is familiar to most: survival of the fittest. From this perspective selfish ruthlessness, not collective cöoperation, will prevail (Dawkins, 1976). These fundamentally opposing views have generated heated debate among groups of scholars as diverse as philosophers (Hobbes, 1651; Locke, 1690) and economists (Frank, 1988; Smith, 1776). It continues to be one of the most active debates in the religious, political and social arenas of our day. Is humankind innately cöoperative or is our existence "a war of ... every man against every man" (Hobbes, 1651).

This thesis does not intend to address this question directly, for to do so would take it in a direction away from its primary intent. However, if cöoperation is the cornerstone of human social interaction then developing a theory concerning the origins and nature of social structure requires confirmation of the existence of its founding element. Therefore, before beginning to address issues of social structure it is important to investigate the evolutionary roots of a much more fundamental human attribute; cöoperation — the glue that holds human communities together (Dugatkin, 1999).

This chapter begins with a review of Darwin's dangerous idea (Dennett, 1995) — the process of natural selection. Next it looks at how sociobiologists have applied the theory of natural selection to phenomena of social interaction followed by a discussion of how evolutionary psychologists have contributed to our understanding of the specific mechanisms of human behaviour. With these as foundation elements to construct an evolutionary lens, the chapter proceeds through what Dugatkin (1999) describes as pathways to cöoperation providing the necessary framework for evolutionary thinking about the origins and sustainability of cöoperative behaviour.

THE THEORY OF NATURAL SELECTION

All living beings interact with their environment and survival depends on the outcome of this interaction. While to some extent individual survival is the result of luck (for example booking passage on the Titanic could be viewed as an unlucky choice) living long enough to pass on your genes to future generations is more likely the result of possessing superior physical or psychological traits (superior in the sense that these traits allow an individual who exhibits them to better cope with the challenges and problems presented by his or her environment (Mayr, 1991)). In evolutionary terms these superior traits are the outcome of a process Darwin (1859) called natural selection.

To describe the process of natural selection Darwin began by establishing the following starting conditions:

1) organic beings vary and this variation is heritable;

2) certain variations convey a survival advantage; and

3) resources are limited.

He then created an if/then algorithm; a set of rules (Dennett, 1995). These rules state that *if* there is a struggle for existence (a struggle for resources) between individuals *then* those possessing advantageous variations will prevail and survive and they will tend to produce offspring similarly characterized. Consistently following these rules accomplishes the same end every time they are applied. In his own words, Darwin summarizes this "principle of preservation" as follows:

> ... many more individuals are born than can survive ... individuals having any advantage however slight, over others, would have the best chance of surviving and of procreating their kind. (Darwin, 1964:81)

Traits that confer a survival advantage on those who possess them and are more likely to be passed down from generation to generation (Williams, 1966). Alternatively, traits or variations that compromise survival are more likely to die out. This is because those who possess such traits face a higher likelihood of not living long enough to procreate and to pass on their traits to future generations. The outcome of natural selection, i.e. an advantageous trait or variation, is called an adaptation. Thus over time organisms change in shape and behaviour to incorporate

those adaptations that enhance their survival. To many, Charles Darwin's greatest contribution was his theory that natural selection is the underlying creative power behind evolution (Dennett, 1995; Mayr, 1991). Natural selection is the mechanism by which evolution operates. It answers the question of — how. What is the means of modification?

In summary, the process of natural selection creates adaptations that allow an individual to respond favorably to problems presented by his or her environment. While natural selection is an extremely slow process it is nevertheless relentless, "always selecting the favorable over the injurious variation over time" (Darwin, 1964:81).

While Darwin was the first to clearly articulate and popularize the theory of natural selection, he did so at a time and in an age that had only the most rudimentary understanding of genetics. Heritability plays a major role in his theory but the mechanics of that process were almost unknown to Darwin and his contemporaries. Subsequent work in this area has only added to the original theory for now we understand that the biological causal factor behind heritable traits is the gene (Dawkins, 1976; Ruse, 1985). Genes are passed from one generation to the next. In combination, Darwinism and genetics are the foundation of modern evolutionary biology. "The basic theory of evolution has been confirmed so completely that modern biologists consider evolution simply a fact" (Mayr 1991). All of life sciences

have been influenced by this powerful paradigm; evolution by natural selection (Barash, 1977; Williams, 1966).

SOCIOBIOLOGY

It was clear from Darwin's early work that he considered an adaptation to be an anatomical structure, a physiological process or a pattern of behaviour (Crawford, 1998). While anatomical features and physiological processes have been well accepted as adaptations, extending this definition to include to patterns of behaviour, particularly human social behaviour, has been much more controversial. For many years, the focus of evolutionary biology was on physical and physiological characteristics. The work of the eminent sociobiologist E.O. Wilson (1975) extended the scope of the evolutionary spotlight to include characteristics of social behaviour. In his classic text Sociobiology: The New Synthesis Wilson presents strong empirical evidence that social behaviour among a vast array of animal groupings has deep evolutionary roots. While his synthesis of research on species as varied as ants, turkeys and jellyfish generated much interest and little controversy, extending his analysis to humankind caused a certain amount of consternation. Sociobiologists caused considerable reaction when they suggested that much of human social behaviour is genetically determined as well. Sociobiology engendered unrelenting political criticism for its supposed endorsement of genetic determinism in the realm of human social interaction (Pinker, 1997; Segerstrale, 1986).

While the belief of sociobiologists in the innate nature of human social behaviour was subject to much criticism and seemed to distract attention from their many scientific contributions, sociobiological thinking did open to scholarly debate the view that adaptations can be behavioural as well as physical or physiological. Despite the controversy, sociobiologists firmly maintain that certain aspects of an animal's social repertoire are undeniably innate evolving as they do through the process of natural selection (Alexander, 1979; Barash, 1977; Ruse, 1985; Trivers, 1985). Given that humanity is an animal species, then human social behaviour should also be subject to the same process of natural selection.

The importance of this view goes beyond the realm of natural sciences. As Wilson points out "one of the functions of sociobiology is to reformulate the foundations of the social sciences" (Wilson, 1975:4). Until this point in time, the study of social behaviour had been the purview of social scientists in fields such as anthropology and sociology. Both disciplines attempted "to explain human behavior primarily by empirical description of the outermost phenotype and by unaided intuition, without reference to evolutionary explanations in the true genetic sense" (Wilson, 1975:4). Wilson concludes that this approach severely limits the study of human behaviour. He and other sociobiologists argue for a synthesis of biology and social sciences. To them our understanding of human social systems would be greatly enhanced by including natural selection "among the forces shaping individual and group behavior in humans" (Masters, 1985:99). Sociobiologists were among the

first scientists to suggest that certain patterns of social behaviour are species specific adaptations crafted by natural selection and genetically encoded into our humanity.

EVOLUTIONARY PSYCHOLOGY

One group of social scientists, the evolutionary psychologists, responded enthusiastically to the challenge presented by sociobiologists. Their work accepts the premise that human behavioural patterns can be adaptive and because of this, they believe evolution has established a universal human nature. This human nature is based on a species typical collection of complex behavioural patterns triggered by deeply imbedded psychological mechanisms (Tooby & Cosmides, 1990b). Early development of this perspective began in the1980's and was fuelled by an original and provocative program of research undertaken by Stanford University psychologists John Tooby and Leda Cosmides (Cosmides, 1989; Cosmides & Tooby, 1987; 1992; 1994; Tooby & Cosmides, 1989; 1990a; 1990b; 1992; 1994). They cite the central premises of evolutionary psychology as follows (Tooby & Cosmides, 1992):

1. there is a universal human nature.
2. universality exists primarily at the level of evolved psychological mechanisms (not expressed cultural behaviours).
3. evolved psychological mechanisms are adaptations constructed by natural selection.

4. the evolved structure of the human mind is adapted to the way of life of Pleistocene hunter-gatherers.

Evolution has created a number of psychological mechanisms each tailored to resolve a particular threat to survival or the adaptive problems experienced by early human populations. Because of the nature and number of problems presented in ancestral environments, evolved psychological mechanisms are likely to be large in number and complex in nature. Many are domain specific; that is, tailored to solve particular problems and only triggered when the environment presents those problems. Buss (1990) argues that it is the number and specific nature of this repertoire of psychological mechanisms that confer an adaptive flexibility on our species. "It is the numerousness and specificity of the tools in the entire tool kit that gives the carpenter great flexibility, not a highly 'plastic' single tool" (Buss, 1990:270).

Throughout this discussion and in the model development to follow, it is necessary to keep in mind that while evolutionary psychology is founded on the construct of innate psychological mechanisms, evolutionary psychologists, like sociobiologists, do not argue for a strict biological determinism. To understand the influence of psychological mechanisms it is important to identify the appropriate level of analysis. The evolutionary invariant is at the level of psychological mechanism not at the level of manifest behaviour (Cosmides & Tooby, 1987).

Humans are not pre-programmed to behave in specific ways. In fact, manifest human behaviour is highly variable. As Symons points out:

> ... human behavior is uniquely flexible, the goal of this behavior is the achievement of specific experiences - such as sweetness, being warm, having high status. Our flexibility of means and our inflexibility of ends are underpinned by an array of psychological mechanisms that is universal among Homo Sapiens ... and finite ... By contrast, the behaviors that these mechanisms produce is not universal..." (Symons, 1992:139).

Psychological mechanisms act as an extensive set of fundamental building blocks that place certain constraints on human behaviour, but do not dictate specific actions. Psychological mechanisms provide a broad evolutionary foundation upon which our socially constructed world of cultures (Berger & Luckmann, 1966) is built. The rules and conventions of social interaction can be structured in many different ways and can alter over time. This is why human cultures can vary so dramatically. Just as the foundations of a building place certain restrictions on the nature of the structure that can be erected upon it, so to does sociobiology affect the nature of the social conventions that can be built on biologically established foundations. Erdal and Whiten express this relationship as follows:

> ... cultural elaborations are likely to be built on a foundation of evolved predispositions, they are not determined in detail by them and the refinements are very varied and complex indeed, but it is only very rarely that cultural elaborations systematically contradict the evolved predispositions on which they were founded. (Erdal & Whiten, 1996:142)

If we adopt the sociobiological perspective and accept that social behaviours can be adaptations then it is possible to take the next step and cast the lens of evolutionary thinking on our phenomenon of interest — cöoperative behaviour. Could the process of natural selection have forged cöoperation?

THE SELFISH GENE: INDIVIDUAL SELECTION

Darwin (1859) theorized that the process of natural selection fueled evolution. According to his research, the single purpose of each form of life is to survive long enough to pass on its unique combination of genetic material to future generations. Darwin referred to this ability to contribute to future generations as "fitness". The greater the fitness of an organism, the higher the probability that it will be successful in transmitting its genes through some reproductive act. It is not sufficient however, to be fit, as if there is some objective measure or absolute standard of fitness. The rule of natural selection is not "survival of the fit" but rather "survival of the fittest".

Competition is the final arbiter. Thus, it is relative, not absolute fitness that determines survival.

Survival in turn determines which specific traits are passed from generation to generation. The strongest and most environmentally adapted individuals live long enough to procreate and pass along their genetic material to their offspring. Included in this package of genes are proven traits, anatomical, physiological and behavioural, that increase the probability of survival of subsequent generations assuming that the future approximates the past. The obvious calculus of this situation is that any characteristic that enhances fitness has a higher probability of being passed from generation to generation while characteristics that compromise fitness will eventually become extinct.

Relative fitness means that for a trait to be selected (i.e. be passed on to future generations) it has to increase the reproductive fitness of the organism that exhibits it more than it increases the fitness of other members of the population. Conversely, traits that diminish the fitness of an individual can be passed down but only if they diminish the fitness of competitors even more. A narrow interpretation of classical Darwinian theory would lead to the conclusion that there is no genetic foundation for the survival of cöoperation or its ultimate manifestation; altruism. Altruistic individuals by their very definition "surrender personal genetic fitness for the enhancement of personal genetic fitness of others" (Wilson, 1975:105). If a gene for altruism did exist, the process of natural selection would eventually lead to its

extinction. Dawkins makes a convincing case for this inevitable outcome in the following conclusion:

> If there is just one selfish rebel, prepared to exploit the altruism of the rest, then he, by definition, is more likely to survive and have children. Each of these children will tend to inherit his selfish traits. After several generations of this natural selection, the 'altruistic group' will become over-run by selfish individuals and will be indistinguishable from the selfish group. (Dawkins, 1976:8)

Although the theory of natural selection suggests that organisms act only in their self-interest, observation reveals a number of populations in which individuals appear to behave in a much more cöoperative manner; a prairie dog calls out to warn others of the approach of a predator, a group of adult trumpeter swans cares for a single brood of young, two male lions act together to gain control of a pride from the dominant male. It is puzzling that animals, supposedly driven by instinct to act in their self interest, would in some situations place the well being of others ahead of their own. The process of natural selection suggests that individuals cannot gain relative fitness if they act in such altruistic ways. What then explains this obvious contradiction between theory and observation?

BLOOD IS THICKER THAN WATER: KIN SELECTION

Hamilton (1964) believed that the answer to this dilemma lay in extending the concept of self-interest to include an interest in the survival of an individual's relatives or "kin". Cöoperative behaviour might have some evolutionary foundation if members of a group are related in some way. His theory was that an organism would behave in ways that contributed to the well being of its kin since their common ancestry resulted in an organism and its kin sharing similar genetic information. If an organism is driven to ensure the continuation of its genetic material it should not matter if the genes in question reside in the organism or one of its close relatives. "A gene may receive positive selection even though disadvantageous to its barers if it causes them to confer sufficiently large advantages on relatives" (Hamilton, 1964:17). To Hamilton, the calling prairie dog was not warning a "group" but was acting altruistically to protect its kin.

Those who support this theory of kin selection believe that animals act in ways that maximize their *inclusive fitness*; inclusive meaning their genetic representation in succeeding generations as measured by the number of their offspring, their relatives, their relatives' offspring and so on. Hamilton developed this theory of inclusive fitness while working with colonies of eusocial insects such as bees, ants, and wasps. These species are widely known for the cöoperative and sometime even self-sacrificial behaviour on the part of their female worker castes. Hamilton hypothesized that the explanation for this form of extremely cöoperative behaviour stemmed from the strong degree of relatedness among female workers. In

the eusocial species males develop from unfertilized eggs and therefore only have only one set of genes. This means that all the females in a hive receive replicas of the same set of genes from their father and 1/2 a set of genes from their mother. The result is that sisters share 3/4 of the same genes. In fact, female worker bees exhibit more genetic similarity with their sisters (3/4) than with their offspring (1/2), if they could produce offspring. Therefore workers can do more for their evolutionary fitness by tending to the needs of their sisters than to the needs of their daughters.

Brian (1966; 1983) pointed out that Hamilton's development of kin selection from the behaviour of eusocial insects was somewhat idealized since it was based on two less than realistic assumptions; first, only one drone fathered each of the workers and second, only one queen laid all of the eggs. Both assumptions did not hold true for most insect colonies. Thus the high degree of relatedness that was Hamilton's explanation for extreme displays of cöoperative behaviour was not as strong as he proposed.

As well, the effect of kin selection quickly declines as the strength of the relationship between parties diminishes. Wilson (1975) maintained that once the relationship between parties reached the level of first cousin, one party would not act in an altruistic manner toward another unless there was a less than one in eight chance (the amount of genetic similarity between cousins) of the action affecting its personal fitness. In realistic terms, kin selection loosened the restrictions of individual selection to allow a small amount of altruistic behaviour to be manifest but only a

small amount and toward a limited group of potential recipients. It did nothing to explain the many altruistic acts directed toward seemingly unrelated individuals.

YOU SCRATCH MY BACK I'LL SCRATCH YOURS: RECIPROCAL ALTRUISM

Further progress toward solving the dilemma of cöoperative behaviour came from the work of biologist Robert L. Trivers (1971) who proposed a theory of "reciprocal altruism" to explain cöoperative acts between unrelated individuals. His view was that self-interest, not altruism, motivated acts of supposed self-sacrifice. Trivers used the example of a "Good Samaritan" who jumps into a river to save a drowning man even when the men are not related and have never met. He suggests that a Samaritan acts out of an expectation that if he successfully saves the person on this occasion, the person will act altruistically toward him at some time in the future; i.e. that he will reciprocate in the future. The advantage of this theory is that altruism can be explained in a way that accounts for the force of individual selection but does not require assumptions about genetic relatedness. Because this behaviour is subject to the calculus of individual selection the Samaritan must conclude that the enhancement to his fitness resulting from the future altruistic act must be greater than the potential decrement to his fitness posed by the original "altruistic" act. Wilson concluded from this "a population at large that enters into a series of such moral obligations, that is reciprocally altruistic acts, will be a population of individuals with

generally increased fitness" (1975:120). Groups bound together by the reciprocity resulting from altruistic acts are fitter than those not so connected.

Trivers (1971) noted a number of conditions that would be required for reciprocal altruism to occur. To act in an altruistic fashion, the Samaritan would need to be confident that at some time in the future he would benefit from the obligation created by his act of heroism. That is there would have to be a high probability that (1) the situation would be reversed, (2) the Samaritan and the victim would have to be able to recognize each other, and (3) the Samaritan would have to trust that the victim would not shirk his future obligation. The complexity caused by these conditions made it difficult to determine exactly if reciprocity is a mechanism for the evolution of altruistic behaviour but at the time it was the only helpful theory to address the occurrence of cöoperative behaviour beyond familial groups.

To Wilson (1978) the development of a theory of reciprocal altruism was an extremely important ingredient in resolving the puzzle of human altruism. After surveying the full range of biological arguments, he suggested that it would be helpful to think in terms of two forms of altruism; hard-core and soft-core. Hard-core altruism is purely for the benefit of the other, with no thought or calculation of future benefit. For this type of altruism, kin selection is paramount and it is clear that the altruistic behaviours of eusocial insects is virtually all hard-core. Soft-core, on the other hand, is ultimately selfish. On the surface the behaviour appears altruistic, but scratch below it and you would find is that the altruist expects some form of

reciprocation. To Wilson (1975) this was an extremely significant differentiation and explained much of human social behaviour.

> ... in human beings soft-core altruism has been carried to elaborate extremes. Reciprocation among distantly related or unrelated individuals is the key to human society. The perfection of the social contract has broken the ancient vertebrate constraints imposed by rigid kin selection. Through the convention of reciprocation ... human beings fashion long-remembered agreements upon which civilizations can be built. (1978:156)

While reciprocity may explain the occurrence of what appear to be outwardly cöoperative acts there is a nagging concern that underlying such behaviour are selfish not altruistic motives. What we observe is not *genuine* cöoperation since it is the existence of a potential payback that really accounts for the behaviour (Dugatkin, 1999). We may have found a way to explain seemly cöoperative behaviour but have not addressed more fundamental questions concerning the innate nature of cöoperative behaviour. If this is so, then we really haven't made much progress in understanding cöoperation and we are back to having to accept the clearly inadequate explanations proposed by kin selection. Is there another way to explain cöoperation?

WE'RE ALL IN THE SAME BOAT: GROUP SELECTION

Wynne-Edwards (1962:1986) attempted to address the dilemmas inherent in cöoperation by first observing that the individuals of many species function as members of a social groupings. His contribution was to challenge the assumption that natural selection operated only at the level of the individual. What if selection applied to groups, as well as to individuals; i.e. survival of the fittest group? Within a group some members would have the self-sacrificing gene for altruism, others would not. If natural selection operated at the level of the group, those groups with a large number of altruists, i.e. those who sacrificed their own fitness to improve the fitness of others, would have an advantage over groups with more selfish members. In this way group selection could explain the occurrence of cöoperative behaviour; that is animals cöoperate to increase the fitness of their group and thus the probability that it will survive.

Wynne-Edwards developed his theory while investigating why higher animals were capable of regulating their population density. He deduced from observation that populations progressed through cycles of increase and decline but seldom exceeded a fairly stable maximum level. There appeared to be some stabilizing force that implied an equilibrium seeking process was occurring. Darwin had addressed this phenomenon by suggesting that forces external to the population such as climate, famine, predators or disease would eventually control a population. Wynne-Edwards suggested an alternative hypothesis that the populations themselves contributed to their own

population control. He identified two sources of internal control: territoriality and hierarchy, the nature of which are well documented in the biological literature.

It was Wynne-Edwards' belief that both territoriality and hierarchy originated from altruistic behaviour on the part of group members. Those having altruistic genes curtailed their personal fitness by excluding themselves from resource rich territories or by accepting submissive positions. In so doing, their cöoperative behaviour ensured that the group would not overfeed or destroy its resource base. Groups containing altruistic members, those willing to restrict their personal fitness for the well being of the group, would prosper while groups with members whose self-interest places the group in jeopardy would perish.

From Wynne-Edwards' perspective individuals cöoperated to enhance the fitness of the group and fitter groups, like fitter individuals, prevailed. Groups without such cöoperative members would be "unable to prevent their own numbers and conflicts from escalating with the result that their habitats would be stripped of renewable assets in a ruthless pursuit of personal fitness." (1986:13)

When Wynne-Edwards first proposed this theoretical explanation for the robustness of cöoperative behaviour, the eminent biologist George C. Williams (1966) objected strongly on two dimensions. First, given the force of individual selection working against the transmission of altruistic genes, how could an altruistic group develop in the first place? Second, even if such a group did emerge, the self-sacrificing

behaviour of altruists would diminish their representation and the selfish would eventually prevail. To Williams, a mechanism that inhibited fertility would not survive at the individual level and therefore could not apply at the group level. A group containing altruists may have an advantage as long as the altruistic genes survived but over time the unrelenting fact of individual selection would severely erode a group's altruistic nature.

Williams's arguments effectively quashed any further development of group selection theory until the mid 1970's when George Price developed a "totally fresh approach to the problem" (Sober & Wilson, 1998:72). He advanced cogent arguments based on a sound mathematical model (Price's equation) to support the operation of a multi-level selection process that could sustain altruism in a population over time. Price's equation made it clear that attention had to be focused on processes occuring within groups and between groups in a population. Selection was operating at multiple levels and it was the net effect that determined the overall outcome. According to this model it was indeed possible for selection to act at the level of the group and overcome the seemingly inevitable action of self-interested selection operating at the level of the individual.

David Sloan Wilson picked up Price's perspective and developed illustrations of how multi-level selection theory might operate to support the existence of alturistic behaviour in a population (Sober & Wilson, 1998; Wilson & Sober, 1994). He begins

with an overview of the fitness implications of altruistic behaviour (see Table 1 for a mathematical model of the following discussion).

TABLE 1

PARAMETERS OF A ONE-GROUP MODEL

Base level of Fitness	X	
Cost of altruistic acts	c	
Benefit from altruistic acts	b	
Step1		
Fitness of an altruist (W_a)	X-c+b	
Fitness of a nonaltruists (W_{na})	X+b	
Step 2 - determining probability		
Number in the group	n	
Proportion of altruists in the group	p	
Probability for an altruist	(np-1)/(n-1)	
Probability for a nonaltruist	(np)/(n-1)	
Step 3 - fitness adjusted for probability of receiving a benefit		
Fitness of an altruist (W_a)	X-c+b[(np-1)/(n-1)]	
Fitness of a nonaltruist (W_{na})	X+b[(np)/(n-1)]	
Example		
Base level of Fitness	X	10
Cost of altruistic acts	c	1
Benefit from altruistic acts	b	5
Number in the group	n	100
Proportion of altruists in the group	p	.2
W_a	10-1+5[(100x.2)/(100-1)] 9+5(.192) 9.96	
W_{na}	10+5[(100x.2)/(100-1)] 10+5(.202) 11.01	

All else being equal, in the absense of altruistic behaviour all individuals in a population will produce the same number of offspring (will exibit the same base level of fitness). However, the presence of altruistic behaviour within a population changes this.

First by acting altruistically there is a *cost* to the fitness of an altruist i.e. by behaving in this manner an altruist has fewer offspring. If the base level of offspring for a population is "X" then an altruistic individual will have fewer offspring - say "X-C". Second while there is a cost to an individual who acts altruistically, altruistic acts can produce a *benefit* to the fitness of others in the population. The fitness of any individual in the population is enhanced by the altruistic acts of others in the group. Thus the fitness of an individual (W) equals the base level of fitness (X) for a member of the population, less a cost for altruistic behaviour if the individual is an altruist, plus a benefit (b) from the altruistic acts of others. The fitness of an altruistic individual could be expressed as $W_A = X-c+b$. The fitness of a nonaltruist as $W = X+b$.

However there is a probability that any one individual in the group will not be affected by the altruistic acts of others and therefore not receive the benefit. The probability that an individual will be the recipient of altruistic acts depends on the number of altruists in the population. If there are many altruists, then there is a greater likelihood that any individual will be the beneficiary of acts of altruism. This means that the fitness of an individual in the group will be affected by the proportion of altruists in the population and the fitness formula needs to be adjusted to reflect this propability. In the case of an altruist the proportion of altruists in the population depends on the size of the group (n) and the proportion of altruists (p). If the group has 100 (n) members and the proportion of altruists is .2 (p) then the propability that the altruist will be affected by the behaviour of another altruist is number of remaining altruists (np-1) divided by the number remaining in the group (n-1) (remember that an altruist receives no benefit from

his altruistic acts). In our example the probability of an altruist receiving a benefit becomes (np-1)/(n-1) or (100x.2-1)/(100-1) = 19/99 = .192. For someone who is not an altruist the probability is slightly higher since the indivdiual in question is not an altruist and has the potential to be affected by the entire group of altruists. Thus for a nonaltruist the probability of receiving a benefit becomes (np)/(n-1) or (100x.2)/(100-1) = 20/99 = .202.

Thus our fitness formula can be adjusted as follows. The fitness of an altruist would be Wa = X-c+b(np-1)/(n-1). The base level fitness less a cost of being an altruist plus a benefit from the altruistic acts of other adjusted for the probability of being a benficiary of such acts. The fitness of a non altruist becomes Wna= X+b(np)/(n-1). The base level fitness plus a benefit from the altruistic acts of other adjusted for the probability of being a benficiary of such acts.

Now that we have a formula to determine fitness lets investigate the impact of variable fitness on the future of this population. If we continue with the above example and assume the base level fitness to be 10, the cost of altruistic behaviour to be 1 and the potential benefit to be 5, the fitness of any altruist in the population (Wa) can be calculated as follows: 10-1+5(100x.2-1/100-1) = 9+5(.192) = 9.96. The fitness of a nonaltruist (Wna) becomes 10-5(100x.2/100-1) = 10 + 5(.202) = 11.01. Therfore the number of altruists in the next generation would be npWa = 100x.2x9.96 = 199.2. The number of nonaltruists would be n(1-p)Wna = 100x(1-.2)x11.01 = 880.8 (see Table 2).

TABLE 2

FITNESS EFFECTS ON THE NEXT GENERATION

Fitness of altruists	9.96
Number of offspring	100x.2x9.96 199.2
Fitness of nonaltruists	11.01
Number of nonaltruists	100x.8x11.01 880.8
Total population	199.2 + 880.8 = 1080
Proportion of altruists	199.2/1080 18.4
Proportion of nonaltruists	880.8/1080 81.6

Proportion of altruists in the population is declining (18.4 vs 20) and the proportion of nonaltruists is increasing (81.6 vs 80).

The total population is now 1080. The new proportion of altruists becomes 199.2/1080 = 18.4 and the new proportion of nonaltruists becomes 880.8/1080 = 81.6. This proportion of altruists is declining (18.4 vs 20) and the proportion of non altruists is increasing (81.6 vs 80). Thus this example fully supports the contention of the individual selectionists and clearly illustrates that over the time altruists will disappear from the population.

Wilson however, extends this discussion by suggesting a few modifications to the starting conditions to illustrate how group selection might alter this scenerio. To begin with he suggests the following conditions:

1. the population could be divided into groups.

2. groups could vary in their proportion of altruists.
3. groups with altruists must produce more offspring (this makes sense since the definition altruists increase the fitness of others in their groups so that groups with altruists will have greater fitness than groups without altruists).
4. while within a generation there is no across group interaction between the altruists and the non altruists, in subsequent generations there is.

Given these conditions Wilson developed a two group model (see Table 3) that illustrates that while the process of natural selection can work against altruism within a group, it can survive in a population of groups through the process of natural selection operating between groups.

TABLE 3

PARAMETERS OF A TWO-GROUP MODEL[1]

	Group 1	**Group 2**
Generation 1		
N	100	100
P	.2	.8
W_a	10-1÷5(19)/99 = 9.96	10-1÷5(79)/99 = 12.99
W_{na}	10÷5(20)/99 = 11.01	10÷5(80)/99 = 14.04
Generation 2		
n altruists	20x 9.96 = 199.2	80x12.99 = 1039.2
n nonaltruists	80x11.01 = 880.8	20x 14.14 = 280.8
n	1080	1320
p altruists	199.2/1080 = .184	1039.2/1320 = .787

Global Population	
Generation 1	
N	100÷100 = 200
Proportion of altruists	[.2(100)+.8(100)]/200 = .5
Generation 2	
N	1080+1320 = 2400
Proportion of altruists	[.184(1080)÷.787(1320)]/2400 = .516

[1] adapted from Sober & Wilson 1998 p. 25

In this model a population is divided into two groups and the proportion of altruists varies significantly between the two groups (.2 vs .8). While it is true that the process of natural selection appears to be operating at the individual level (the proportion of altruists in group 1 declines from .2 to .184 and the proportion of altruists in group 2 declines from .8 to .787) paradoxically, the proportion of altruists in the total population increases (.5 to .516). This is due to the fact that groups with high number of altruists

(like group 2) have a much higher total fitness (1320 vs 1080). In such groups the fitness of both altruists and nonaltruists alike is much greater than the baseline level of fitness (12.99 vs 10 for altruists and 14.04 vs 10 for nonaltruists) but it is the additional altruists from group two (1039.2) that are contributing to the increase in proportion of altruists in the population in general (.516 vs .5).

It is true that the proportion of altruists in each separate group decreases and if each group maintained its initial membership, altruists would disappear over time. What makes this process more than a brief anomoly however, is Wilson's condition of group interaction and reformation and his contention that altruists tend to seek out and group with other altruists. If this is the case then, the result of this interaction (i.e. the formation of high proportion altruistic groups) would ensure the continuation over time of groups with high proportions of altruists. Wilson contends that "altruism can evolve to the extent that altruists and nonaltruists become concentrated in different groups" (Sober & Wilson, 1998:26).

And finally the more significant the impact of the altruistic behaviour is on the fitness of a group the more succeessful an altruistic group will be in competition with other nonaltruistic groups. If in our example, the benefit to the individual fitness of one member of a group from the altruistic behaviour of another was doubled to 10 from 5, the size of the altruistic group would increase from 1320 to 1720 (an increase of 30%) compared to an increase of only 9% (from 1080 to 1180) for the nonaltruistic group. As well, the size of the population would increase from 2400 to 2900 and proportion of

altruists would increase from approximately 52% of the population to over 54%. Wilson's final conclusion is that "altruism can evolve if the process of group selection is sufficiently strong" (Sober & Wilson, 1998:27).

Wilson's theory of multi-level selection supports the sustainability of cöoperation even in the face of seemly strong pressures to eliminate it. Dugatkin summarizes the effects of multi-level selection as follows:

> Within any group which contains cöoperators and non-cöoperators cöoperators come up short. They pay the costs of cöoperation while the non-cöoperators pay nothing yet manage to parasitize the benefits. Within group selection acts against cöoperation as receiving benefits and refusing to pay costs (non-cöoperators) always is favored over getting benefits and paying costs (cöoperators). The kicker, however, is that groups with many cöoperators out compete groups with few cooperators ... and this between group competition favors cöoperation. (Dugatkin, 1999:143)

SUMMARY

Naive evolutionary theory would suggest that cöoperative behaviour is not an evolutionarily stable strategy (Bowlby, 1969) since it can lead to the compromise of individual advantage and as such would become extinct thanks to the process of

natural selection that favors survival of the fittest. There are many arguments however to explain the occurrence of frequently observed cöoperative or altruistic behaviours; the strongest of which is Wilson's multi-level selection theory. This chapter establishes that not only is cöoperative behaviour possible but that it can be an extremely useful evolutionarily stable strategy.

In the next chapter we will extend the study of cöoperative behaviour and again using an evolutionary lens move on to investigate cöoperation's manifestation — social structure.

CHAPTER 3

A VIEW FROM THE TROPICAL RAIN FOREST

"What limit can be put to this power, acting during long ages and rigidly scrutinizing the whole constitution, structure and habits of each creature — favoring the good and rejecting the bad? I can see no limit to this power, in slowly and beautifully adapting each form to the most complex relations of life."

Charles Darwin[4]

Through the cöoperative interaction of individual elements, a system can organize itself into a macroscopic state manifesting a well-defined structure (Haken, 1984). The resulting structure is not designed or imposed by an external agent but arises instead from the natural interactions of its constituent parts. When the system under consideration is an organizational work team and the individual elements are members of that team, then this self-organizing process can produce a relatively stable pattern of social connections. These linkages will determine the roles assumed and relationships established among individuals within the group. The resulting pattern is not dependent upon the imposed criteria of management but emerges instead from this 'unselfconscious process" (Alexander, 1964). Thus, social structure can be considered an emergent phenomenon that results from the ongoing interaction of individual actors relating to each other over time.

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[4] On the Origin of the Species; 1859:469

Further, when systems are open to their environment the process of self-organization will be influenced by factors outside the system. Thus the structural patterns that emerge are contingent upon the interactions of system elements, characteristics of initial environmental starting conditions and feedback concerning the alteration of these elements and conditions over time. Open systems are responsive to their surrounding environment and consequently the environment has profound influence on resulting configurations (Wheatley, 1992).

This chapter seeks to identify the patterns of social structure that emerge in groups and to understand the salient characteristics of the environment that influence the nature and functioning of these structures. To begin this path of discovery however, requires appreciation that the structures resulting from self-directed action possess characteristics of their own; properties that are distinct from those of the individual elements that comprise them. For example, features such as cohesion, norms and openness are properties of a group not a person within the group. Johnston (1999) refers to these macro-level traits as emergent properties - arising as they do from the outcome of a process of self-organization.

What determines the nature of these structural traits and resulting emergent properties? Johnston suggests that the answer to this question is deeply rooted in evolution and the process of natural selection. "In the evolutionary paradigm ... selection acts on the emergent properties, and the actual physical design will be a consequence of the successful functional emergent properties... (1999:10-11).

Through the process of self-organization individual attitudes and preferences become coordinated in such a manner that new properties emerge at the level of the group. These properties convey functional capabilities on groups that enable them to exploit environmental affordances in ways those individual actors cannot (Caporael & Baron, 1997). Certain structural designs lead to specific emergent properties that convey survival advantage to the groups that display such properties. Is it possible then that social structure is a group level adaptation that has been crafted by natural selection to enhance survival?

This dissertation accepts Johnston's perspective on the origins of emergent properties and proceeds from the position that developing a deeper understanding of the form and function of social structure requires viewing the phenomenon through an evolutionary lens. Just as we learned more about cöoperation by investigating its evolutionary roots, it is possible that evolution can tell us a great deal about the origins of social structure. While Tooby and Cosmides (1992) directed us to seek an understanding of evolution's creations in a species' past not its present, direct knowledge of humankind's social relations in ancestral times is for the most part unavailable to modern investigation. Therefore, the chapter begins by asserting that it is acceptable practice to seek knowledge of our species' pre-history social behaviour in the present day actions of its closest relatives: monkeys and apes. It then turns to the work of primate ethologists and socioecologists to develop a model describing a contingent relationship between social structure and a group's resource context — identifying which features of a group's environment contribute to the emergence of

what forms of social structure. As the chapter concludes, it provides an evolutionary explanation for the origins of this contingent relationship.

LOOKING FOR AN EVOLUTION BASED THEORY

If social structures are adaptations, and sociobiologists have certainly made a strong case to suggest that social behaviour can be adaptive, then it is important to fully appreciate that the adaptations of the human mind evolved in response to problems experienced by our ancestors. Bowlby (1969) refers to this as the environment of evolutionary adaptation (the EEA). Adaptations do not necessarily enable a species to respond to the problems of its current environment only to the experiences of its past. "Natural selection put a premium on behavior patterns that helped our pre-human and early ancestors to adapt to the environmental conditions *of their time*" (Breuer, 1982).

As Darwin noted at the start of this chapter, the pace of natural selection is extremely slow operating as it does over thousands of generations. Humankind's transition from hunting and gathering to other forms of activity for subsistence (farming, manufacturing, and thinking) has been a recent phenomenon. As a result, in most situations it is very difficult to look at a current pattern of behaviour and from a modern perspective try and determine if it is an adaptation and if so, its function. Wright (1994) reminds us that the connection between our adaptive mechanisms and contemporary environments is often "opaque to introspection" (1994:10).

It is also extremely difficult to look far enough into the past to determine the nature of our ancestral environment. Unfortunately, the era we are interested in pre-dates written historical record and social interactions leave little physical evidence for archaeological discovery. As Stanford (1999) points out "evidence of early humans in the fossil record is, and always will be — full of bones but lacking flesh, both literally and figuratively" (1999:7). Consequently, the exact features of early human social interaction are for the most part lost to modern researchers (Tooby & DeVore, 1987).

If we are cautioned against making incorrect associations between current utility and reasons for historical origins (Gould, 1987) and we don't know what social life was like for our pre-history ancestors, then where can we look for insight about early social structures and the problems imposed by the Pleistocene environment? Buss (1990) encourages evolutionary researchers to seek, "... knowledge of other species for comparative analysis" (1990:283). Wilson (1978) echoes this view and suggests that the genetic influence on human social behaviours can best be evaluated "by comparison with the behavior of other species" (1978:20).

In the realm of comparative studies, it is well accepted practice to look for clues about the social behaviour of pre-history humankind in the present-day behaviour of our closest evolutionary relatives, the non-human primates (Potts, 1987). Lenski (1975) states that "though we have no direct knowledge of these first

hominids, we can draw a number of inferences about them from the study of modern primates" (1975:143). Monkeys and apes live in environments similar to those of our human ancestors; they function in social groupings and they are our closest genetic relatives making them very much like us in biochemical composition and cognitive ability (Dugatkin, 1999; Gribbin & Gribbin, 1988). While I am not suggesting that studying apes is a substitute for studying humans, I am proposing that studies of non-human primates can suggest underlying principles that enhance our understanding of the human condition (Hinde, 1987). For example, the early work of psychologist Abraham Maslow was with monkeys and there is strong evidence that his insights concerning human motivation were generated from his studies of aggression among non-human primates (Cullen, 1997).

If we share a similar socio-evolutionary heritage with our primate cousins then deriving understanding from an examination of their simpler circumstances could help to pierce the veil of our own complexity and garner some basic insights into human social behaviour in modern organizations. Consequently, the study of chimpanzees and other primate groups may be able to inform us about the form of social structure in early human groups and the environmental contingencies that lead to the emergence of its particular forms.

TWO MODES OF SOCIAL STRUCTURE - PRIMATE MODELS

The seminal investigation of the social structure of non-human primate groups is found in the work of British ethologist Michael Chance. Beginning in the 1950's and continuing for over 15 years, Chance conducted detailed observation and study of various species of non-human primates (Chance, 1956; 1963). His work established that monkeys and apes live in small heterogeneous (mixed sex, inter-generational) groups displaying highly structured and stable social relationships. According to Chance & Jolly (1970) the social structure of these groups exhibited one of two patterns or modes: agonic or hedonic.

Agonic. The first mode he called agonic because of the agonistic nature of the animals residing in these troops. Those who attain and maintain dominance in an agonic troop do so through acts of aggression and agonistic display (e.g. neck biting, staring and other acts of intimidation). At the slightest provocation, less dominant members are ready to perform acts of submission or appeasement to ward off attack. Submissive members of these groups never stray very far from the dominants to ensure they have a full view of their actions but at the same time they maintain a respectful distance to keep out of "harms way". Threats from dominants (both explicit and implicit) keep members of the group spatially separated but clustered closely in a single troop formation. Because of the ever-present possibility of aggressive attack from within, most animals in agonic troops are constantly in a state of high arousal.

Except for those whose role it is to scan the environment for potential predatory threats, most of the remainder of the troop keeps its attention focused on the dominants. As a result, most of the troop shows little curiosity about others in the group or their physical surroundings. In the agonic mode the group's social attention is focused exclusively on its dominant members. When external danger threatens, the group clusters together and looks to the dominant for protection and direction.

Hedonic. Alternatively, members of hedonic groups exhibit behaviour that is much more variable and flexible. Individuals relate to one another without reference to the dominance hierarchy and they actively interact with their environment handling objects with interest and curiosity. Prominence, not dominance is sought through various forms of display behaviour. A process of social solicitation, not intimidation, determines rank. Individuals "compete" for the attention of others through display behaviours. These behaviours are frequently followed by inter-personal rewards such as grooming, play and mothering or by communal activities such as food sharing. There is little outward conflict within the group and because members are not in a constant state of anxiety arousal fluctuates more normally.

Unlike agonic troops, members of hedonic groups do not need to be in constant view of each other. They easily split off in small foraging "teams" with shifting composition. When they return to the main troop the atmosphere is so social and interactive that Reynolds (1965) compares the mood of their reunions to that of a

"carnival". This pattern of alternating separation and coming together is referred to as fission/fusion.

When threatened by danger a hedonic group responds in a completely different manner than an agonic troop. Members gather:

> ... together as a group, making body contact, slapping and hugging each other, from which activity each member gathers confidence to attack the predator on its own. The group is not the source of common defense as in the agonic mode, but a source of mutual confidence from which the individual makes individual assaults". (Chance, 1980:89)

These two modes of social structure can be summarized in the following table adapted from Chance (1980:90).

TABLE 4

FEATURES OF AGONIC AND HEDONIC SOCIAL STRUCTURES[1]

Feature	Agonic	Hedonic
Social Cohesion & Attention	Continuous (single troop)	Periodic (fission/fusion)
Attention to a central figure	To modulate threat and avoid attack (dominance/positional leader)	In response to display (prominence/situational leader)
Continuous Attention	Confined within society	Capable of being directed at physical environment
Arrangement of Individuals	Spatially separated (respectful distance dyads)	Close contact (hugging/touching networks)
Social Relations	Balanced; successful avoidance of punishment	Rewarded (mothering/sharing)
Arousal	Continuous (medium to high)	Fluctuating low to medium)

1 Pierce & White 1999: 845

Chance's initial belief was that social structure is an inherited, genetic characteristic specific to a particular species. For example, rhesus monkeys were thought to be agonic and chimpanzees hedonic. However, the work of Canadian

anthropologist Margaret Power calls into question this assumption and suggests an alternative view.

A CHIMPANZEE PUZZLE

Margaret Power (1988; 1991) was intrigued by inconsistent findings concerning the behaviour and structure of chimpanzee groups that were noted in ethological research studies conducted during the 1960's and 1970's. Observations from field studies conducted during the early part of the period differed dramatically from those recorded in studies that took place a few years later. The early researchers observed gregarious animals that exhibited a natural curiosity about each other and their surroundings (Goodall, 1963, 1965; Nishida, 1968; Sugiyama, 1968). Although highly social, chimpanzee groups did not appear tightly bonded and there was little outward hostile or aggressive (agonistic) behaviour among members of the group.

Subsequent studies reported decidedly different forms of group interaction. Researchers later in the decade observed strict dominance hierarchies, with aggressive and outwardly hostile social behaviour (Goodall, 1979; Goodall et al, 1979; Nishida, 1979). Rather than peaceful open groups of non-aggressive chimpanzees, these researchers reported behaviour that was directly competitive and fiercely territorial.

After a detailed review of these studies, Power identified a significant contextual difference between the groups studied. In the early investigations, researchers attempted to observe chimpanzees in their natural habitat. However, naturalistic methods of field study proved to be difficult and costly due to the densely forested nature of the habitat and chimpanzee foraging behaviour. In response to these problems, some researchers changed their study methodology from naturalist observation to artificial provisioning. Under the provisioned approach, researchers supplied food to the chimpanzees at central feeding sites located near their research camps. For these researchers, provisioning seemed to be an effective strategy. It brought the animals to the researchers and allowed for detailed observation over long periods of time in much more accommodating conditions.

Power believed it was the artificial provisioning that produced the differences in the social behaviour of the chimpanzees being studied. When provisioned, the animals no longer needed to forage for food. Instead, they clustered together waiting for the researchers to bring the food to them. Once the food arrived, there was immediate and direct competition for it among the many animals that had been waiting around the feeding site. Competition intensified as there were frequently more animals waiting than food available to feed them. There was also a significant reduction in the amount of greeting behaviour because the chimpanzees now clustered around the centralized feeding stations and no longer foraged in small groups. In the past, greeting had been a significant form of social contact prompting togetherness and lessening the fear of aggression among members of the group.

Power suggested that artificial provisioning concentrated the food resources and introduced direct competition thereby altering natural patterns of social interaction. It was her view that altering the "resource context" affected the social behaviours that emerged within the group.

SOCIAL STRUCTURE AND RESOURCE CONTEXT

A more detailed understanding of the relationship between social structure and resource context is found in the literature of socioecology. There is strong theoretical support for the belief that ecological conditions influenced social organization but connections and patterns are difficult to identify in the field (Gartlan, 1968). Early studies of non-human primate groups produced inconsistent findings and were disappointing to those with an ecological orientation. Progress occurred when researchers abandoned the use of global descriptors of animal habitat such as forest, savanna or desert (Elton, 1966) in favor of a more detailed characterization of the relevant environmental context. As more meaningful dimensions of an animal's resource context were identified and isolated, predictable patterns of social behaviour began to emerge. The features of a group's resource context can be considered along four dimensions 1) distribution 2) predictability 3) visibility and 4) timing. Within each dimension, empirical support is available linking certain characteristics of the resource context to particular features of group social structure.

Distribution. Resources can be either widely scattered throughout a territory or clustered together in identifiable clumps or patches. Southwick (1967) and later Boccia, Laudenslager and Reite (1988) found that clumping resources lead to increased aggressive (agonic) behaviour in macaque monkeys. Sugiyama and Ohsawa (1982) came to a similar conclusion as Power in their study of free range versus provisioned chimpanzees. They suggested that the clumping of resources that occurred when the chimpanzees were provisioned increased direct competition for resources and lead to an increase in agonistic behaviour. Mitchell, Boinski and van Schaik (1991) studied two closely related species of squirrel monkey that lived in differing environments. Monkeys living in resource fields where the food existed in defensible clumps exhibited strong hierarchical dominance (agonic) behaviour. Those residing in resource fields with scattered resources displayed weaker dominance relationships thus demonstrating that their form of social interaction was influenced by the nature of their resource context and was not a species-specific attribute.

Predictability. Within an animal's resource field food and water may occur in predictable locations, or at predictable times (within various plant growth cycles or seasons). In some situations, animals can dependably find these resources at specific sites within their territory; or, they are available at specific times during the year. Other resource conditions are not as predictable. In these situations, there is no way to determine beforehand where food or water can be located or when it may be available. This is particularly true when the food source includes highly mobile

animals. Neither live animals nor animal carcasses are likely to occur reliably at the same place over time (Kurland & Beckerman, 1985). When resources are predictable, monkeys forage together in large groups with agonic social behaviours. If on the other hand either location or timing of resource acquisition is unpredictable, monkeys scatter and forage in small groups or in some cases on their own. When they come together, their social behaviours are hedonic (Denham, 1971).

Visibility. Some resource fields, such as grassland savanna, are very open allowing the animals in a troop to easily observe each other's actions over a large territory. Other habitats, such as tropical rain forest, are lush and overgrown preventing visual contact beyond a few meters. In open grasslands, animals are keenly aware of their troop mates, watching with curiosity to see what food resources others might have encountered. High visibility in the savanna environment encourages competitive behaviour allowing dominant members to challenge others for access to prized food items. In forest settings however, the density of cover allows animals to forage without concern that others in the group might aggressively challenge for food items (Rowell, 1966). In the low-visibility context, Rowell has observed the establishment of the hedonic mode.

Timing. A resource may be acquired and put to use or consumed immediately creating conditions of immediate-return. Alternatively, there may be a delay between acquisition and consumption creating a situation of delayed return. This distinction between immediate return and delayed return was a critical difference for Woodburn

(1982) in his investigations of human egalitarian societies. He found that societies that had economies based on immediate rather than delayed return were assertively egalitarian. Woodburn observed that immediate return egalitarian societies had 1) flexible and constantly changing social groupings (fission/fusion), 2) individual choice of association and 3) relationships that stressed sharing and mutuality (Woodburn, 1982:434). Woodburn's egalitarian societies have much in common with hedonic social structures. Thus, the immediate-return - delayed-return distinction may be critical to the emergence of the agonic or hedonic mode of social structure in human communities.

It is interesting to note that while delayed-return economies are common among human communities, non-human primates rarely experience such conditions except under contrived circumstances. However, the artificial provisioning of the chimpanzees, described earlier by Power created a delayed return context that resulted in a shift from hedonic to agonic-like behaviours (Power, 1991).

Considering the work of Chance and Power with non-human primates, and the literature of socioecology, two modes of social structure can be identified and further associated with specific aspects the resource context. This relationship is summarized in the following table.

TABLE 5

RELATIONSHIP BETWEEN RESOURCE CONTEXT AND MODES OF SOCIAL STRUCTURE[5]

	Agonic	Hedonic
• Distribution[1]	Clustered/Focused	Scattered/Dispersed
• Predictability[2]	High	Low
• Visibility[3]	High	Low
• Timing[4]	Delayed return	Immediate return

[1] Broccia, Laudenslager & Reite (1988); Mitchell, Boinski & VanSchaik (1991); Southwick (1967); Sugiyama & Ohsawa (1982).
[2] Denham (1971)
[3] Rowell (1966)
[4] Woodburn (1982)

[5] Pierce & White (1999: 848)

AN EVOLUTIONARY EXPLANATION

There is no doubt that humankind is a profoundly social species. We live in groups - families; play in groups -teams; work in groups -organizations. "Man is a social animal" (Argyle, 1991). Why would this be so? Evolutionary theory suggests that group membership confers a survival advantage on those who belong. In the first place, threat of predation is greatly diminished by group formation. Burgess

(1989:344-345) summarizes the advantages of aggregation as a defense against predators as follows:

1. When individuals are aggregated, predators must search over wider areas for them decreasing the probability that aggregated individuals will be found and killed (Brock & Riffenberg, 1960; Gross-Custard, 1970), especially if individuals can hide together in patchy cover (Burgess & Uetz, 1982).
2. When individuals are aggregated, they can pool their collective watchfulness and better detect predators and other dangers (Altmann, 1956; Eibl-Eibesfeldt, 1962; Major, 1977; Burgess & Shaw, 1979).
3. When individuals are aggregated, there is less chance that any single individual will die during predatory attack (Hamilton, 1971) because of camouflage and shielding of other members (Major, 1977) and by the possible satiation of predator's appetites (Galton, 1871).

As well, there are advantages in group living that apply to the acquisition of resources. Harvey and Green (1981:154) summarize the advantages of groups for obtaining food as follows:

1. Locating food either by joining feeding conspecifics and thus producing groups (Krebs, 1974) or using the behaviour of other group members to locate food sources (Ward & Zahavi, 1973; Krebs, MacRoberts & Cullen, 1972).
2. Catching food by cöoperative hunting (Bertram, 1978).
3. Defending food or captured prey from other conspecific groups or competing species (Kruuk, 1972; Estes & Goddard ,1967)
4. Exploiting food resources through feeding facilitation (Clutton-Brock, 1974).

Additional advantages of group living include an increased supply of potential mates (Wrangham, 1975), help in the care of offspring (Baumeister & Leary, 1995) and facilitation of learning (Harvey & Green, 1981). It is easy to see why Barchas (1986) concludes, "over the course of evolution, the small group became the basic survival strategy developed by the human species" (1986:212).

However, living in groups, while clearly advantageous from a survival standpoint has its problems and is sometimes difficult to arrange. Specifically the nature of a group's resource context can create significant problems for group formation and cohesion. For example, when resources are concentrated, predictable, and visible and their availability is delayed, individuals seeking these resources are naturally drawn together. This type of resource context makes the resources contestable establishing conditions in which individuals from the same social group must compete directly for the same resources. Manson and Wrangham (1991) attribute inter-group aggression to the extent to which resources can be profitably seized. Contestability, or alienability as they refer to it, is in turn "determined by the spatiotemporal distribution of resources" (1991:374).

While many aspects of group functioning enhance survival, fighting for resources among group members, with the likelihood of injury or death, reduces it. In order for a group to form and stay together when it confronts a contestable resource context, a social structure is needed that ameliorates destructive competition among

group members. The agonic mode of social structure establishes clear hierarchy and procedures for resource allocation among individual group members and constrains competition and conflict. Washburn and Moore (1980) note that the clear dominance hierarchy of baboon troops reduces group in-fighting to a minimum. The agonic mode of social structure provides an effective solution so that individual competition does not overwhelm group cohesion. The adaptive problem of group maintenance within contestable resource contexts has been resolved by the evolution of this mode of social interaction. Cullen (1997) maintains that early primatologists believed that having a dominance hierarchy in place ensured that social order did not collapse into destructive competition. Haraway (1978) went so far as to call hierarchy the "foundation of cooperation" (1978:33).

However, hierarchy is not the only form of social organization. When resources are scattered, unpredictable, visible and available for immediate consumption, the resource context is less contestable. In a patchy resource context, the most difficult problem is finding food not fighting for it. Washburn and Moore (1980) note that "the normal spacing of a troop of gorillas or chimpanzees as they forage through the forest keeps animals far enough apart for each to gather without interference from another" (1980:142). Thus, it is advantageous for individuals to forage separately or in very small groups to look for resources. However, acquiring resources by foraging naturally draws individuals apart thereby hampering group formation. Ethologists studying various species have noted that in ecological conditions where food items are dispersed and irregularly available, group formation

is much less likely to occur (Bertram, 1978; Jarman, 1974). Thus, a resource context that naturally separates individuals would seem to require a social structure that will bring the members together. The hedonic mode is such a social structure. It engages group members in interpersonal bonding activities such as greeting, sharing, physical contact, and other forms of rich interaction. In the absence of competitive pressures, these enjoyable social interactions evoke positive feelings. These feelings in turn increase the likelihood that groups will form and individuals will seek each other out and come together in relatively stable groups. A resource context perceived to be less contestable evokes social relationships that foster group affiliation and continued membership.

In addition to the positive feelings that draw individuals together, it is possible that hedonic social structures have another function. While it is clearly efficient for individuals to forage alone or in small groups when the food context is patchy, it is even more efficient for individual food search to be accompanied by the sharing of information with other searchers about resource location and quality (Schoener, 1971; Smith, 1981). However, as noted in the review of cöoperative behaviour presented in Chapter 2, there is a danger of diminished fitness by sharing with others if they do not share in return — the problem of shirking. A social structure that favors gregariousness and sharing, such as the hedonic mode, increases the likelihood of sustained reciprocity. Kurland and Beckerman (1985) conclude that because of the advantages of social foraging "in the patchy savanna environment, selection would have favored increased gregariousness and cöoperation" (1985:73).

Once a group has formed the social structure produced in response to ecological pressures becomes in turn an extremely relevant component of an individual's environment (Masters, 1985; Tooby & DeVore, 1987). The individual is no longer entirely free to pursue individualistic goals. The emergent properties of the collective modify the behaviour of the individual members. Thus, the social structure begins to influence social interaction within the group resulting in a tension between individual and collective interests (Harvey & Greene, 1981). Effective social structures are those that reduce the source of this tension and enable an individual to adjust his or her self-interest for the greater benefits of continuing group membership.

It is clear that different resource contexts require different resource acquisition tactics and that these tactics (competition or foraging) each create problems for group formation and cohesion. In both cases, social structure is the solution to an adaptive problem. The form structure takes however, (agonic or hedonic) is contingent upon how individuals perceive the contestability of their resource context. Thus, social structures are derived from the operation of deeply embedded psychological mechanisms that are triggered by an individual's perception of the contestability of his or her resource context.

SUMMARY

Sociobiologists have made a strong case that certain forms of social behaviour are adaptive. If social structure is an adaptation, it developed during the Pleistocene era of humankind's development. Since we cannot return to that long ago time and have little evidence of the nature of early human social structures, we seek insight from the structures of groups of a much more accessible subject - the contemporary non-human primate.

Observation and research on monkey and chimpanzee groups developed the model constructed in this chapter. It proposes that social structure is an emergent pattern of interpersonal roles and relationships that displays one of two fundamental patterns or modes: 1) the hierarchical structure of the agonic mode or 2) the more egalitarian structure of the hedonic mode. The theory states that the particular pattern that develops in a given group depends upon the nature of that group's resource context. If, as baboons of the grassland savanna experience, resources are concentrated, predictable, highly visible and consumption of them is delayed then an agonic social structure is likely to emerge. Alternatively, if, as chimpanzees of the tropical rain forests experience, resources are scattered, unpredictable, hidden and consumption of them is more immediate, then the hedonic pattern is more likely to emerge. Thus, the theory states that social structure is triggered by how individual members of a group perceive their resource context. The reason this happens is that various resource contexts present serious problems for group formation and cohesion.

Social structure is a group level adaptation that enables individuals to balance the tension between self interest and group interest and sustain cöoperative behaviour in the face of such challenges.

I have now proposed a model of the patterns of social structure, proposed a theory as to what triggers its different forms and developed an evolutionary explanation as to why such a contingent relationship might exist. In the next chapter we will seek confirmation that the patterns and relationships identified from ethological and socioecological research with non-human primates are evident in human social groupings as well.

CHAPTER 4

FROM MONKEY TROOP TO MODERN ORGANIZATION

zhu/twasi: "genuine people", the !Kung term for themselves.
Richard B. Lee[5]

As previously discussed, "the reconstruction of hominid evolutionary history is a scientific problem of exceptional difficulty" (Tooby & DeVore, 1987). Much of humanity's past is lost and cannot be definitively reconstructed by current archaeological methods. It is impossible to watch our Pleistocene ancestors go about their daily business, to note the patterns of their social interaction and to develop theory based on direct observation. The best we can do is make inferences from what we do know about their life and what we are able to observe in today's world that may have had its roots deep in the past. We have already investigated the social patterns of humanity's closest relative the non-human primate and used this observation to develop a theory. However, what evidence is there that the patterns observed in chimpanzee groups and baboon troops apply to human groups? How can the case be strengthened given the limitations arising from the fact that the evolutionary process called upon for explanation took place so very long ago?

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[5] The Dobe !Kung; 1984: 159

In this chapter I intend to support the theory with evidence from archaeologists who study the fossil remains of ancient communities, from anthropologists who study traditional societies that have preserved archaic traits and management researchers who study the complexities of human functioning in modern organizations. By doing so I hope to more fully support the contention that it is the nature of the resource context that influences the form and functioning of human social interaction. Tooby and DeVore (1987) strongly recommend such a broad-based approach to the development of hominid behavioural theory stating that it should be:

> deduced from evolutionary theory, refined with empirically validated evolutionary biology, phylogenetically honed by primate studies and fitted with specific evidence about hominids deduced from traces left in their living descendents, their fossils, the archaeological record and the reconstruction of paleoenvironments. (Tooby & DeVore, 1987:237)

STUDIES OF OUR HUMAN ANCESTORS

As an archaeologist, Glynn Isaac (1978) takes an imaginative leap and from his knowledge of the fossil evidence of early African hominids creates the following scenario:

> If an observer could be transported back through time and climb a tree in the area around the Koobi Fora Formation — what would he see? Far across the plains, a group of four or five men approach ... As the men approach, the observer becomes aware of other primates below him. A group of creatures has been reclining on the sand in the shade of a tree while some youngsters play around them. As the men approach, these creatures arise ... They seem to be female and they whoop excitedly as some of the young run out to greet the arriving party... The two groups come together in the shade of the tree, and there is excited calling, gesturing and greeting contacts ... (Isaac, 1978:219-221)

There is no direct evidence that such an event ever occurred, but Isaac weaves his story from knowledge of hominid fossil finds and maintains that, while clearly fabricated, his description may not be far from the truth. There is archaeological evidence that early African hominids lived in settings where the distribution of food and water was patchy and unpredictable (Andrews, 1981; Behrensmeyer, 1978). In this dispersed and unpredictable resource setting small group foraging strategy, as described by Isaac, would have been the most effective. It is interesting that the behaviour of the creatures in Issac's story is consistent with the chimpanzee troop fission/fusion pattern and the carnival like reunions described by Reynolds (1965) both of which are representative of hedonic social structures.

While there is little direct evidence in the archeological record of the social organization of early humankind, this has not stopped archaeologists like Isaac and others from hypothesizing about the nature of early human society. These researchers take their knowledge of the environment of the time and their interpretation of the artifacts and fossil remains left behind to suggest a more fully formed picture of life in long ago times. Whallon (1989) recommends "the only way to understand ... now vanished stages is to build fully hypothetical models, not based on any modern analogy but constructed instead from a knowledge of the major relevant variables involved and their interrelationships" (1989:452).

Whallon was interested in the nature of human communities during the Paleolithic era and in particular what might have led to an unprecedented growth spurt that was evidenced in the archaeological record. During this era, both the number and size of human groups increased dramatically. Previous research had shown that as group size increased decision making quality decreased resulting in pressures to introduce hierarchy (Johnson, 1983; Reynolds, 1984). Therefore one would have expected human groups of this era to display social differentiation and hierarchical relations. However, Whallon hypothesized a very different outcome because of the nature of the resource context experienced by groups of this era. Paleolithic humanity lived in impoverished resource conditions. What food and water resources they did have were "less predictable in spatial and temporal availability" (1989:447). Whallon predicted that in this sparse and unpredictable resource context the most efficient food acquisition strategy would be for individuals or small sub-

groups to fan out to seek resources and then regroup to share what they found. Such a strategy would increase the probability that at least one member of the group would locate some amount of food and water and that everyone in the group would share in that person's luck. Thus all individuals in a group engage in the same type of activity (foraging) but do so separately in time and/or space. There is no specialization of labor. Everyone is performing the same type of economic activity but doing so in a different location or at a different time.

When resources are scarce and unpredictably scattered over a large territory the most effective strategy is separation of labor and not specialization of labor; complemented by egalitarian sharing not hierarchical control. Whallon believed that "egalitarian organization ... may confer a survival advantage to groups in environments characterized by unpredictable differential availability of resources in space and time" (1989:448). He further concluded that the major population expansion of the Upper Paleolithic era was made possible by the separation of labor within human groups and their ability to create and maintain egalitarian social structures. In Whallon's descriptions and analysis, we can see the predicted relationship between resource context and social structure.

Washburn and Moore (1980) also noted the emergence and importance of cöoperative social systems in very early human groups. They were interested in the earliest beginnings of our species; that period of transition from non-human to human primate. They document the progression from forest canopy, to forest floor to

radically different savanna habitat and connect this progression to the transition from ape to humankind. The authors suggest that innovations in tool construction, carrying technology and hunting enabled early humans to sustain themselves in previously inhospitable environments and moved them further from their non-human primate ancestors. However, Washburn and Moore go on to note that a savanna hunting and foraging existence created new problems that they suggest required complementary innovations in hominid social relations. They suggest social systems based on dominance hierarchies that were prevalent among preceding ape populations would have been much less effective in the dealing with the problems of food acquisition in scarce patchy food environments that require foraging and sharing.

> With sharing, dominance very likely became less important in social control. If a dominant hominid had taken all the food, the rest of the group might have perished in hard times, and the dominant would not have survived alone ... Selection at last began to give the edge to cooperation. The groups that shared ... became those that flourished and continued. (Washburn & Moore, 1980:142-3)

Thus, the change in resource context encountered by early humans as they entered a new and different habitat necessitated the alteration of their traditional social structures. The changes described by Washburn and Moore, patchy unpredictable resource context leading to egalitarian sharing social structures, are consistent with those that would be predicted by this dissertation's model.

In Knauft's (1991) study of violence in human societies he reviewed a wide range of information about aggression, domination and violence among non-human primates, simple societies (early hunter/gatherers), and mid-range societies (those more complex pre-state societies that succeeded simple societies). He was interested in documenting the prevalence and nature of aggressive dominance in these pre-history communities over time. The pattern of dominance and violence he found he described as being U-shaped. "Patterns of sociality and violence are in certain formal respects similar among great apes and middle range societies but systematically different among simple human societies" (1991:407). In the great ape and middle range societies researchers had documented "overt competition", "dominance hierarchy" and "competitive defense" (1991:407). Whereas in simple societies he found records of "open social networks", "non hostile inter-group interactions" and the existence of "cooperative niches" (1991:407). Previous speculation was that human development assumed a straight-line trajectory; moving from nonviolent noncompetitive egalitarians to more aggressively competitive hierarchical societies. By placing the non-human ancestors before the emergence of *Homo sapiens*, Knauft makes the case for a more U-shaped progression. Primate social structure proceeds from the prevalence of dominance hierarchies through a prolonged period of intense sociality (egalitarianism) and then back again to hierarchical based forms.

What is particularly interesting is Knauft's contention that this pattern of social interaction can be traced to resource distribution conditions for these societies.

From his extensive review, he concluded that violence and hierarchy were rarely found among decentralized foragers who practiced significant food sharing. "Decentralized leadership, diffuse and flexible inter-band alliances, generalized reciprocity and adult male equality tend on the whole to be more common in more autonomous and more decentralized foragers" (1991:393). Alternatively he found that with the advent of sedentism and agriculture/herding (the living conditions of the mid-range societies) that violence increased dramatically along with competition and hierarchy. "It is likely that ... coercion and violence as systematic means of organizational constraint developed especially with the increasing socioeconomic complexity and potential hierarchy afforded by substantial stored food surplus and food production" (1991:391). Concentrating the resources through food storage made them contestable and had profound effects on the nature of the social structure that emerged.

It is interesting to note that just as described earlier in this dissertation, Knauft found two patterns of social structure within non-human primate communities of great apes and chimpanzees. Dominance hierarchies and outward hostility was identified among many species of apes but was not evident among chimpanzees and bonobos. He suggests that the lack of aggression among chimpanzee and bonobo groups resulted from of the nature of their dispersed resource context. He quotes Whallon (1989:448-9) in support of the conclusion that "the typical pattern of dominance relations among individuals ... would not be particularly adaptive in environments of low resource density and predictability (1989:448). The overall

pattern that Knauft describes "has the common ancestor of humans and apes living in relatively closed male-philopatric groups then spreading out from central area where resources were concentrated to marginal habitats where resources are dispersed. In these marginal areas, the open flexible groupings characterized by extant hunter-gatherers would have emerged" (Rodseth, 1991:415). This description of long ago events is particularly reminiscent of the earlier description presented by Washburn and Moore (1980)

STUDIES OF INDIVIDUAL MODERN TRADITIONAL SOCIETIES

It is evident that the modern traditional societies studied by anthropologists are decidedly different from most of the human groups found in our world today. However, because they live in environmental conditions that are similar to those experienced by pre-history humanity, they can be a valuable source of insight about the relationship between ecology and behaviour. The hunter-gatherer societies still functioning today practice a life style that characterized much of our evolutionary history (Eibl-Eibesfeldt, 1991). Stanford (1999) reminds us that:

> Modern foraging peoples are not relics from the past. They have lives and societies with as much culture and sophistry as any other group of modern humans. But technologically they tend to be simpler, allowing us to see how people who need to subsist from their forest and savanna worlds can do so. (Stanford, 1999:7)

If the theory developed in this dissertation is correct, then we should be able to see its application in the social interactions of these traditional people and make even stronger inferences about its applicability to pre- history humankind.

Probably one of the most observed and investigated of modern traditional societies is that of the San, a population of indigenous people who inhabit Africa's Kalahari Desert and "earn" their living by hunting and gathering. The most extensively studied of the San population has been that of the !Kung. According to Lee "the Dobe !Kung are probably the world's best documented foraging society" (1984:12). These modern day hunters and gatherers inhabit the far northern fringes of the Kalahari. Due to the wide diurnal variation in temperature, !Kung can experience brutal heat during the day (highs between October and March of 35°- 45° Celsius) and frigid cold during the night (60 nights a year the temperature falls below 5° Celsius) (Lee & DeVore, 1979:30). While rain falls in their territory from June to September the actual amount of rain received can vary significantly because of the climatic mechanisms that produce precipitation in the area. For most of the year standing water is rare and there are only 10 permanent waterholes in their entire territory.

Harsh climatic conditions have led to stunted and broken vegetation and as a result the area does not support large herds of migratory animals. The San's source of animal protein includes birds, reptiles and small mammals as well as a variety of

insect matter. Most of their nutrition however, comes from abundant high nutrition vegetation. At first glance it would appear that due to the abundance of vegetation in their environment these people would not experience resource scarcity, however they do face scarcity in other resources important to them. As previously mentioned water is a precariously available commodity particularly in times of drought. As well the !Kung place significant value on meat even though vegetable matter is readily available. It may be that either they value what they can not have or that meat contains nutrients that are not readily available from plant materials. Whatever the reason, meat is considered highly desirable and is diligently sought after. Tanaka (1980) comments that "considering meat to be 'true food' the San cannot tolerate long periods without it" (1980:119). If we look at the distribution of these needed resources (water and meat) we can see that they are widely scattered and their acquisition is highly unpredictable. Clearly, these are resource conditions that favor foraging and sharing as well as the emergence of hedonic social structures.

What then are the characteristics of !Kung social life? The !Kung do not live alone. They join in bands of multigenerational families linked by what Marshall (1976) refers to as "consanguineous or familial bonds" (1976:287). While they live in groups however, there is no permanency to membership within these groups. The composition is constantly shifting with membership varying over time from a small handful to a few dozen (Tanaka, 1980:116). Tanaka describes this as a fission/fusion pattern of cohesion. Fission (breaking apart) takes place in response to such events as food scarcity, illness and injury, or in response to threats of social discord.

Alternatively fusion (coming together) occurs when food is abundant, when consolidation is required to enhance cöoperative effort (to assist with hunting for large animals) or just to congregate enough people for celebration or religious ceremonies. According to Tanaka:

> The various camps, which are residential groups of the San, are themselves quite unstable and temporary, but precisely because of this fact the whole of San society has an extremely flexible internal structure and possesses an enduring overall stability. The phenomenon of continually shifting group alliances ... is a beautiful example of adaptation. (Tanaka, 1980:126).

Within these shifting groups there is no accumulation of personal possessions. Generosity, equality of treatment and humility are prized character traits accompanied by intense sociality resulting in high levels of cöoperation and sharing. According to Tanaka, "the most admired character trait among the San is generosity and the most despised and disliked are stinginess and selfishness" (1980:98). Marshall (1976) describes the !Kung as extremely dependent emotionally on the sense of belonging and companionship. Her observation is that they cluster together in small highly gregarious groups to gossip, laugh and talk incessantly. "The !Kung are the most loquacious people I know. Conversation in a !Kung encampment is a constant sound like the sound of a brook, and as low and lapping, except for shrieks of laughter" (1976:269).

The story that is told by all observers of this traditional society is very consistent. The highly flexible social structure based on egalitarian sharing and enjoyable social interaction sounds very much like the hedonic mode of social structure and is consistent with what would be predicted based on descriptions of the !Kung's patchy and unpredictable resource context.

Silberbauer (1981) studied a people who probably live in the most physically inhospitable conditions of any peoples in the world. He observed and reported on the life of the G/wi of the central Kalahari Desert. He begins his report with an extensive description of the G/wi's physical surroundings. On a yearly basis the G/wi face two significantly different climate conditions; the dry season, that is most intensive in September and October, and the wet season, which peaks in May. During the dry season, daily temperatures regularly exceed 40° Celsius. A strong dry wind blows across a rain-parched environment. Due to the lack of rain and extreme heat, G/wi households are limited to a small number of esculent plants for both food and water. Because it is so difficult to engage in strenuous activity the G/wi forage within a 3 to 4 km radius of their base camp. Hunting decreases significantly during the hot dry season. First, because most of the game has migrated out of the territory and second, because the return on hunting is not worth the energy expended. As conditions improve (i.e. precipitation increases and the variety of vegetation increases) their foraging range dramatically increases from 12 to 14 km and hunting activities commence. In the peak wet season, vegetation becomes abundant and they don't

have to forage as far to be successful. Their foraging territory shrinks and hunting becomes more opportunistic with hunters snaring small animals who happen by. "In general they select the prey that will give them the greatest reward for the least expenditure of time and energy" (Silberbauer, 1981:272).

In order to adapt to this extremely harsh and variable environment, G/wi bands break into small household-based groups during the dry season (fission) and reform into much larger communities (fusion) when conditions improve. Silberbauer suggests that the practice of dispersing the band and reforming it allows the G/wi to deal with the competition that would undoubtedly arise if the full band stayed together during the dry season.

Silberbauer goes on to address the social functioning of these groups. Again, the communities he describes display many of the characteristics of hedonic social structure. There is no specialization of function between households. Each can carry out a full range of gathering and hunting activities to sustain it during times of isolation. This reinforces the sense of equality when the households re-group during times that are more hospitable. Their theological beliefs stress equal access to resources thus there is no status differentiation between individuals or households. As the dry season approaches Silberbauer notes sadness at the thought of departure but great anticipation as the time of reunion nears. He also records that G/wi "like to sit close together and interpersonal contact is frequent and extensive" (1981:285). Decisions are made by a rapidly achieved consensus among all the band members

placing responsibility for community governance on each member. There are no leaders, chiefs or obviously dominant members. Finally, Silberbauer notes extensive sharing and exchange among individuals and households. Everything they possess from information to personal possessions is appropriate for exchange. "The capacity of the G/wi exchange system to equate a broad spectrum of goods and services for purposes of reciprocation ... facilitates the flow of commodities and favors" (1981:295).

Elizabeth Cashdan (1980) published an interesting report in Current Anthropology about another tribe of Kalahari hunter-gatherers called the //Gana. Over a two-year period (1976 – 1977) she collected data on a number of //Gana bands. She noted a significant difference between the social structures of these groups and those reported for other San communities. The economic and political inequalities she noted within and between the //Gana bands are very much in contrast to the fierce egalitarian social structures reported for other bushman tribes, the !Kung or the G/wi. What differentiates the //Gana from their other Kalahari neighbors is that they supplement their hunting and gathering subsistence with a small amount of food production. They cultivate water retaining Tsama melons and they herd goats and occasionally cattle. In addition, during the time of the year when they are growing and tending, they settle in one location, this allows them to store limited amounts of their food production. While the //Gana are hunters and gatherers they are also farmers and herders.

Cashdan attributes the less egalitarian social structure of the //Gana bands to different economic conditions. In harsh environments due to the unpredictability of food and water resources human groups need to develop a buffer to survive periods of extreme scarcity. The !Kung and G/wi have developed egalitarian social structures that enforce sharing. Wiessner (1977) concludes "because an individual shares what he has when someone is in need, without regard to balanced reciprocity, such a strategy protects the !Kung from an uncertain but devastating loss by substituting a certain but small loss" (Cashdan, 1980:117). Alternatively the //Gana developed the ability to produce excess in times of plenty so storage becomes their buffer against want. "Agriculture, storage and husbandry are important buffers that protect the //Gana to some extent from the temporal variability in the supply of water, bush foods and game" (Cashdan, 1980:118). These alternative approaches to resource buffering while different, but equally effective, have also resulted in the emergence of different forms of social structure. Those who share are egalitarian; those who store are not. Thus, the configuration of social structure is related to the nature of the resource distribution. When resources are dispersed and unpredictable social structures are egalitarian; when resources are concentrated and predictable (through efforts to store) they are not.

STUDIES THAT SYNTHESIZE RESEARCH ON MODERN TRADITIONAL SOCIETIES

One of the earliest anthropological projects that brought together research on a number of traditional societies was conducted in the 1930's by a group of prominent

scientists and edited by Margaret Mead (1937). Their work reflected a popular movement of the time that was attempting to integrate knowledge about human behaviour across two previously separate yet increasingly interconnected streams of knowledge. "Hypotheses (about human behaviour) must be firmly attached to both the biological underpinning and the cultural conditioning which shapes the individual at every turn" (1937:2). The call was for students of personality (individual functioning) and students of culture (social behaviour) to acknowledge the value of a more holistic approach to understanding why people acted the way they did. These social scientists were seeking what they hoped would be a more "genuine" social science.

> The culture and personality approach, then, demands that these separate disciplines cease to abstract certain aspects of human life and study them without reference to the whole individual ... there is a common meeting ground where the hypotheses of each discipline can be tested out and made relevant to a more genuine social science (Mead, 1937:2-3).

In response to this demand a group of anthropologists and psychologists accepted the task of integrating knowledge about culture and an important facet of personality they referred to as cöoperation. They wanted to make a connection between the features of a group's culture and the natural inclinations of its members. Is there a connection between cöoperation and culture that could provide a deeper

understanding of human behaviour? By the early 1930's, there existed a number of studies concerning a wide range of traditional communities in many parts of the world. Mead and her colleagues identified the most prominent researchers and their research. In some cases they conducted their analysis from existing studies in others, they asked the researchers to reorganize their notes in light of the problem under investigation. In all, they reviewed work on 13 traditional societies. Not all the studies were originally conducted with the research question in mind. Because of this, Mead and her colleagues are clear that what they were attempting was exploratory at best. However, their efforts resulted in an extensive and scholarly report — ground breaking for the time.

From the descriptions provided, she was able to group the cultures into one of three general patterns; cöoperative, competitive or individualistic. Of the 13 communities studied six were judged to be cöoperative (e.g. Iroquois; Maori), three competitive (e.g. Manus; Kwakiutl) and four individualistic (e.g. Bachiga; Eskimo). Individualistic cultures, by definition, do not face the extreme problems of group formation and cohesion since they have chosen a minimal reliance on group living. Thus, it is Mead's analysis of the cöoperative and competitive groups that is of interest to this dissertation. It is interesting that Mead identified two broad grouping of social relations; competitive (agonic) and cöoperative (hedonic). She found that individuals within the competitive groups seek dominance. Concepts of rank and wealth are interwoven through out these cultures and members are clearly stratified into "haves" and "have-nots". Prestige is aligned with status. Their competitive

outlook is also reflected in relations with other communities. Mead describes these as some of the most warlike and violent groups within the sample. "Warlike hostilities among these three peoples are more organized ... and take the form of active headhunting" (1937:469). Mead suggests that within competitive societies stratification stabilizes the position of the dominant groups and thereby limits competition (1937:470). Thus Mead, as others, views social structure as a solution to the problem of destructive competition.

Life in cöoperative groups is very different. In these societies status may or may not be important but status is not something that is competed for. Status is either ascribed by birth or unimportant to members of the group. In either case, striving for status does not enter personal decision-making or contribute to personal motivation. In cöoperative societies, the community shares a common goal. An individual's achievements are not directed at his or her personal benefit but instead are intended to make a significant contribution to the attainment of the group goal. Mead also notes that in many of the cöoperative societies "there was a high value placed upon cooperative ties between villages in terms of feasts and inter-village borrowing and that these served to diminish warfare" (1937:474). This lack of aggression and violence found in cöoperative groups was in sharp contrast to the warlike nature of the internally competitive groups.

While Mead found similar modes of social structure to those proposed in this dissertation, her search for an explanation took a decidedly different approach. This

probably occurred because in a tautological way she considered social structure to be the cause of the behaviours she observed. From Mead's perspective, a competitive social structure produces competitive behaviour and a cöoperative social structure produces cöoperative behaviour. She did look for relationships between social structure and a number of such variables including openness of the group, activities of the members (i.e. hunting, farming, fishing, gathering), and ego strength of the members but found no consistent connection. It is interesting to note however, that while investigating the connection between activities of members and social structure, she did conclude that while the technology of production is not related to the form of social structure, the distribution of goods is. "The mechanisms of distribution are therefore primary in determining the major emphasis as cooperative, competitive or individualistic" (1937:459). However, she notes this as almost an afterthought, and the theme is not developed any further in subsequent discussions or in her conclusions.

Testart (1982) was interested in hunter-gatherer societies and felt that previous studies had not appreciated what he considered to be a very important difference among them. While all these societies hunted for or gathered their food, in some the members consumed an item of food as soon as it was acquired and in others they did not. In these hunter-gatherer societies members consumed only a portion of what they acquired and practiced large-scale seasonal storage for the rest. More importantly he noted that not all hunter-gatherer societies are egalitarian and further

that in these societies there is a relationship between food storage and form of social structure.

> It seems that only nomadic hunting and gathering societies that do not practice intense storage are egalitarian, while important social inequalities similar to those exhibited in agricultural societies are present among sedentary, food-storing hunter-gatherer societies (Testart, 1982:525)

To investigate this further he went to the existing literature and identified 40 hunter-gatherer societies that had been extensively studied by anthropologists. These were communities that did not practice agriculture or animal husbandry. From descriptions in the literature he divided the groups into storing and non-storing communities and determined the social structure of each. He found that only 2 of the 30 non-storing communities (immediate consumption) were stratified and non-egalitarian whereas 8 of the 10 storing communities (delayed consumption) were. These findings are consistent with the prediction that storing resources (making them contestable) would lead to the emergence of an agonic social structure.

Woodburn (1982) was also interested in modern traditional societies that depended on hunting and gathering for their subsistence. Like Testart, he concluded that there were important differences between such societies based on whether consumption was immediate or delayed. After a series of studies (Woodburn, 1979;

1980), he concluded that important insight could be gained by classifying hunter-gatherer communities into two types; immediate return and delayed return. As in Testart's model, food is consumed as soon as it is obtained in immediate return societies. As well, the technology involved in capturing or gathering food is very simple and once obtained there is no storage or elaborate processing of food items. For his definition of delayed return societies, Woodburn added the practice of rudimentary forms of herding or agriculture to the more passive activity of storage. In herding and farming activities, there is a delay between the investment of labour to produce food and the yield on that labour.

Woodburn then reviewed the literature on the practices and resource conditions of a number of modern traditional hunting and gathering societies and identified six he considered as exclusively immediate return. While these six represented societies from disparate parts of the world; the Mbuti Pygmies of Zaire; the !Kung Bushmen of Botswana and Namibia; the Pandaram and Paliyan of south India; the Batek Negritos of Malaysia and the Hadza of Tanzania, they all exhibited social relationships that Woodburn considered to be "profoundly egalitarian" (1982:434). In contrast, he concluded about that "not one of them (delayed return societies) is egalitarian to the same extent as any one of the immediate return systems" (1982:434).

In describing these egalitarian societies, he noted other consistencies.

> ... the ability of individuals to attach themselves and detach themselves at will from groupings and relationships; to resist the imposition of authority by force, to use resources freely without reference to other people, to share as equals in game meat brought into camp, to obtain personal possessions without entering into dependent relationships. (Woodburn, 1982:445)

He concluded that these features of their social structure allowed the members of immediate return societies to disengage people from property. They used what they had when they got it. They did not accumulate, save or hoard their resources. Immediate return practices lead to the development of hedonic-like social structures. While Woodburn did not focus on delayed return societies to the same extent, he does allude to inequality, competition and hierarchy as features of delayed return societies; relationships more consistent with the agonic form.

Testart and Woodburn's work illustrates the crucial role that delay plays in the development of egalitarian social structures. From this stream of research, it is possible to make the connection between the delay feature of the resource context and the emergence of different forms of social structure.

STUDIES OF MODERN ORGANIZATIONS

On the face of it, modern human organizations seem very different from monkey troops or even early hunter/gatherer communities. Indeed, the evolution of human society and organizations has added much complexity to our existence. However, do these layers of complexity fundamentally alter our social predisposition, or just make them more difficult to observe and interpret? If social behaviours are moulded by evolution, then these behaviours should exist within modern organizations and existing ethnographic studies of organizations, while they may not have used this theoretical lens, should have observed and noted the anticipated patterns of behaviour. Accordingly, I have conducted a re-examination of two existing organizational studies for traces of the expected relationships.

The Management of Innovation by Burns and Stalker (1961) and Regional Advantage by Saxenian (1994) were reviewed to see if the correspondence between resource context and social structure suggested by non-human primate research might be present within modern human organizations these authors studied. The intent of this exercise was to re-interpret extant organizational research to determine if there was evidence of the same patterns and relationships identified by ethologists and socioecologists within human organizations. Although there were numerous studies to select among (other examples include Argyris, 1974; Homans, 1941; Lawrence & Lorsch, 1967; Whyte, 1955), these two were chosen because of their completeness and the amount rich description provided by the authors. In addition, these two studies approached the question from different but salient perspectives. Burns and

Stalker began with an investigation of the internal workings of organizations and found a connection to environmental variables. Saxenian started with the environment context of organizations and made the connection to their inner workings.

In Burns and Stalker's classic study of the Scottish electronics industry, the authors took an anthropological approach considering the organizations they studied to be:

> ...communities of people at work, that is, in much the same terms one would use in the study of conduct and relationships in a village, an urban neighborhood or a small primitive community. (Burns & Stalker, 1961:1)

The focus of their work was the nature of social interactions (social structures) within firms. Through extensive observation and interviewing, they uncovered many differences among the 15 firms they studied. Despite the amount of apparent variation, they were able to identify two distinct and emergent patterns of management practice: mechanistic and organic.

From a review of Burns and Stalker's original work there appears to be a notable similarity between the agonic and hedonic social structures of non-human primate groups and the mechanistic and organic systems of management practice they

uncovered in human organizations. Like agonic troops of monkeys, *mechanistic* human organizations are hierarchical in nature, with control, authority and communication rigidly dependent on position. Superiors are dominant in their position and expect subordinates to follow direction submissively. Attention is focused inwardly on the nature of the task with "greater importance and prestige attaching to internal (local) than to general (cosmopolitan) knowledge, experience and skill." (Burns & Stalker, 1961:120) Daily interaction and communication is based on position and normally occurs in a dyadic form between superior and subordinate.

In *organic* (hedonic) systems, employees are stratified, but their relationships are non-hierarchical. Authority flows from competence and prominence, often varying with the task at hand. "The lead in joint discussions is frequently taken by seniors, but it is an essential presumption of the organic system that the lead, i.e. 'authority', is taken by whoever shows himself most informed and capable" (1961:122). There is also greater contact with those outside the organization. In the Scottish electronics firms, scientists closely associated with researchers in universities, government agencies and on occasion, even with those in other electronics firms. Their daily communications occurred within a network of personal contacts both inside and outside their organization.

In the work of Burns and Stalker ample evidence exists connecting agonic with mechanistic and hedonic with organic systems, but the connection between

management system (social structure) and resource context was less evident. This is not surprising, as their work was not initially concerned with environmental conditions. They identified 'rate of change' as the salient dimension of environmental context only after they became involved in the research. Since they did not perceive the role of resource context, they did not describe it in much detail. However, they did make some observations supporting the resource context /social structure connection. For example, in research and development units, seen as organic systems by Burns and Stalker, the vital resource of scientific and technical information was widely scattered inside and outside the organization. Scientists and technicians could be described as foraging what they needed. Alternatively, the resources needed by mechanistic manufacturing departments, primarily capital and labor, were centrally controlled and accessible only through direct competition with other organizational needs in the capital allocation process.

There may also be an argument that the rate of change in the environment (the independent variable in Burns & Stalker's model) can be connected to the predictability of the organization's resource context. Stable environments tend to generate stable income flows making resource flows and availability highly predictable. High change environments on the other hand, decrease the predictability of income (and information) flows. Stable and highly predictable resource contexts support mechanistic (agonic) systems whereas variable low predictable resource contexts supported organic (hedonic) systems.

While Burns and Stalker started their investigation inside industrial firms eventually identifying the importance of external factors, Saxenian's work progressed from the outside-in; from the environmental context of firms to their internal workings. Her study focused on the impact of what she called an industrial system on the structure and performance of individual companies. Her research identified two forms of industrial system: the network-based and the individual-firm. It compared two regional clusters of computer companies, one representing the network-based system located in Silicon Valley in California and the other exemplifying the individual-firm system located along Route 128 near Boston Massachusetts.

The characteristics of the resource context she described for Silicon Valley are similar to those that support the emergence of hedonic social structures. In this California region, the primary resources of funding and information were scattered, unpredictable and usually acquired by a form of foraging. Most firms received their start-up capital from a variety of sources with venture capitalists playing a significant role. It was not unusual for two or more venture capitalists to have invested in a Silicon Valley start-up and for founders, employees and other interested individuals to have contributed the equity needed to launch and sustain these enterprises. Deal making and risk taking characterized the financial environment of the region resulting in an unpredictable and fluctuating resource context. Information was equally widely distributed and shared throughout the region. Networks of individuals acquired and willingly shared the latest in technological and market information. Saxenian notes

that practices of collaboration and sharing of information were ubiquitous throughout the region.

Massachusetts Route 128 companies on the other hand, functioned in a resource context consistent with agonic interrelationships. For many years the industry in this region and its R&D efforts were supported by large defense contracts. This concentrated the source of financial resources to a single government agency and created a certain amount of predictability in the volume and flow of these resources to the firms involved. Within these large vertically integrated companies, access to resources was firmly held in the hands of a small group of senior executives. Internal competition between competing divisions was the accepted method of acquisition. Information was seen as proprietary, often trapped within the boundaries of the firm. There was little, if any, contact and therefore information flow, between employees of Route 128 companies and those outside the firm. Clearly, the employees of these firms were inwardly focused (like the agonic baboon troops).

The nature of the internal structure of the firms in these two locations followed the expected patterns based on the nature of their resource fields. Silicon Valley firms like HP and Sun Microsystems appeared to be hedonic with loosely linked confederations of variable membership engineering teams. Route 128 firms, like DEC and Apollo displayed agonic features with the traditional centralized hierarchical form and highly loyal but inwardly focused employees.

Silicon Valley firms were open and highly interactive. "There are people gathered together ... to discuss every area of common scientific interest in the Valley. Around every technological subject, or every engineering concern, you have meeting groups that tend to foster new ideas and innovate. People rub shoulders and share ideas." (1994:34) Route 128 firms, on the other hand, prided themselves in their independence and self-sufficiency. "Practices of secrecy and corporate loyalty govern relations between firms and their customers, suppliers, and competitors reinforcing a regional culture that encourages stability and self-reliance" (Saxenian, 1994:3).

Leadership style was also noticeably different between the two communities. Silicon Valley company founders shared decision-making and conferred leadership and autonomy on those most able of leading. On the other hand, senior executives dominated route 128 firms. "A small group at the corporate level made all the decisions that mattered". (Saxenian, 1994:76)

Additionally, the frequent job changing of engineers in Silicon Valley resembled the fission /fusion pattern of chimpanzee troops. Saxenian's description of trade shows, industry associations and even informal social gatherings are reminiscent of chimpanzee carnivals. Alternatively, those who worked for Route 128 firms were expected to stay with the same company for their entire career. They were 'in it for the long run' (1994:62). If they did leave, it was perceived as disloyal.

When someone left a Route 128 company, all ties to the former company and colleagues were severed. There was fission without fusion.

The observations from Burns and Stalker and Saxenian are consistent with the predicted relationship between resource context and emergent social structure derived from socio-ecological research. The emergence of a specific pattern of social structure is strongly influenced by a group's resource context. Hierarchical, inwardly focused structures with dominant leadership will emerge when centralized, predictable and visible resources are acquired through direct competition. Egalitarian, outward looking structures with situational leadership emerge when scattered, unpredictable and less visible resources are acquired through actions of individuals or small foraging teams.

SUMMARY

In this chapter, I have shown that the theory advanced in this dissertation, while developed from observations of non-human primates is evident in human populations as well. What we know and can surmise about ancient human societies suggests that, for the most part, they lived in harsh sparsely resourced environments and primarily foraged for their food and water. Their social structures encouraged communal living and sharing to offset the uncertainty of their life and reduce the ever-present risk of starvation. Evidence also suggests that when they developed the

necessary technology to support agriculture and herding, sharing and equality changed to aggressive competition and hierarchy.

From a review of modern traditional societies, we learned that hunters and gatherers who forage for their resources adopt hedonic like social structures. They stress equality, sharing and close interdependent relationships in communities that break apart and come together on a regular basis. However, evidence also suggests that it is not the activity of hunting and gathering per se, that leads to such egalitarian social structures. Those foragers who store part of what they acquire or supplement their gathering and hunting with herding and farming, begin to assume more agonic like social structures. As resources are concentrated and open to contestation inequality, status and competition begin to emerge and fission/fusion is replaced by more a sedentary pattern.

In the reinterpretation of modern management research we see mechanistic and organic social structures emerge that are very similar to agonic and hedonic patterns of social interaction. An investigation of resource context in the work of Burns and Stalker as well as the work of Saxenian reveals a connection between structure and resource distribution in the expected direction. Thus, the patterns predicted by the theory are clearly evidenced in these examples of contemporary management research. When resources are concentrated and people have to compete for them, hierarchical social structures emerge that, by the assignment of status, constrain potential disputes and engender apparent cöoperation. When resources are

dispersed and unpredictable social structures emerge that allow groups to survive through a sanctioned pattern of foraging and cöoperative sharing of the spoils. In both social structures interpersonal behaviour is highly cöoperative thereby sustaining group cohesion but the way in which cöoperation is achieved is very different and dependent on characteristics of the group's resource context.

I have now proposed a model of the patterns of social structure, proposed a theory as to what triggers its different forms and developed an evolutionary explanation as to why such a contingent relationship might exist. I have reviewed existing literature in the areas of archaeology, anthropology and management literature to build support for the model in situations involving human interaction. In the following chapter, I will move to the next logical activity — support theory development by empirically testing it. The research hypotheses and research design are outlined in the Chapter 5.

CHAPTER 5

METHODOLOGY

"Good theory is testable. Its results can be translated into hypotheses subject to falsification by appropriate experiments and field studies."
E.O. Wilson[6]

The theory developed in this dissertation states that the nature of a group's social structure is influenced by how its members perceive the resource context within which the group is functioning. The resource context dictates the manner of resource acquisition and the manner of resource acquisition establishes problems for the formation and ongoing cohesion of groups. Social structures emerge that provide workable solutions (or adaptations) to these problems. When individuals feel their resource context is configured in such a way that they must compete with other group members for needed resources, then an agonic or hierarchical social structure will emerge. Alternatively, if members perceive that the resources they need are configured so that the best way to acquire them is by fanning out to search independently or in small sub-groups, then their social structure will be hedonic in nature, i.e. much more egalitarian.

The theory also suggests the characteristics of a resource context that would lead to the development of an agonic social structure. In such a context, resources are

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[6] Sociobiology, 1975: 22

clustered, predictable, and visible and their consumption is potentially delayed. For the purposes of empirical investigation of this theory, this form of resource context will be referred to as the *contest* context. The configuration that leads to a hedonic social structure has essential resources that are scattered, unpredictable and their acquisition is often not visible to others. Their consumption is immediate; that is, there need be no delay between acquisition and consumption. This pattern will be referred to as the *forage* context. Configured in this way the theory suggests the following propositions:

P1: Individuals who perceive a contest context will form groups that exhibit agonic social structures.

P2: Individuals who perceive a forage context will form groups that exhibit hedonic social structures.

RESEARCH STRATEGY AND SETTING

Both a research strategy and its research setting should be determined by the nature of the research problem (Creswell, 1994). In this dissertation, a theory has been deductively developed that proposes a cause-effect relationship — the nature of a group's resource context influences the form of its social structure. The intent of the empirical investigation is to determine if the proposed relationship exists. In such cases a reasonable choice of methodology is to conduct an experiment in which the

researcher manipulates hypothesized causes (independent variables) to determine the effect of the manipulation of the phenomenon of interest (dependent variable). An experiment is particularly well suited for this task because the hypothesized relationship is investigated under controlled conditions. This allows a researcher to eliminate as many alternative causes as possible and to focus primarily on the theoretically derived causes. " If done properly, the researcher may be able to conclude that varying the levels of the independent variable caused the observed differences in the dependent variable, since nothing in the situation was systematically different across groups except for the independent variable" (Fisher, 1984:169). Thus, the nature of this particular research problem dictates the necessity of employing an experimental investigation.

Experiments can take place in field settings or in laboratory settings. For this dissertation, a laboratory setting was selected over a field site. While it is decidedly easier to make arguments to support the generalizability of experimental findings that are derived from real world conditions, field settings are notoriously difficult to arrange, particularly for theory testing problems. Many companies are reluctant to get involved in activities that do not contribute to the bottom line and that have the potential to cost them time or money. The possibility of a field setting for this research was explored with a number of companies over an extended period of time and no company was willing to participate. On the other hand a laboratory setting is much easier to arrange since most of the arrangements are under the direct control of the researcher.

While the practicalities of finding a suitable research site for this dissertation favored a laboratory setting, there were also compelling theoretical reasons why this approach was eventually selected. Conducting research within actively functioning real world organizations sometimes requires a significant amount of leniency with regard to control variables. The real world is a messy and often confusing place and experiments require precision and predictability. Because of the level of control required to support causality, a high level of internal validity was considered essential and the most reasonable setting for internally valid research is the laboratory (Fromkin & Steufert, 1976).

It is true that laboratory research is strongly criticized for its lack of external validity (Campbell & Stanley, 1963), but there are others who defend this approach particularly for the initial investigation of a supposed causal relationship (Berkowitz & Donnerstein, 1982; Dipboye & Flanagan, 1979; Fisher, 1984). When the purpose of the research is to test hypothesized causal relationships between universal constructs, the experimental control available in a laboratory setting is essential. The testing of causal relationships demands high levels of internal validity. If the intended effects cannot be demonstrated under controlled laboratory conditions, it is futile to worry about generalizability (Fromkin & Steufert, 1976).

As well, Mook (1983) suggests that the laboratory setting may be the most appropriate setting if the intent of the research is to demonstrate the power of the

phenomenon. Since others have not tested this theory, there is definitely a need to test its power.

For these reasons, the research conducted for this dissertation employs an experimental design within a laboratory setting.

OVERVIEW OF PURPOSE AND DESIGN

The purpose of the experiment designed for this dissertation was to determine the effect of different of forms of resource context on the emergence of social structure. To investigate if a contingent relationship exists between resource context and social structure, subjects were randomly assigned to groups. During the course of the experiment, each group was required to complete a task in the form of a game. Every group had the same task to complete and members of the group were provided with the same incentive structure to play. Half of the players played the game in a contest context and the other half played in a forage context. Measurements of each group's social structure were taken after the game had finished to see if the inter-relationships that emerged resembled those of the hypothesized pattern; that is, did the contest context evoke an agonic social structure and did the forage context evoke the hedonic form?

PILOT STUDY

Before beginning the research trials a preliminary form of the game was designed and a pilot study conducted to refine the design, develop appropriate post game measures and to establish appropriate recruitment and logistics arrangements. The pilot study took place over a three month time period. During that time 60 players played the game, 39 in 7 contest context games and 21 in 4 forage context games (see Exhibit 1 for the pilot phase game schedule). There were more contest games played because the contest game was used to refine the details of the generic game (i.e. those rules that were common to both games). Seven of the eight possible configurations of the game were played during the pilot phase (2 forms of the game x 2 sexes x 2 group sizes). The methodology described below presents the revised research design and notes those components that were significantly affected by the experience of the pilot study.

LABORATORY EXPERIMENT

Participants

Participants were male and female university students registered in Business 20 or Business 257 who received payment to play the game. Business 20 is a first year introductory course in business and Business 257 is a second year overview business course. There were 185 students who volunteered and 114 eventually played the game. I chose to use younger students at earlier stages of their studies to reduce the possibility that subjects would call upon previous experience in

organizations to devise appropriate social structures. Since the theory being tested applies to humankind one can make the argument that using university students is defensible and results will be generalizable (Fisher, 1984:180).

Procedure

Participants played the game in same gender groups of five or six players. Evolutionary psychology speaks to a number of significant differences between the type of psychological mechanisms that develop in males and those that develop in females (Archer, 1996; Buss, 1995; Eagly, 1997). As well, I was concerned that given the age of participants and the short amount of time available for the game, mixed-sex groups might introduce the potential for dyadic mating directed behaviours. There was concern that such behaviour would interfere with the development of group social structures (see Buss, 1999 for a thorough review of the evolutionary foundations of mating behaviour). As the intent of the research was to observe the effects of resource context on social structure and not the effects of gender or mating behaviour, groups were either all males or all females.

Games were played in groups of five or six players. Group size was not constant because of attendance problems experienced during the pilot phase. During the pilot studies a number of games had to be canceled because not all six participants showed up to play the game although they indicated they would. Reinforcing the importance of attendance, calling the night before to remind players of the game and even inviting more and expecting a certain number of no-shows did not ensure a full

6-person group. For the research trials, whenever possible, Isigned up seven potential players and then played the game if either five or six players attended.

In terms of group size, a group of five or six subjects is large enough so that functioning together requires the formation of some form of social structure. As well, work groups of five or six members are not uncommon in real world organizational settings that would increase the generalizability of the findings. Additionally larger groups would have increased the cost and complexity of the experiment.

Groups were randomly generated and a check was made to ensure that participants were not well known to each other before playing the game. This reduced the likelihood that previously established social connections would influence the relationships that develop during the experiment. In the pilot phase, potential participants were also asked to rate themselves on puzzle building experience. The intent was to eliminate those who had a significant amount of experience and whose participation might artificially influence the development of the group's social structure (i.e. they would direct it from a position of expert power). This reduced the likelihood that a group member would be given superior status based on his or her puzzle building ability. However, during the pilot stage it was determined that none of the potential participants rated themselves as having significant 3D puzzle building experience and in fact very few participants rated themselves as having had any at all. Asking for this information slowed the recruitment process - the more information you request from potential participants, the less likely they are to fill in the participant

contact form. Thus, puzzle building experience was not taken into consideration in constructing groups for the research trials.

Task

Each player was required to build a 220-piece 3D jigsaw puzzle of a Victorian House (see Exhibit 2). Prior to the game I had divided the puzzle into four stand alone sections or modules which meant that any module could be built independent of the other three. The individual puzzle pieces for each module were separated and placed in a zip-lock plastic bag. A card showing the module number was taped to the inside of the bag in such a way that it was clearly visible from the outside. To complete the task a player needed to acquire a set of bags numbered from 1 to 4, construct each module and combine the modules into the finished product. Players were given a picture of the finished puzzle and various construction aids (provided by the puzzle manufacturing company) to assist them with their task.

A 3D jigsaw puzzle was selected for the task because completing a jigsaw puzzle is a well-defined activity and the resources needed to complete the task (i.e. the puzzle pieces) are standardized. Also constructing a jigsaw puzzle, particularly a 3-D jigsaw puzzle, is a task of reasonable interest. In the pilot study subjects who played with the Victorian House were asked to rate their interest in the task. On a scale where 1 was "Interesting" and 5 was "Boring", their mean score was 1.9.

Breaking the puzzle down into modules (resources became bags not pieces) made the task easier and allowed many of the subjects to complete it in the allotted time. In the pilot study I started with a 357-piece puzzle of a Japanese Pagoda. The size and complexity of the puzzle caused much frustration among players and none was able to complete it in the time available. The 220-piece puzzle was substituted and completion rates increased significantly without an associated reduction in level of interest in the task.

After a period of refinement in the game rules during the pilot phase, the pagoda puzzle was tried again (November 25th game) but the results were similar. The size and complexity of the puzzle was too great for players to finish or to enjoy the game. Thus, a decision was made to use the Victorian House for the research trials. To avoid significant puzzle degradation the original set of House puzzles was replaced at game eleven of the research trials.

Rules of the Game

Participants played the game in groups of five or six players. There was one complete puzzle for each player in the group and all had the same task — to finish building their puzzle in the allotted time. The duration of each game was approximately 2 hours and 15 minutes. The exact amount of time varied depending on the amount of time required for set up. Players were told at the beginning of the game that building a 3D puzzle is a challenging task and in the researcher's experience only 1/2 to 2/3 of the players had actually completed the task. This

information was shared to ensure that players were sufficiently motivated to acquire puzzle pieces as early as possible to maximize the amount of time they had for puzzle building.

The resources that a player needed to complete his or her task were the puzzle bags. In a 5-player game, there was a total 20 puzzle bags (5 puzzles x 4 bags per puzzle). The full set of bags was referred to as the "resource bank". In the 5-person game the resource bank consisted of five bags labeled 1; five labeled 2; five labeled 3 and five labeled 4. For a 6-player game the bank contained 24 puzzle bags: six bags labeled 1; six labeled 2; six labeled 3 and six labeled 4. Since all the puzzles were the same (i.e. a Victorian House), all puzzle bags within the bank that carried the same number were interchangeable. This meant that any puzzle Bag 1 could be built and then added to the module built from any puzzle Bag 2, to the module built from any Bag 3 or to the module built from any Bag 4. All bags with the same number contained exactly the same pieces.

At the start of each game the total resource bank was in my office and I used the bags to construct a resource context (independent variable) that resembled one of the two contexts under investigation either a contest context or a forage context. This meant that there were two forms of the game and the rules of each game reflected the different ways in which players acquired the resources they needed to complete their task.

MANIPULATION OF THE INDEPENDENT VARIALBLE - CONTEST CONDITION

In the Puzzle Construction Game (creating a contest context) every 20 minutes I brought bags to the game room in predetermined quantities called shipments. The players were provided with a schedule of shipments in the game rules. The shipment was placed in the middle of the game table and then I left the room. It was up to the players to determine the distribution of the bags among themselves.

The first shipment contained the same number of bags as players in the group and each bag in the shipment was the same module number. Providing one bag per player of the same module meant that there was no apparent advantage of one player claiming more than one bag thus increasing the probability that each player would obtain a bag from the first shipment. In addition, the module selected for the first shipment was the easiest one to construct. The first shipment was designed to increase the likelihood that all the players would begin the game building a relatively easy module and thereby become more fully engaged in the game. The second and third shipments contained the hardest module to construct. At this point players' interest and energy was at its highest and increasing the likelihood that players would continue with the game. The pilot study confirmed that once players started the game and invested time and energy into it, they were more likely to stay to the end. After the first shipment, there were never enough bags to allot one bag to each player (see

Exhibit 3 for shipment schedules) and groups were required to address the distribution problem.

When the puzzle bags were brought into the room according to a predetermined schedule and placed in a "clump" on the table, resources were concentrated, predictable and their acquisition visible to all the players. To introduce delayed consumption, players in this form of the game had what was called a "delay option". Players could choose to forgo construction of a bag they obtained from one shipment for the assurance of receiving a bag from the next shipment. They kept possession of the first bag but if they chose not to build it immediately and wait until the next shipment, they would be assured of having two bags. This option was provided to players for the first two shipments of the game. Extending it beyond this was not feasible given the total number of bags available.

MANIPULATION OF THE INDEPENDENT VARIALBLE - FORAGE CONDITION

In the Puzzle Fabrication Game (creating a forage context) puzzle bags were randomly distributed within a territory outside the game room and players were directed to leave the room and scavenge for these bags. They were told that bags would be distributed at various sites throughout the territory and at varying time intervals. However, they were told that all the bags would be distributed by a specific time. The time indicated allowed them 30 minutes construction time if they located a bag at the stated time limit. This was done to assure players that the task was doable.

Again this was considered necessary due to the experience of the pilot study. As in the construction game, players were advised of the difficulty of the task and given the same estimated probability they could complete it.

To ensure that the players returned to the game room after locating resources an artificial predation scenario was established. Players were told that there was a strong possibility that partially constructed puzzles left outside the game room would be confiscated by game helpers. Game helpers (other doctoral students) were used to distribute the bags so that players did not camp outside my office waiting to observe a puzzle bag distribution, another adjustment from the experience of the pilot study.

The territory was large enough so that bags could be found by individual players without others seeing their acquisition but not so large that players needed to spend a significant amount of their time foraging. Players in the forage game were not given the delay option so there was no reason for them not to begin building once they had obtained a bag. Table 6 provides a comparison of the features of the two resource contexts and the features of the game that create the corresponding resource context.

TABLE 6

MANIPULATION OF THE INDEPENDENT VARIABLE

	Contest	Forage
Distribution	*concentrated*	*Scattered*
	All resources are delivered to players in the game room	Puzzle bags are distributed within a territory outside the game room.
Predictability	*predictable*	*Unpredictable*
	Subjects are told in advance the size and frequency of resource shipments.	Resources are made available at varying time intervals
Visibility	*visible*	*Invisible*
	Resources are delivered to the game room thus all players see the shipment at the same time and are aware of who gets what.	Resources are scattered across the territory enabling a player to acquire resources without necessarily being observed by other members of the group.
Timing	*delayed*	*Immediate*
	Subjects are allowed to delay construction for some future benefit (an additional bag)	Subjects can start to build immediately upon acquiring a resource.

While those who played the fabrication game were told that the bags would be distributed unpredictably in time, I used the exactly the same timing schedule for both forms of the game. In addition, the type of bag (module #) distributed in each contest

shipment or each forage distribution was exactly the same (see Exhibit 3 for shipment schedules). As with the contest game, this approach improved the likelihood that players would obtain an easily constructed module at the start of the game and "hook" them into playing.

Incentive

In the real world of monkey's and apes, acquiring resources (usually food and water) is rewarding in itself. There is intrinsic value embedded in the resource. In trying to pattern the experiment after the real world, I was concerned that acquiring puzzle bags in order to win the game would not be sufficiently rewarding. As a result, I built in an incentive by providing a bonus payment to the first two players to complete their puzzles. I also paid people to play the game to increase the number of potential participants.

Everyone who played the game received a payment of $15. Those who finished their puzzle in the allotted time received an additional payment of $5 for a total of $20. The first two players in the group to finish their puzzle received an additional $25 for a total of $45. Players were given the option of withdrawing from the game. If they did they were told they would receive $5. Only one player chose to withdraw before the end of the game. These compensation levels were established based on the funding level of the project and the experience of the pilot study. Establishing an amount for puzzle completion increased players' willingness to stay to the end and the bonus money appeared to provide sufficient competitive incentive.

Participation money (the $15) and completion money ($5) were paid in cash after the post-game questionnaire was submitted. Bonus payments ($25 for finishing first or second) were mailed to the winners. This was done to reduce the likelihood that players would get together at the beginning of the game and make a deal to split the total compensation in some way. The players were all strangers at the beginning of the game and splitting the bonus money, if it were mailed after the fact, would require more effort in follow-up and a higher level of trust.

POST GAME QUESTIONNAIRE

Measurement of the Dependent Variable

The theory developed in this dissertation was based in part on ethological observations of non-human primates. It is obvious that the exact behaviours manifest within groups of chimpanzees and baboons would not be the same as those found in human groups. What is likely to be similar, and therefore salient, are the underlying patterns of social structure. From a review of Table 4, there appear to be four characteristics or dimensions that differentiate the two patterns: cohesion (physical proximity), leadership, relationships and feelings.

Cohesion

In agonic social structures, physical proximity is close. Members of agonic groups travel together in stable troop formations. In hedonic groups physical

proximity varies because of the fission/fusion pattern of foraging. Members of hedonic groups spend much of their time foraging apart from the group. Cohesion (the maintenance of physical proximity) was not considered for the purposes of post-test measurement because the game rules established the conditions of cohesion. Thus in the post-test questionnaire I tried to capture how the players perceived the leadership and interrelationships that developed during the game as well as the feelings of the players about the game experience.

Relationships

Relationships in agonic groups are competitive and adversarial whereas relationships in hedonic groups are supportive and non-competitive. However, it is difficult to measure these as there are no existing scales of agonic and hedonic social structures in human groups. While I was unable to find an applicable measure of relationships in these social structures, I did review various measures of culture. While social structure and culture are not the same thing, cultures are reflective of social structures. Researchers, management consultants and those involved in organizational development use one of these measures, the Organizational Culture Inventory (OCI), to measure organizational culture. The inventory has been in development for over ten years and has been used in a number of research and development activities. In 1993 an article published in Psychological Reports did a comprehensive evaluation of the OCI's reliability and validity and concluded that the scales were reliable and the instrument was a valid quantitative method of assess organizational culture (Cooke & Szumal, 1993). While the inventory was designed to

measure culture and not social structure, four of the scales measure the type of interrelationships that are commonly found in agonic and hedonic social structures. These are the Affiliative, Humanistic-Encouraging, Power and Competitive scales and the developers (Cooke & Lafferty, 1983) describe them as follows:

An **Affiliative** culture characterizes organizations that place a high priority on constructive interpersonal relationships. Members are expected to be friendly, open, and sensitive to their work group. Members are loyal to their work groups and feel they "fit in" comfortably.

A **Humanistic-Encouraging** culture characterizes organizations that are managed in a participative and person-centered way. Members are expected to be supportive, constructive and open to influences in their dealing with one another.

A **Power** culture is descriptive of non-participative organizations structured on the basis of authority inherent in members' positions. Members believe they will be rewarded for taking charge and controlling subordinates (and being responsive to the demands of superiors).

A **Competitive** culture is one in which winning is valued and members are rewarded for out-performing one another. People in such organizations operate in a "win-lose" framework and believe they must work against (rather than with) their peers to be noticed.

Because of the types of interrelationships found in hedonic groups, members of these groups would rate high on the Affiliative and Humanistic-Encouraging scales. Alternatively members of agonic groups would score high on the Power and Competitive scales. These scales, consisting of 40 items (see Exhibit 4) were initially used in the pilot study. However, the scale items were designed to measure relationships in workplace settings and many were not directly applicable to the game situation. This caused confusion to players trying to relate the items to the game experience. As well, subjects found the scales lengthy to complete and repetitive.

Thus I developed items in the style of the OCI inventory and created two new scales to measure relationships: one to measure relationships in agonic social structure and one to measure those in hedonic (see Exhibit 5). I developed these dependent measures in the manner of the OCI items and from my knowledge of the two modes of social structure. Thus, the dependent measures of group relationships are exploratory in nature.

Using these scales to operationalize the construct of relationships in social structures, I developed the following hypotheses:

H1: Players in the contest context will score higher on the agonic scale than players in the forage resource context.

H2: Players in the forage context will score higher on the hedonic scale than players in the contest resource context.

Leadership and Feelings

Within agonic groups, there is a clear hierarchy of power and control in which members assume either dominant or submissive roles. Since relationships in agonic groups are competitive and adversarial, individual arousal is high producing feelings of fear and anxiety. In hedonic groups, leadership is much more fluid shifting from one member to another depending on the particular needs of the group. There is not a fixed hierarchy of power and control but a more egalitarian sense of shared activity.

Again, there are no existing measures of the style of leadership or the feelings prevalent in agonic or hedonic groups. In the same way that I developed scales for relationships, I developed single item questions to determine the nature of leadership and decision making in the groups and the feelings of the players about the game experience. As with the scales for relationships in social structures, these measures are exploratory in nature.

Using these items to operationalize the constructs of leadership and feelings in social structures, I developed the following hypotheses: (see Exhibit 6 for a table that indicates which items relate to leadership and which relate to feelings).

H3: **Players in the forage resource context will score higher on "I would work with this group again".**

H4: **Players in the forage resource context will score higher on "We made decisions as a group"**

H5: **Players in the contest resource context would score higher on "I felt uncomfortable playing the game".**

H6: **Players in the contest resource context will score higher on "I worked on my own".**

H7: **Players in the contest resource context will score higher on "Decisions were made by a few individuals in the group".**

H8: **Players in the forage resource context will score higher on "My friends should play the game".**

H9: **Players in the contest resource context will score higher on "People argued over what to do".**

H10: **Players in the contest resource contest will score higher on "One or two individuals assumed a leadership role".**

H11: Players in the forage resource context will score higher on "I felt at ease playing the game".

H12: Players in the forage resource context will score higher on "I worked with everyone in the group".

H13: Players in the forage resource context will score higher on "I had fun".

H14: Players in the contest resource context will score higher on "This was an unpleasant experience".

Items were refined during the pilot phase based on player questions and stated concerns about the items. I was in the game room while the players completed the questionnaire and I recorded player questions or statements about the questions and if necessary adjusted the wording prior to the next pilot test. Thus the questionnaire was refined over the 11 pilot tests.

The post-game questionnaire contained a series of questions about the game and the playing conditions. Players were also asked to answer an open-ended question eliciting suggestions as to how to improve the game (see Appendix C-1). During the pilot phase the answers to these questions helped with the refinement of the game. These questions were retained during the research trials to maintain the

guise that players were participating in the testing and development of a behavioural simulation game.

Manipulation Check

To determine if the subjects perceive the context in the way the experimenter intended, a manipulation check was added to the post-game questionnaire (see Appendix C-1).

THE PROCESS

Recruitment of Subjects

Subjects for both the pilot test and the research trials were recruited from Business 20 and Business 257 sections at The University of Western Ontario, Huron College, Brescia College and King's College. I visited each section of the two courses near the end of a regularly scheduled class and was introduced by the classroom teacher as a researcher from Ivey who had an interesting proposition for them. I then introduced myself and told the students that I was a researcher working with one of the faculty at the Richard Ivey School of Business on the development of behavioural simulation game. I explained that behaviour simulations were used in business programs as an alternative to traditional lectures and that we hoped to market this particular simulation to business schools across North America. The simulation involved playing a game and I needed students who could play and thus help with its development. They were not told that I was conducting a research

experiment or that I was a doctoral student. Previous research has shown that behaviour of subjects who believe they are participating in a research experiment is affected by that knowledge (Fromkin & Streufert, 1976). Some perceive an experiment as a test and experience stressful anxiety or alternatively during the experiment they assume a role such as "good subject" or "trouble maker". Potential subjects were advised that the purpose of their participation was to assist in the development and validation of an educational behavioural simulation game. This deception was employed to increase the likelihood that subjects would (1) put more effort in their participation believing that the task is more important than "just some research project" and (2) would not see themselves as subjects in an experiment thereby reducing the possibility that assuming the role of subject would confound their responses to the independent variable. This cover story was consistently supported throughout the research and some accommodation was made in the post game questionnaires to sustain this guise.

Upon announcing the project I placed an overhead on the projector and read it to the class (see Appendix A-1). The overhead outlined the essential details of participation - where, when, how long, and how much compensation as well as assuring the students that participation was voluntary and would not influence their grade in the course. I then distributed "Participant Information Forms" (see Appendix A-2) to students and asked that if they were interested to fill them in and hand them back to me as they left the classroom. The form asked interested students to provide their name; e-mail address; local phone number and indicate their gender.

Recruitment was done at two times; once in the fall to generate participants for the pilot studies and research trials and again in early January to generate more potential participants for the research trails (see Exhibit 7 for recruitment schedule). The fall recruitment focused on Business 20 students and the winter on Business 257 students.

Formation of Groups

Completed Participant Information Forms were filed alphabetically, by first name, in a binder and used to store contact information on potential players. The week before a game was scheduled the I would begin to contact potential players and sign up participants until the group was full (recall a full group was 7 players). As each person indicated he or she could attend, I asked if they knew any of the previously confirmed players. Since many of these students attended class together, other players were "known" but they were not excluded unless they indicated they were friends or roommates. On average Bus 20 and 257 classes contain around 90 students so being in class together did not necessarily constitute having a significant friendship. I recorded the name of each person who agreed to attend and their contact information on a Session Preparation Sheet (see Appendix A-3).

Sample Size and Game Schedule

A power analysis was conducted to determine an appropriate sample size for this experiment. Unfortunately, given the absence of previous research on this theory

there was very little indication as to an expected effect size. Cohen (1969) defines an effect size of .2 as small and .5 as medium. The I chose an effect size of .3 as reasonable. This level requires that the theory explain at least 30 percent of the variance in the outcomes of the two groups. To have 95% power for a 5% one-tailed test with a critical effect size of .3 requires 112 subjects. Thus a target of 120 subjects was set which would require 10 games of each form to be played if all games were played by 6-member teams.

Games were scheduled for Monday, Tuesday, Wednesday and Thursday evenings between 5 p.m. and 8 p.m., as well as Saturday and Sunday afternoons from 2 p.m. to 5 p.m. Given that the design required playing at least 20 games and scheduled games were sometimes canceled, scheduling games six days a week was necessary to complete the experiment in a reasonable time frame. The results of the pilot test indicated that 3 hours was a reasonable time commitment to ask of subjects given the compensation provided and it was sufficient time to set up the game, complete the task and answer the post game questionnaire. Starting the games at 5 p.m. allowed students to have an early supper, play the game and still have sufficient time to study or engage in other evening activities thereby increasing their willingness to attend. In all there were 21 games played between January 18 and March 11 — 10 contest games and 11 forage games (see Exhibit 8 for game schedule).

Pre-game Preparations

To improve the likelihood that all players would show up to play the game, each player was contacted by phone or by e-mail (if appropriate) the day before the scheduled game and reminded of the event. If they indicated that they could not attend, attempts were made to recruit an alternate player. Players were asked to meet the me at a public location inside the business school at the designated time. A location was selected that was near the most frequently used Bus 20/257 classroom. I checked to make sure that the player knew of the exact location. The player was also given a contact number to use if for some reason subsequent events occurred and they could not make the session.

On the day of the game, I would reference the applicable Session Preparation Sheet (see Appendix A-3) and use the checklist to make sure that all materials were available and that the room was set up properly. This helped to ensure consistent practices across all the games played. Ten minutes before the start time I went to the meeting location in the business school and waited for the players to arrive. The meeting location was under a large clock. When a player arrived, his/her name would be checked off the list. I introduced myself as the game director and was consistently referred to as such in all game related materials.

If six players had not arrived by the start time, I waited for up to an additional 10 minutes. If five or six players arrived the game would be held. If four or fewer players arrived, the game was canceled. An apology was made to players who did

attend and attempts were made to reschedule them for a later game. If seven players arrived, one was given the attendance incentive (S15) and excused. This only happened once and the player was booked for a future game and participated at that time.

From the meeting site, I led playing groups to the game room. On the way, they were shown the location of the closest washrooms and exit door.

Research Location and Room Set Up

The game room was located in the lower level of the National Centre for Management Research and Development (NCMRD). Dimensions of the room were 14-feet 10 -inches x 15-feet 7-inches. In the center of the room was a large table (7-feet x 6-feet 1-inch). Six chairs were evenly spaced around three sides of the table. The game room was large enough for subjects to have sufficient space to move around and the table surface was large enough to allow them the room they needed to construct up to six puzzles. The room was well lighted, with overhead florescent lighting and appropriately heated and ventilated. A video camera was set up in the north east corner of the room, a blackboard was located behind the side of the table without chairs and a TV monitor was set up in the south east corner of the room (see Exhibit 9 for a diagram of the game room set up).

The foraging territory was located adjacent to the game room and all on one level of the NCMRD. Puzzle bags were left at any location within the foraging

territory and in the open to make puzzle bags easily noticeable. See Exhibit 10 for a map of the foraging territory and its relationship to the game room.

Game Set Up

When the players entered the room there were six playing locations set up around the table. At each location, there was a pen and a copy of an Assignment Sheet. Players were instructed to find a seat and to make themselves comfortable by removing their coats and storing their knapsacks etc. If there were only five players, the playing location closest to the video camera was removed. After the players were comfortably seated, they were given pre-prepared nametags to put on and the set-up for the game commenced.

I read the contents of the Assignment Sheet and players were asked to read along. The Assignment Sheet (see Appendix B-1) was exactly the same for both forms of the game except the title was adjusted to match the form of the game being played (Puzzle Construction or Puzzle Fabrication). The assignment sheet provided details about the amount and timing of compensation and gave players an overview of the process. It assured the participants that all information collected in the game would be confidential and that participation was strictly voluntary. It advised players that they could withdraw from the game and the implications of withdrawing for their compensation. It also asked that players not discuss the game with others who might play after, since between the pilot stage and the research trials, games were staged over many months.

One of the sections on the Assignment Sheet advised players that the game would be video-taped. This was done so that I could review the tapes to see what actually happened in the room. While the qualitative review of these tapes was not specifically included in the research design, having the tapes would provide a fall back option if extremely unusual results occurred. After advising the players that the session would be taped, the I turned on the video recorder.

A consent form was printed at the bottom of the Assignment Sheet. After reading the Assignment Sheet players were asked to sign the consent, detach it and hand it to me.

After receiving the consent forms I distributed copies of the game rules (see Appendix B-2 and B-3). The actual rules a player received depended on the form of the game being played. The two sets of rules were exactly the same except for the name of the game and the sections that addressed the distribution of resources. I then asked the players to watch a video in which a third party, not directly involved in the research, read the puzzle rules. They were invited to follow along on their copy. The video was used to ensure the game rules were consistently read every time the game was played and because it allowed players to get a visual image of items described in the written instructions. Having a third party reader reduced the likelihood that I would reveal a bias in the reading of the game rules.

Question Time

After the video instruction tape was turned off the players were directed to talk among themselves and to seek clarification of any questions they might have from within the group. I left the room and gave the group five minutes to talk among themselves. This also gave the me an opportunity to distribute the first shipment of puzzle bags if the forage form of the game was being played. When I returned to the group I answered questions of clarification only. I would not provide any direction to the group as to how to organize themselves or what strategies to employ. If those questions were asked I told the questioner to seek clarification from within the group.

After the questions were answered I either left the first shipment of puzzle bags on the table for the Puzzle Construction game or allowed the players to leave the room to forage for bags in the Puzzle Fabrication game.

Subjects Physiological Needs

Snacks of soda pop and cookies were provided to each group at the same time (1.5 hours into the session) to avoid unwanted interference from subjects' physiological needs. Washroom facilities were also close at hand and had been pointed out to the players on the way to the game room.

Post Game Questionnaire

When the game was over, I returned to the game room and inspected the puzzles to determine their state of completion to determine the awarding of bonus

compensation. I then handed out copies of the post-game questionnaire and asked that they be completed and returned. Upon receiving the completed questionnaire the players were paid in cash and asked to sign a receipt (see Appendix C-3) for the funds. They were then advised that they were free to go.

Post Game Procedures

After each game the puzzles were taken apart and pieces divided into their appropriate module. I had labelled the back of each piece with its module number to facilitate sorting. The pieces in each module were counted to ensure they were all accounted for and the module pieces placed in an appropriately numbered bag.

Post Game Contact

After the research trials were completed all subjects received a letter presenting the true nature of the experiment and provided contact information so they could discuss any questions or concerns with the experimenter (see Appendix C-3).

Data Management

All subjects were assigned a code number that was placed on the post-game questionnaire. The code indicated the gender of the group, the form of the game played, the game number and the player number within the group. Questionnaires were locked in a filing cabinet and available only to the principal investigator. All data recorded for analysis contained only the code, not the name of the player.

CHAPTER 6

RESULTS

The proof is in the pudding ...
My grandmother

Chapter 6 presents the results and analysis of the experimental design. First an assessment of the measures is made followed by the presentation of descriptive and inferential statistics concerning the data collected.

DATA SCREENING

One person entered the data into an SPSS database and another independently checked every entry. Errors were identified and corrected. The data was then scanned to identify out-of-range or missing values. There were no out-of-range items. There were however five players who submitted questionnaires with unanswered questions representing a total of 9 individual data elements. The missing values were replaced with the median score from the player's group.

The resulting number of subjects was 114 and the number of groups was 21. The frequency distribution of players and groups by resource context and gender is provided in the table below:

TABLE 7

SAMPLE DISTRIBUTION BY CONTEXT, GENDER AND LEVEL

	Female		Male		Total	
	Individuals	*Groups*	*Individuals*	*Groups*	*Individuals*	*Groups*
CONTEST	26	5	29	5	55	10
FORAGE	27	5	32	6	59	11
Total	53	10	61	11	114	21

SCALE DEVELOPMENT

Prior to the empirical testing two scales were developed as dependent measures – the agonic scale and the hedonic scale. Scale items were randomly presented in Question A. Below are the scales, items and corresponding question number.

Original Dependent Measure Scales

Agonic scale

A2 Tried to be a winner
A3 Acted forcefully, wanted their own way
A6 Were hard, tough
A7 Tried to outperform others
A9 Tried to put others down
A10 Competed rather than co-operated
A15 Tried to dominate the discussion
A16 Turned the game into a contest

Hedonic scale

A1 Cooperated with each other
A4 Dealt with each other in a friendly, pleasant way
A5 Showed concern for others
A8 Were helpful to others
A11 Encouraged others
A12 Respected the opinions of others
A13 Got along with others in the group
A14 Listened to the suggestions of others

Data Transformation – Question A

For each item in Question A, players were asked to indicate the number of players in their group who exhibited the type of behaviour described in the item. Since players were in groups of 5 or 6 the data needed to be transformed to allow for data aggregation. An examination of the histograms for each item in Question A revealed that much of the data were clustered at one end or the other of the distribution. I decided to convert the raw scores into an ordinal scale of 1- representing *no* players; 2 representing *some* players and 3 representing *all* players.

After the data were transformed an inter-item correlation matrix was produced.

TABLE 8

INTER ITEM CORRELATION COEFFICIENTS

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16
A1	1.00															
A2	.036	1.00														
A3	-.228	.179	1.00													
A4	.430	-.026	-.309	1.00												
A5	.368	.088	-.147	.190	1.00											
A6	-.079	.113	.330	-.216	-.069	1.00										
A7	-.138	.240	.214	-.081	-.331	.171	1.00									
A8	.023	-.093	-.087	.094	.077	-.039	-.021	1.00								
A9	.204	.254	.108	.096	.147	.141	.141	-.709	1.00							
A10	-.330	.113	.256	-.272	-.207	.233	.123	.013	-.194	1.00						
A11	.353	-.100	-.196	.211	.318	-.116	-.205	.029	.138	-.258	1.00					
A12	.279	-.183	-.346	.261	.115	-.181	-.203	.034	-.094	-.179	.406	1.00				
A13	.218	-.097	-.210	.421	.013	-.106	.017	-.093	.123	-.172	.073	.338	1.00			
A14	.188	.006	-.263	.256	.245	-.093	-.155	.048	.033	-.260	.359	.391	.378	1.00		
A15	-.072	.207	.350	-.401	-.082	.273	.146	.029	.040	.239	-.285	-.329	-.313	-.299	1.00	
A16	-.057	.252	.277	.151	-.273	.163	.338	-.165	.254	.298	-.047	-.128	-.025	-.194	.130	1.00

Each significant correlation was examined to ensure that those that were positive were positively correlated with items of the same scale or those that were negative were negatively correlated with items of the alternative scale. Only 1 item (A9) violated this criterion. It was eliminated from the agonic scale. Item A8, whose only significant correlation was with item A9, was eliminated from the hedonic scale.

Principal Components Analysis

The original 16 items were also submitted to a principal components analysis with a varimax rotation. This procedure identified 5 components with Eigenvalues over 1. These five components explained 58% of the variance.

TABLE 9

PRINCIPAL COMPONENTS ANALYSIS

	1	2	3	4	5
A6	.749				
A15	.581				
A3	.574				
A4	-.526	.380			
A10	.486	-.303			
A13	-.483				
A11		.809			
A1		.616			
A14		.488			
A12		.483			
A8			-.923		
A9			.907		
A7				.801	
A16				.658	
A5		.501		-.594	
A2					.939

A social structure is not a unidimensional construct. Therefore, it is not surprising that a number of factors would emerge from a principal components analysis. The reason this was done was to determine whether it was reasonable from a face validity standpoint to group the emergent factors within their respective scales. Examining the factors more closely reveals the following:

Factor 1 conveys a sense of domination.

A6 Were hard/tough

A15 Tried to dominate the discussion

A3 Acted forcefully

A4 Dealt with others in a friendly, pleasant way (negative)

A10 Competed rather than cooperated

A13 Got along with others in the group (negative)

Factor 2 conveys a sense of active cooperation.

A11 Encouraged others

A1 Cooperated with each other

A14 Listened to suggestions of others

A12 Respected the opinions of others

Factor 3 conveys a sense of active purposeful domination.

A8 Were helpful to others (negative)

A9 Tried to outperform others

Factor 4 conveys a sense of independent competition – me against them.

A7 Tried to outperform others

A16 Turned the game into a contest

A5 Showed concern for others (negative)

Factor 5 conveys a sense of striving to win.

A5 Tried to be a winner

Combining Factor 1- domination, Factor 4 – independent competition and Factor 5 – striving to win, appears to reflect valid dimensions of the agonic social structure as does using Factor 2 – active cöoperation, to reflect the hedonic social structure.

Three items – A4, A13 and A5 were negatively correlated with their factors. However, two of them – A4 and A5 were also positively correlated with factor 2. I decided to include these items in the hedonic scale to increase the number of items in the scale (from 4 to 6). According to Nunnally (1970) increasing the number of items can raise the reliability of a test. Item 13 was reversed coded and included in the agonic scale.

While it might have appeared reasonable to include Factor 3 - active purposeful domination in the agonic scale, recall that the initial calculation of correlation coefficients showed that items 8 and 9 did not correlate appropriately with

the other items of the agonic scale. Since they do correlate strongly with each other (-.709) and have a high correlation with their factor (-.923 and .907 respectively) I decided they should be retained and treated as a separate 2-item scale.

Review of the components indicated that they were consistent with the proposed scales; that is items clustered in a predictable way. However, this analysis revealed a component that combined items A8 and A9 that had previously been eliminated because of their failure to correlate appropriately with the other items of the initial two scales. Items A8 and A9 have a high correlation with their component (-.923 and .907 respectively) and are highly correlated with each other (-.709). If the meaning of item A8 is reversed, as indicated by the negative correlations, A8 and A9 appear as noted above to represent a form of "active" agonic behaviour. Therefore I decided that instead of eliminating the two items, they should be retained and combined into a new two-item scale called the "Active" scale.

Reliability Check

The three scales were then tested to determine their internal reliability using the Cronbach's Alpha statistic.

The Agonic Scale had a Cronbach's Alpha of .67.

TABLE 10

INTER-ITEM CORRELATIONS – AGONIC SCALE

	A2	A3	A6	A7	A10	A13	A15	A16
A2	1.000							
A3	.1794	1.000						
A6	.1133	.3299	1.000					
A7	.2395	.2137	.1707	1.000				
A10	.1133	.2563	.2335	.1227	1.000			
A13	.0972	.2102	.1064	-.0167	.1723	1.000		
A15	.2070	.3503	.2730	.1465	.2393	.3132	1.000	
A16	.2522	.2768	.1625	.3376	.2977	.0247	.1299	1.00

Standardized item Alpha = .6643

Upon reviewing the inter-item correlations of the scale items, it was noted that item A13 was very weakly correlated with three other items on the scale; item A2 (.0972), item A7 (-.0167) and item A16 (.0247) so item A13 was removed from the scale. After removing this item the Cronbach's Alpha increased slightly to .6653 .

The Hedonic Scale had a Cronbach's Alpha of .71.

TABLE 11

INTER-ITEM CORRELATIONS – HEDONIC SCALE

	A1	A4	A5	A11	A12	A14
A1	1.000					
A4	.4301	1.000				
A5	.3682	.1896	1.000			
A11	.3530	.2107	.3183	1.000		
A12	.2790	.2609	.1151	.4064	1.000	
A14	.1879	.2559	.2452	.3588	.3910	1.000

Standardized item alpha = .7115

As was suggested by Stevens (1986), the reliability of the measure increased by extending the scale from 4 to 6 items. The 4 item scale had a Cronbach's Alpha of .66. Increasing the scale resulted in a noticeable increase in the alpha statistic – from .66 to .71.

The Active Scale had a Cronbach's Alpha of .83

TABLE 12

INTER-ITEM CORRELATIONS – ACTIVE SCALE

	A8	A9
A8	1.000	
A9	.7087	1.000

Standardized item alpha = .8295

Final Dependent Measure Scales

Agonic Scale

A2	Tried to be a winner
A3	Acted forcefully, wanted their own way
A6	Were hard, tough
A7	Tried to outperform others
A10	Competed rather than co-operated
A15	Tried to dominate the discussion
A16	Turned the game into a contest

Hedonic Scale

A1	Cooperated with each other
A4	Dealt with each other in a friendly, pleasant way
A5	Showed concern for others
A11	Encouraged others
A12	Respected the opinions of others
A14	Listened to the suggestions of others

Active Scale

A8	Were unhelpful to others
A9	Tried to put others down

Since I intended to use parametric statistics to analyze the data each scale was tested for skewness and kurtosis to see if the data were normally distributed. All values fell within acceptable ranges.

TABLE 13

SKEWNWESS & KURTOSIS OF DEPENDENT MEASURE SCALES

	Skewness		Kurtosis	
	Statistic	**Std. Error**	**Statistic**	**Std. Error**
Agonic	.593	.226	-.176	.449
Hedonic	-.786	.226	.112	.449
Active	.747	.226	-.770	.449

Tests of homogeneity of variance accompanied each of the inferential tests as they were conducted and violations of this assumption are discussed with each test. However, violations of the assumptions of normality and homogeneity were not considered serious as the test statistic used in all data analysis was Analysis of Variance that is fairly robust with regard to such violations (Steel & Torrie, 1980).

This dissertation's theory states that it is the individual's perception of context that influences the emergence of social structure. So the post test questionnaire asked players to report their perceptions and statistical analysis is provided for the individual level of data. However, when conducting an ANOVA analysis it is assumed that the observations are independent, that is, there is no chance that a common experience among subjects would cause them to have answers that are somewhat correlated because of certain features of the common experience (Hair, Anderson, Tatham, & Black, 1995). Because subjects played the game in groups there is some question as to whether the observations of this experiment were independent since the treatment involved interactions among the players (Glass & Hopkins, 1984). Consequently, all analysis has been done and is reported at the group as well as the individual level.

DEPENDENT MEASURES – SINGLE ITEMS

Question B asked players to respond on a number of single item measures. Subjects responded on a Likert scale ranging from 1 to 7 where level 1 was "strongly disagree" and level 7 was "strongly agree". There was no missing data and all responses fell within the acceptable range. Tests for skewness and kurtosis were conducted to determine normality of the data.

TABLE 14

SKEWNESS AND KURTOSIS OF SINGLE ITEM MEASURES

	Skewness		Kurtosis	
	Statistic	**Std. Error**	**Statistic**	**Std. Error**
B1	-.832	.229	.153	.455
B2	-.359	.229	-.719	.455
B3	1.681	.229	1.780	.455
B4	-.203	.229	-.822	.455
B5	.000	.229	-1.217	.455
B6	-.776	.229	-.064	.455
B7	3.152	.229	11.648	.455
B8	-.262	.229	-1.211	.455
B9	-.810	.229	-.342	.455
B10	-.628	.229	-.435	.455
B11	-1.189	.229	1.146	.455
B12	2.270	.229	4.884	.455

Three items, B3 (I felt uncomfortable playing the game), B7 (People argued over what to do) and B12 (This was an unpleasant experience) appeared significantly skewed. A further examination of the data revealed that for item B3 75% of the responses were either level 1 or 2 and for item B7 90% and for item B12 84% of the responses were at these levels. If the research is intended to identify relationships between variables, there must be enough variability in the scores to allow relationships to manifest. It was decided that since there was so little variance displayed in these items, further analysis would be inappropriate and items B3, B7 and B12 were removed from further consideration.

MANIPULATION CHECK

Cohen's Kappa Co-efficient measures the agreement between two evaluations and can be used to measure the agreement between player perceptions of the resource context and actual experimental conditions. The coefficient Kappa indicates how well two ratings agree. The larger the Coefficient, the greater the validity of the independent variable manipulation. If all players who played the game in the same context condition perceive the resource context in the same way, the Kappa has a value of 1.

TABLE 15

COEFFICIENT KAPPA ANALYSIS OF INDEPENDENT VARIABLE MANIPULATION

	Overall Agreement	Kappa	95% Confidence Bounds	
C1	81.6% (93/114)	0.62	0.478	0.763
C2	83.3% (95/114)	0.675	0.543	0.806
C3	72.8% (83/114)	0.431	0.266	0.595
C4	52.6% (60/114)	-0.08	-0.226	0.066

Kappa values between .40 and .75 are considered fair to good agreement that raters perceive the same condition. Ratings below .4 indicate poor agreement. Items C1, C2, and C3 meet the fair to good criteria but item C4 is poor. Upon review item C4 contrasted "when I got one I could build" with "when I got one I could wait and be assured of additional bags in the future". Players in the contest context did not perceive the difference in the expected manner. Players in this context should have circled the second option but only nine of the 54 players did so. Forty-five of the 59

players in the forage context circled the first option as expected. Thus it is clear that the source of the misperception was those who played in the contest context. In total only slightly more than 50% of the subjects circled the expected response meaning that either they did not perceive the context in the way the experimenter intended or they did not entirely understand the meaning of the question. It is the my opinion that the former explanation is more likely the case. This is consistent with anecdotal evidence that the dimension of "resource delay" was not fully understood by the players. In only two of the 11 contest games did any of the players select the delay option. As well, the most frequently asked question in the debriefing session was to "explain the delay option more fully".

STATISTICAL RESULTS

DEPENDENT MEASURE SCALES

Significance levels for all tests were determined using a one-tailed test of significance since the theory predicts the direction of the effect. In addition, in cases where the Lavene statistical test of the homogeneity of variances rejects the null hypothesis i.e. the variances are not homogeneous, the number 1 has been placed after the level indicator to signify that the variances are not homogeneous. Before any tests were conducted a boxplot graph of the data was drawn to identify and eliminate any outliers. All the tables indicate the resulting sample size.

Agonic Scale

H_1 Players in the contest resource context will score higher on the agonic scale than players in the forage resource context.

	Individual			Group		
	N	Mean	S.D.	N	Mean	S.D.
Contest	53	9.89	1.79	8	10.02	.40
Forage	55	9.56	1.79	11	9.91	1.55
Total	108	9.72	1.79	19	9.95	1.18

	Mean		Direction as Predicted	ANOVA	
	Contest	Forage		F	Sig.
Individual	9.89	9.56	Yes	.877	.18
Group[1]	10.02	9.91	Yes	.036	.43

While the direction of the difference in means was in the direction predicted, the difference can not be considered significant.

Hedonic Scale

H_2 Players in the forage resource context will score higher on the hedonic scale than players in the contest resource context.

	Individual			Group		
	N	Mean	S.D.	N	Mean	S.D.
Contest	52	16.08	1.52	10	15.80	.99
Forage	59	16.15	1.78	10	16.36	.69
Total	111	16.12	1.66	20	16.08	.88

	Mean		Direction as Predicted	ANOVA	
	Contest	Forage		F	Sig.
Individual	16.08	16.15	Yes	.057	.41
Group[1]	15.80	16.36	Yes	2.124	.08

At the individual level of analysis there appears to be little difference between those in the contest and those in the forage context. However, at the group level the difference approaches the significance level of .05.

Individual Item B1

H_3 Players in the forage resource context will score higher on "I would work with this group again".

	Individual			Group		
	N	**Mean**	**S.D.**	**N**	**Mean**	**S.D.**
Contest	55	5.80	1.11	10	5.77	.56
Forage	58	5.91	1.11	10	6.00	.57
Total	113	5.86	1.11	20	5.87	.56

	Mean		Direction as	ANOVA	
	Contest	**Forage**	**Predicted**	**F**	**Sig.**
Individual	5.80	5.91	Yes	.295	.30
Group	5.77	6.00	Yes	.623	.22

While the difference was in the direction predicted it was not significant at either the individual or group level.

Individual Item B2

H_4 Players in the forage resource context will score higher on "We made decisions as a group".

	Individual			Group		
	N	Mean	S.D.	N	Mean	S.D.
Contest	55	4.75	1.80	10	4.72	1.36
Forage	58	4.79	1.52	11	4.71	1.02
Total	113	4.77	1.65	21	4.71	1.16

	Mean		Direction as Predicted	ANOVA	
	Contest	Forage		F	Sig.
Individual	4.75	4.79	Yes	.023	.44
Group	4.72	4.71	No	.000	.50

Scores on this item are virtually the same between the two groups at both levels of analysis. There is no difference between those who participated in the contest or forage context.

Individual Item B4

H_6 Players in the contest resource context will score higher on "I worked on my own".

	Individual			Group		
	N	Mean	S.D.	N	Mean	S.D.
Contest	55	4.40	1.97	10	4.45	1.20
Forage	59	4.17	1.57	11	4.19	.83
Total	114	4.28	1.77	21	4.31	1.01

	Mean		Direction as Predicted	ANOVA	
	Contest	Forage		F	Sig.
Individual[1]	4.40	4.17	Yes	.482	.24
Group	4.45	4.19	Yes	.351	.28

The difference was in the direction predicted however, it was not significant at either the individual or group level.

Individual Item B5

H_7 Players in the contest resource context will score higher on "Decisions were made by a few individuals in the group".

	Individual			Group		
	N	Mean	S.D.	N	Mean	S.D.
Contest	55	3.40	1.72	10	3.41	.98
Forage	59	3.36	1.80	11	3.35	.81
Total	114	3.38	1.75	21	3.38	.87

	Mean		Direction as Predicted	ANOVA	
	Contest	Forage		F	Sig.
Individual	3.40	3.36	Yes	.018	.45
Group	3.41	3.35	Yes	.030	.43

The difference was not significant at either the individual or the group level.

Individual Item B6

H_8 Players in the forage resource context will score higher on "My friends should play this game".

	Individual			Group		
	N	Mean	S.D.	N	Mean	S.D.
Contest	55	5.18	1.55	10	5.18	.56
Forage	59	5.41	1.74	11	5.41	.71
Total	114	5.30	1.65	21	5.30	.64

	Mean		Direction as Predicted	ANOVA	
	Contest	Forage		F	Sig.
Individual	5.18	5.41	Yes	.527	.24
Group	5.18	5.41	Yes	.677	.21

While the difference was in the direction predicted it was not significant at either the individual or the group level.

Individual Item B8

H_{10} Players in the contest resource context will score higher on "One or two individuals assumed a leadership role".

	Individual			Group		
	N	Mean	S.D.	N	Mean	S.D.
Contest	55	4.27	2.09	10	4.27	.80
Forage	59	4.02	1.83	11	4.00	1.04
Total	114	4.14	1.96	21	4.13	.92

	Mean		Direction as Predicted	ANOVA	
	Contest	Forage		F	Sig.
Individual	4.27	4.02	Yes	.483	.25
Group	4.27	4.00	Yes	.437	.26

While the difference was in the direction predicted it was not significant at either the individual or the group level.

Individual Item B9

H_{11} Players in the forage resource context will score higher on "I felt at ease playing the game".

	Individual			Group		
	N	Mean	S.D.	N	Mean	S.D.
Contest	55	5.27	1.74	10	5.22	1.07
Forage	59	5.49	1.55	11	5.51	.48
Total	114	5.39	1.64	21	5.37	.81

	Mean		Direction as Predicted	ANOVA	
	Contest	Forage		F	Sig.
Individual	5.27	5.49	Yes	.506	.24
Group[1]	5.22	5.51	Yes	.642	.22

While the difference was in the direction predicted it was not significant at either the individual or the group level.

Individual Item B10

H_{12} Players in the forage resource context will score higher on "I worked with everyone in the group".

	Individual			Group		
	N	Mean	S.D.	N	Mean	S.D.
Contest	55	5.04	1.78	10	5.01	1.20
Forage	56	5.63	1.20	10	5.67	.45
Total	111	5.33	1.54	20	5.34	.95

	Mean		Direction as Predicted	ANOVA	
	Contest	Forage		F	Sig.
Individual[1]	5.04	5.63	Yes	4.174	.02
Group	5.01	5.67	Yes	2.679	.06

For this item, the predicted difference is significant at the individual level of analysis but is not for the group level.

Individual Item B11

H13 Players in the forage resource context will score higher on "I had fun".

	Individual			Group		
	N	Mean	S.D.	N	Mean	S.D.
Contest	54	5.76	1.32	10	5.65	.73
Forage	56	6.04	1.04	10	5.70	.31
Total	110	5.90	1.19	20	5.67	.55

	Mean		Direction as Predicted	ANOVA	
	Contest	Forage		F	Sig.
Individual[1]	5.76	6.04	Yes	1.495	.11
Group1	5.65	5.70	Yes	.034	.43

While the difference was in the direction predicted it was not significant at either the individual or the group level.

Because of the measurement problems with items B3, B7 and B12 the following hypotheses could not be tested.

H_5 Players in the contest resource context will score higher on "I felt uncomfortable playing the game"

H_9 Players in the contest resource context will score higher on "People argued over what to do".

H_{14} Players in the contest resource context will score higher on "This was an unpleasant experience".

The Active Scale was not developed until after the data analysis. Therefore an additional hypothesis was developed:

Active Scale

H15 Players in the contest resource context will score higher on the active scale than players in the forage resource context.

	Individual			Group		
	N	Mean	S.D.	N	Mean	S.D.
Contest	55	3.76	1.51	10	3.67	1.46
Forage	59	3.02	1.21	9	2.52	.33
Total	114	3.38	1.41	19	3.13	1.21

	Mean		Direction as Predicted	ANOVA	
	Contest	Forage		F	Sig.
Individual[1]	3.76	3.02	Yes	8.508	.002
Group[1]	3.67	2.52	Yes	5.297	.02

At both the individual and the group level, there was a significant difference between groups. Those in the contest context scored higher on the active scale than those in the forage context. It should be noted however, that at both the individual and the group level of analysis the data violated the homogeneity assumption. According to Stevens (1986) such a violation has a slight effect on the α in that the actual is slightly increased over the nominal (1986:201). In this case however, the α is low enough at both levels of analysis to suggest that the violation should not threaten the significance of the findings.

It is interesting to note that at the individual level all of the outcomes (12/12) were in the direction predicted by the theory and at the group level 11 of 12 were as predicted. Analysis confirmed that many of these differences were not statistically significant. However, it seems unusual for the outcomes to be so consistently in the

direction predicted. If the theory were unfounded, one would expect to find a more outcomes in the negative direction. By chance alone one would expect a 50-50 distribution. A chi-square of this outcome (12/12 for individual level data and 11/12 for group level) shows that both outcomes are highly unlikely (significance < .001).

INFLUENCE OF GENDER.

Because of the research design, it was possible to analyze the effect of gender on the dependent variables at both the individual and the group level. Therefore, I decided to look at the effect of gender on all of the dependent measures. The table below presents the results of an ANOVA analysis at the individual respondent level. A two-tailed test of significance is used, as there is no theoretical basis to suggest direction of the effect of gender.

TABLE 16

THE EFFECT OF GENDER ON THE DEPENDENT MEASURES INDIVIDUAL LEVEL OF ANALYSIS

		Female		Male		ANOVA	
	N	Mean	S.D.	Mean	S.D.	F	Sig.
Agonic Scale	112	9.87	2.29	9.92	1.66	.016	.900
Hedonic Scale	109	16.19	1.69	16.20	1.47	.001	.980
Active Scale[1]	108	2.49	.59	3.82	1.43	35.89	.000*
I would work with this group again	113	5.98	1.05	5.75	1.16	1.335	.271
We made decisions as a group	114	5.23	1.05	4.31	1.72	8.972	.003*
I worked on my own	114	4.23	1.75	4.33	1.80	.093	.761
Decisions were made by a few individuals in the group	114	3.02	1.78	3.69	1.68	4.264	.041*
My friends should play this game	114	5.13	1.72	5.44	1.59	1.004	.319
One or two individuals assumed a leadership role	114	3.74	2.02	4.49	1.85	4.347	.039*
I felt at ease playing the game	114	5.32	1.60	5.44	1.68	.156	.694
I worked with everyone in the group	110	5.78	1.24	5.05	1.44	7.515	.007*
I had fun	110	6.00	1.30	5.81	1.09	.671	.414

* $p < .05$

The mean score of males on the Active Scale was significantly higher than that of females. In addition females scored significantly higher on the following single item measures:

B2 We made decisions as a group.

B10 I worked with everyone in the group.

Females scored significantly lower than males on the following items:

B5 Decisions were made by a few individuals in the group.

B8 One or two individuals assumed a leadership role.

An ANOVA analysis was also conducted at the group respondent level. Again significance levels are reported at for a two-tailed test of significance.

TABLE 17

THE EFFECT OF GENDER ON THE DEPENDENT MEASURES GROUP LEVEL OF ANALYSIS

		Female		Male		ANOVA	
	N	Mean	S.D.	Mean	S.D.	F	Sig.
Agonic Scale	20	9.87	1.19	9.80	.93	.022	.885
Hedonic Scale	21	16.14	.91	15.81	1.08	.573	.458
Active Scale[1]	19	2.5	.32	3.5	1.19	6.21	.023*
I would work with this group again	21	5.96	.56	5.65	.69	1.229	.282
We made decisions as a group	21	5.17	1.08	4.30	1.11	3.263	.087
I worked on my own[1]	19	4.51	1.01	4.51	.71	.000	.991
Decisions were made by a few individuals in the group	20	2.86	.67	3.68	.79	6.127	.023*
My friends should play this game	20	5.13	.46	5.60	.62	3.65	.072
One or two individuals assumed a leadership role	20	3.76	.71	4.67	.76	7.67	.013*
I felt at ease playing the game	20	5.31	.62	5.66	.59	1.67	.213
I worked with everyone in the group	20	5.57	1.14	5.10	.67	1.291	.271
I had fun	18	5.81	.5	5.55	.44	1.368	.259

* $p < .05$

Similar to the findings at the individual level of analysis, male groups scored significantly higher than female groups on the Active Scale. However two of the previously significant single item measures were no longer significant at this level of analysis. Female groups still scored significantly lower than male groups on the following items:

B5 Decisions were made by a few individuals in the group

B8 One or two individuals assumed a leadership role.

Having found some significant findings with regard to gender I conducted further ANOVA analysis looking at both resource context and gender as possible main effects. The results of this analysis are shown below.

TABLE 18

THE EFFECT OF RESOURCE CONTEXT AND GENDER ON THE DEPENDENT MEASURES – INDIVIDUAL LEVEL

		Significance Level		
		Resource	**Gender**	**Interaction**
	Agonic Scale	.316	.212	.730
	Hedonic Scale	.304	.828	.474
	Active Scale	.067	.000*	.556
B1	I would work with this group again	.510	.286	.091
B2	**We made decisions as a group**	.766	.006*	.055
B3	I felt uncomfortable playing the game	Eliminated		
B4	I worked on my own	.472	.766	.669
B5	**Decisions were made by a few individuals in the group**	.812	.045*	.301
B6	My friends should play this game	.543	.347	.141
B7	People argued over what to do	Eliminated		
B8	**One or two individuals assumed a leadership role**	.479	.039*	.747
B9	I felt at ease playing the game	.482	.701	.916
B10	**I worked with everyone in the group**	.254	.031*	.519
B11	I had fun	.224	.418	.878
B12	This was an unpleasant experience	Eliminated		

* $p<.05$

In each case the gender effect identified at the single item analysis held when resource context was added and in no case was there an identifiable interaction effect. In addition the previously identified effect of resource context on the Active scale is no longer significant when gender is added however, there is no interaction effect between the two independent variables.

An ANOVA analysis was also conducted at the group level of analysis. The results are presented below:

TABLE 19

THE EFFECT OF RESOURCE CONTEXT AND GENDER ON THE DEPENDENT MEASURES – GROUP LEVEL

		Significance Levels		
		Resource	**Gender**	**Interaction**
	Agonic Scale	.437	.460	.984
	Hedonic Scale	.185	.751	.702
	Active Scale	.105	.081	.363
B1	I would work with this group again	.441	.487	.234
B2	We made decisions as a group	.903	.100	.199
B3	I felt uncomfortable playing the game	Eliminated		
B4	I worked on my own	.343	.882	.146
B5	**Decisions were made by a few individuals in the group**	.817	.035*	.742
B6	My friends should play this game	.811	.105	.258
B7	People argued over what to do	Eliminated		
B8	**One or two individuals assumed a leadership role**	.755	.018*	.857
B9	I felt at ease playing the game	.955	.198	.332
B10	I worked with everyone in the group	.126	.263	.708
B11	I had fun	.216	.596	.653
B12	This was an unpleasant experience	Eliminated		

* $p<.05$

At this level of analysis, the significant findings with regard resource context and gender differences on the Active Scale are no longer significant at the .05 level. As with the analysis at the individual level, the gender differences identified for single items B2 and B10 are no longer significant.

POST HOC ANALYSIS OF POWER

Power is the probability that statistical significance will be detected if it is present. Effect size, alpha level, and sample size influence power. In this study effect size is extremely difficult to determine since so little previous empirical work has been reported. If a moderate effect size (.5) is assumed, then the approximate power for this research is as follows (Hair, Anderson, Tatham & Black, 1995:10):

TABLE 20

POWER ANALYSIS – MEDIUM EFFECT

	α	Sample Size	Effect Size	Power
Individual	.05	100	.5	.940
Group	.05	20	.5	.338

At the individual level it would appear that the analysis would have sufficient power (94%) but this would not be the case at the group level - power 33.8%.

If the effect size is small, the power declines dramatically.

TABLE 21

POWER ANALYSIS – SMALL EFFECT

	α	Sample Size	Effect Size	Power
Individual	.05	100	.2	.290
Group	.05	20	.2	.095

There is only a 29% probability that any statistically significant result would be detected at the individual level and only a 9.5% probability at the group level.

Thus, power analysis indicates that statistical power may be an issue when considering the results of this statistical analysis. Consequently, many of the non-results found in this research may be due to the low power of the test and a larger sample size would be required to detect differences between resource contexts. This will be discussed further in the following chapter.

CHAPTER 7

DISCUSSION

"At this point in time, at least, we have to be satisfied with imperfect answers. Those who maintain that science can only deal with perfect knowledge simply need to learn more about the process of doing science..."

Cherulnik[7]

The intent of this chapter is to discuss the results reported in Chapter 6. It opens with a summary of the findings and proceeds to discuss the interpretation of these results. It will conclude with suggestions as to future research program and an assessment of the contributions of the research.

SUMMARY OF THE RESULTS

The objective of this empirical investigation was to demonstrate a causal relationship between resource context and social structure. The theory developed in Chapters One through Four postulates that in situations where resources are concentrated, predictable, and highly visible and their consumption is delayed, agonic social structures are likely to emerge. Alternatively, if resources are scattered, unpredictable, and hidden and their consumption is more immediate, then the hedonic pattern is more likely to be found.

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[7] Behavioral Research, 1983: 11

The statistical analysis of the agonic and hedonic scales, measures of the dependent variable social structure, did not uncover a significant difference between the scores of those who played in the contest context and those who played in the forage context in either the hypothesized direction or the opposite direction. An initial analysis of the responses on the third dependent measure, the active scale, did show a significant difference between the means of the two groups. Those who played in the contest context scored significantly higher on this measure than those who played in the forage context suggesting that contest context contributed to the development of actively agonic relationships. This difference was somewhat attenuated by the effects of gender. When gender was added as an additional independent variable, significance declined at both the individual and group level. However, it is important to note that there was not an interaction effect between resource context and gender for this measure.

Among the single item measures, one question did elicit a significantly different response between groups. Those who played the game in the forage context were more likely to indicate that they worked with everyone in the group than those who played in the contest context. However, this difference became non-significant when gender was considered.

While statistical significance could not be established for many of the measures, the number of times in which a measured difference was in the predicted direction was significantly greater than would be expected by chance.

Even though the effect of gender was not part of the initial model, it did emerge as a notable feature of the data analysis particularly with respect to the single item measures. The single-item questions were designed to elicit responses from participants about group leadership and decision making within the group as well as record their feelings about the experience. It is interesting to note that gender differences were only evidenced for those items having to do with leadership and decision making and did not appear to influence measures of affect.

Leadership & Decision Making Items		**Significant**
B2	We made decisions as a group	Yes
B4	I worked on my own	No
B5	Decisions were made by a few individuals in the group	Yes
B8	One or two individuals assumed a leadership role	Yes
B10	I worked with everyone in the group	Yes

Feelings Items		
B1	I would work with this group again	No
B6	My friends should play this game	No
B9	I felt at ease playing the game	No

B11 I had fun No

Males declared, at both the individual and group level, that decisions were made by a few individuals and as well, those one or two individuals assumed a leadership role. Alternatively females at the individual level felt that they made decisions as a group and that during the course of the experiment they worked with everyone in the group. These results are highly consistent with a large body of research on the gender and cöoperation and gender and leadership style (Eagly & Johnson, 1990; Mojà, 1992; Helgesen, 1990).

INTERPRETATION OF THE RESULTS

If an investigation is well designed, employs an adequate sample size and administers valid measures, then failed predictions should challenge the completeness of the initial theory. However, failure to find statistically significant differences does not necessarily confirm the null hypothesis. Deficiencies in a research project's design or implementation could also lead to non-findings. If there were significant problems with the empiricism of an investigation, it would be inappropriate to comment or make an assessment of the adequacy of the theoretical frame. Therefore it is necessary to begin the interpretation section with a determination of the validity of the findings.

INTERNAL VALIDITY – DESIGN ISSUES

Time

When the research design was developed there were no previous investigations to shed light on the issue of how long it takes to develop a mature stable social structure. The groups that were observed in developing the theory had a long history of involvement and interaction. Research has shown however, that status and dominance hierarchies form quickly – within the first five minutes (Fisek & Ofshe, 1970). But it is tenuous at best to extend this finding to suggest that fully functioning, multi-dimensional social structures among people who start with no basis for relationship can form this quickly.

The amount of time allotted for the experiment was chosen on the basis of convenience and what seemed to be a reasonable time commitment to ask of participants given the compensation offered. This decision was based more on practical consideration than on theoretical direction. It may be that the findings reflect the relationship between resource context and social structure at an early developmental stage of the interaction and that it was too early in the formation of the social structure to take valid measurements.

Size of the Incentive

As with time, there is nothing in the theory that speaks to the issue of size of the incentive. The theory does acknowledge the need for resource scarcity and the potential for individual benefit but it does not address the magnitude of the incentive.

The incentive structure in this experiment gave everyone who played a payment of $15. Those who finished their puzzle in the allotted time received an additional payment of $5 and the first two players to finish their puzzle received an additional $25. This particular arrangement was based on what seemed reasonable compensation and on the total of available funding. Unfortunately the total amount was eroded by the necessity of repeated pilot tests. Attempts were made to extract the largest possible incentive from the funds available but the amounts provided may not have been meaningful enough to influence behaviour particularly those types of action judged to be aggressively competitive.

INTERNAL VALIDITY – IMPLEMENTATION ISSUES

Selection – Treatment Interaction

The participants used for the experiment were students who volunteered to participate and followed through with their commitment to play the game. I made efforts to make participation as easy as possible. I went to the student classrooms to initiate contact. It took only a few moments for those who were interested to provide brief information (name, sex, and contact information) on a sheet provided to them. Games took place Monday to Thursday evenings and Saturday and Sunday afternoons so potential subjects had a number of opportunities to participate at their convenience. The time of day (5 p.m. to 8 p.m. on weeknights and 2 p.m. to 5 p.m.

on weekends) was selected to reduce potential interference with class commitments and social obligations. Finally, subjects were compensated for their time ($15).

Despite these accommodations, it is possible that those who volunteered and participated were more cōoperative than those who did not. This cōoperative orientation may have influenced their participation in the game and attenuated competitive behaviours thereby mediating the influence of the contest context.

Subject Interaction – Diffusion of Treatments

All of the subjects in the experiment were students who took one of two popular undergraduate courses at the University of Western Ontario (Business 20 and Business 257). The games were played over a six-month period and by the end of the research trials over 150 students had taken part. While none of those who played a particular game were friends or roommates and students were recruited from three campus locations, there was still a high probability that those who played shared classes with other participants. Subjects were specifically instructed not to discuss the game with others but it is possible that subjects talked among themselves and participants may have communicated knowledge about the experiment to others who played after.

Experimenter Expectancies

Rosenthal (1972) provides evidence that an experimenter's expectations can influence the data obtained in an experiment. This experiment was designed to

reduce the amount of contact between the experimenter and subjects to lessen the possibility that my expectations would be transmitted to subjects, even inadvertently. The assignment was read to subjects from a prepared script and game instructions were provided on standardized videotapes using a third-party reader. Every subject received the same information in the same way prior to the experiment.

However, funds did not permit hiring someone to administer the test so I had to do it. In preparing for the game, the experimenter met subjects at a neutral meeting place and then took them to the game room. While aware of the possibility of contamination, I needed to have pleasant conversation with the early arrivers as not all the players showed up at the same time. To ensure that subjects would stay to play the game, my demeanour during the pre-game period could be described as pleasant and cöoperative. In trying to be "nice" to potential subjects I may have established a tone of cöoperation. This may have established a similar tone of "cöoperation" for the experimental period thereby influencing the outcome of the experiment.

CONSTRUCT VALIDITY

Independent Variable – Resource Context

The independent variable in this experiment was resource context, i.e. the way in which needed resources are configured in a group's environment. The experimental manipulation involved altering the resource context to align with the four dimensions identified in the theory (concentration, predictability, visibility and

delay). A manipulation check was included in the post game questionnaire to determine if the subjects perceived their resource context in the way I intended. As identified in the Results Chapter, there is some question as to whether the delay option was completely understood by players in the contest context. I made efforts during the pre-test phase to simplify and clarify this option but the contest game could be played without exercising the right of delay. The finding that few of the players choose to delay could indicate that they took the easier route. Instead of thinking through the implications and opportunities of delaying, they chose to ignore it. There is some doubt therefore, that this dimension of the resource context was effectively operationalized.

Dependent Variable – Social Structure

As indicated in the Methodology Section there are no existing measures of social structure, as it is understood in this theoretical model. Thus the measures used in this study are a first attempt at operationalizing the complex multi-dimensional construct. The scales and single items were designed from my intuitive understanding of the dynamics of these social structures gleaned from readings on the social interaction of non-human primates and early humankind.

There is some support for accepting that agonic and hedonic social structures do exist in human groups since other writers have employed this taxonomy for use in human applications (Wedgewood-Oppenheim, 1988; Stevens & Price, 1996) but a full understanding of the salient dimensions and interactions among these has not yet

been attained. Because the construct itself lacks clarity, efforts to measure social structure are at best exploratory. Given the state of our knowledge about agonic and hedonic social structures, the inability to find a strong relationship between resource context and social structure may have resulted from an incomplete or inaccurate operationalization of the dependent variable.

Social Desirability

The measures used for this experiment were based on the use of pen and paper questionnaires. There is no assurance that the ratings recorded by the respondents on their questionnaire actually corresponded to their true perceptions. Sherman and Reeve (1997) caution that because an experimental situation involves human interaction (researcher and subject) there is always the possibility that a response is "consciously or unconsciously, designed to deceive or otherwise manipulate the behaviour of the receivers rather than to communicate accurately the person's ... predisposition" (1997:155). It is interesting to note that two of the three items that needed to be eliminated due to lack of response dispersion reflected negative messages to me.

B3 I felt uncomfortable playing the game

B12 This was an unpleasant experience.

In both cases the responses were tightly clustered around the "Strongly Disagree" anchor. While it is possible that since the students were playing a game

they defined the situation as enjoyable, it is also possible that the respondents did not want to offend or distress me so they indicated a more positive response than they actually experienced.

This concern for how they appeared to the researcher may have been reflected in generally more positive responses to socially desirable behaviours (Edwards, 1957) such as cöoperation and concern for others and restrained negative responses for less socially desirable behaviours such as domination and aggressive competition. In a situation where people do not know each other well and spend a relatively short period of time together it is reasonable that they may hesitate to report the occurrence of socially undesirable behaviours. Domination, toughness and aggression, key elements in the agonic scale may be seen as undesirable social characteristics among these young university students. It is possible that the agonic measures were somewhat attenuated by a desirability concern.

It is interesting to note that there was a significant difference between resource context groups for the active agonic scale. This scale appeared to capture a much more extreme form of agonic behaviour that if it had occurred, may have been evident enough to offset social desirability.

STATISTICAL CONCLUSION VALIDITY

Reliability of the Measures

Reliability is an indicator of the precision of a measurement tool — to what extent will I get the same result each time I use the tool? All measurement tools are subject to some degree of unreliability. There is no such thing as a perfect measure; some degree of imperfection is always expected. However, if a measure's imperfection is serious, use of the tool will obscure scientific lawfulness. Nunnally (1970) comments that "whatever 'real' lawfulness there is in nature will be blurred if an unreliable measure is used..." (1970:108).

An internal consistency measure was used to address the reliability of the scale items. The Cronbach's Alpha of the agonic scale was .67; the hedonic scale was .71 and the active agonic scale .83. Efforts were made to construct the most reliable scales possible but two of the three scales failed to attain Nunnally's (1970) criteria for acceptable reliability (.80). Given that the scale development for these constructs is in its early stages, marginal reliability is to be expected but it does weaken the validity of the data collected.

Statistical Power

Most of the findings of this study concerning the independent variable of resource context and dependent variable of social structure have failed to demonstrate a significant causal relationship. Cook and Campbell (1979) recommend that "power

analyses are desirable in any report of a study where the major research conclusion is that one variable does not cause another" (1979:40). Lack of power greatly increases the probability of making Type II errors i.e., reaching the wrong conclusion by accepting the null hypothesis when in fact it should be rejected. Type II errors are made when a relationship exists, but it is not identified.

The power analysis conducted in the results chapter concludes that given the size of the individual level sample (n =114) the power of this experiment would have been sufficient to detect a medium effect but not a small effect. However, the size of the group level sample (n=21) would not have produced enough power to detect either a medium or small effect. As it is early on in the development and testing of this theoretical model little is known about the true strength of the relationship between resource context and social structure but it is more likely to be medium or small rather than large. Thus for most of the data in this study it is not clear whether the results showing lack of covariance between the independent variable and the dependent variable are due to the absence of a relationship or weakness of the experiment due to small sample size.

Every effort was made to recruit participants for the experiment. Over 1500 students at three campus locations were approached to volunteer. Repeated contacts were made with those who showed interest to get them to commit to participating in a game. Those who signed up for a game were contacted and reminded of their commitment the night before to increase the likelihood of them following through.

Also some of the pool of potential subjects was used for pre-test sessions thus they were unavailable for the research trials. While the initial intent was to have 4 pre-test sessions (one for each context/gender combination), it actually took 10 sessions to work out the design and operational details. As well, it was a challenge to get students to actually play a game. I had to cancel fourteen games during the pre-test and trial phases because not enough players showed up to play. The final number of subjects was also constrained by the funding available for the project since subjects were compensated for their participation and some received monetary rewards as part of the game design.

EXTERNAL VALIDITY

Since the intent of this experiment was to demonstrate a relationship between resource context and social structure as predicted by the theory, issues of external validity were considered less important and not the subject of this investigation. Because of this, threats to external validity are not considered.

SUMMARY OF VALIDITY ISSUES

In every experiment there are threats to validity. Some are the result of incomplete or faulty design, others arise in the course of conducting the research. In this investigation the most worrisome issues concern the validity of the construct measures, the representativeness of the sample (subjects may have been more

cöoperative than the population in general), and lack of sufficient power to detect a reasonable effect.

COMPETING HYPOTHESES

Weak empirical findings also put in question the underlying theory. It is possible that the pattern identified (i.e. the relationship between resource context and social structure) is not the result of an evolutionary process but is instead the result of our species' ability to learn and adjust behaviour based on experience. Maybe humans have learned that particular social structures work best when the resource context is patterned in a specific way. It is important to the continued pursuit of an evolutionary view to try and disentangle the effects of responding to evolutionarily established cues from utilizing learned behavioural responses. However, separating the effects of nature from nurture may be a difficult, if not impossible, task.

A NOTE ABOUT TESTING FOR ADAPTATIONS

The theory developed in this research is one that addresses origins. What are the origins of certain patterns of social behaviour in groups? This is fundamentally an investigation into ultimate explanation. However, the requirement of empirical study moves the focus from the realm of the ultimate to that of the proximate. If, as the theory suggests, agonic and hedonic social structures evolved through the process of natural selection to solve the group cohesion problems of early human kind, then we should be able to see them manifest in observable contemporary social behaviour.

However, manifest behaviour is complex and multi-dimensional. There are many answers to the question of why a certain person acts in a certain way at a particular point in time. This dissertation argues that some of these answers (those of ultimate causation) can be found deep in human history and can be developed by understanding the process of natural selection and the environmental problems facing our long ago ancestors. Our tools may not be trying to measure the right thing or we may be looking in the right place for evidence of deep origins (Grey, 1985; Holcomb, 1998; Stanford, 1999). What is needed in this entire field of studying adaptations is a more sophisticated understanding of how we go about seeing the ultimate when it is so intricately connected to the proximal.

CONTRIBUTIONS

This dissertation focused attention on the little investigated phenomenon of organizational social structure. In seeking to understand the origins of social structure it identified an important feature of organizational context — resource context. As well, by integrating findings and identifying patterns of relationships, it described four salient dimensions of a resource context, namely; distribution, predictability, visibility and delay. These dimensions will provide those wishing to study organizational resource context with specific features to consider.

Further, it has specified the relationship between resource context and social structure and using evolutionary theory it proposed a plausible explanation as to why

social structure might be influenced by resource context in such a manner. The work of this dissertation combines description and explanation to make a strong theoretical contribution.

This dissertation is also a sincere attempt at theory building by bridging (Reisman, 1988). The work of this dissertation surveys a wide range of disciplines that are not traditionally considered in the development of organizational theory and models how understanding from other fields can be brought to bear on the develop of new and innovative theory. It draws on evolutionary biology, ethology, socioecology and anthropology and in so doing introduces organizational researchers to alternative theoretical perspectives to inform their thinking. Others who work in the humanities and social sciences have attempted to use an evolutionary lens (Alexander (1987) in ethics; Masters (1985) in philosophy; Bitzig (1986) in history, and Frank (1988) in economics) but employing this perspective in the investigation of organizational phenomena is in its relative "infancy" (a notable attempt is the recent work of Nelson, 1995; Nicholson, 1997; 1998 and Salter, 1999). Reisman (1988) maintains that while difficult to attempt using a bridging approach has the potential to result in major expansions of knowledge.

By providing a new theoretical lens based on the disciplines of evolutionary biology and evolutionary social psychology, this theory contributes fundamental insight and creates possible areas for extension for a variety of topics relevant to organizational researchers in the realm of organizational design. For example,

structural contingency theory suggests that performance is a function of the match or "fit" between various components of an organization's context and its structure (Drazin & Van de Ven, 1985). A certain element of an organization's environment requires a firm to adopt a particular form of structure and or organizational process for it to function effectively. A mismatch between context and structure creates an inefficiency that eventually compromises performance. In all of this work, structure is assumed to be a macro level construct that is designed and imposed upon organizational work units by higher levels of "all knowing" management. Structure in these models is a constructed artifact.

What would happen if the construct of structure were extended to include the non-designed emergent phenomenon of social structure? Would performance be enhanced by the fit between context and social structure? While the construct of social structure and its pervasiveness in organizations has been acknowledged within the field for almost as long as the field of organizational research has been codified, there has been little attention paid to the effect of social structure on performance.

One possible explanation for this lack of attention is that because social structure is an emergent phenomenon, researchers felt that managers did not have the same level of control over it as they have had over formal structure. If social structures cannot be constructed or designed then why study them? The work of this dissertation has introduced the idea that it is possible to influence social structures influencing the perception of an organization's resource context. Thus it becomes

possible and potentially profitable to study the contingency implications of social structures.

Another area of theoretical interest that could be influenced by the work of this dissertation is research on the strategy formulation process (Mintzberg, 1978). It would fit appropriately within the classic work of Bower (1970) and Burgelman (1983, 1991) in which they propose an organization's strategy results from the complex interplay of the induced and autonomous strategic behaviour of its middle managers. Strategic behaviours in turn are influenced by a firm's structural and strategic context. Burgelman initially accepted Bower's (1970) conceptualization of structural context as a set of administrative mechanisms designed and put in place by an organization's senior managers to keep strategic behaviour in line with the current concept of corporate strategy. From Bower and Burgelman's perspective structural context is constructed by means of rational choice and decision making.

An alternative view is that structural context is both designed and emergent. That while managers can and do impose certain rules, regulations and procedures on the functioning of their employees, the day-to-day interaction of people in groups introduces a social dimension that also needs to be considered as part of the structural context. In Burgelman's later work (1991), the construct of structural context is expanded to include cultural mechanisms (Ouchi, 1980) but there is no indication as to their functioning or the relationship between cultural mechanisms and is original

notion of administrative mechanisms. Social structure may be an appropriate manifestation of these cultural mechanisms.

Additionally, both Bower and Burgelman conducted their research in large mature organizations with one form of organizational structure — controlled, formalized, hierarchical. According to the theory proposed in this dissertaion, this type of resource setting leads to the emergence of one form of social structure — agonic. Thus it is not surprising the in these organizations structural context was seen as an impediment to the emergence of autonomous strategic behaviour, "autonomous strategic initiatives attempt to escape the selective effects of the current structural context" (Burgelman, 1983:65).

What if there existed an alternative form of structural context, one that encouraged rather than restrained "spontaneously occurring" autonomous behaviours? This dissertation describes such a structure (hedonic) and suggests ways in which to foster its emergence. Researchers could then investigate the implications of a structural context that encourages rather than discourages autonomous behaviours.

It is interesting to note that Ghoshal and Bartlett, (1994) maintain that further advance in the field of strategy research will result from the investigation of factors which "influence ... the choices and actions of individuals within the firm" (1994:91). They assert that factors embedded in an organization's context are

important sources of influence on managerial action. They conclude "the main influence of general managers lies in their role as shapers of an organization's context" (1994:108).

As well as academic contributions this dissertation presents a new way of looking at some very interesting managerial issues. For example it suggests where managers might effectively intervene to create the kind of social structures they needed to enhance organizational performance. In areas where managers have direct control, organizational resources can be configured to create the type of resource context required to evoke the form of social structure required. How a firm chooses to allocate its monetary resources through budgeting and capital allocation processes is an important aspect of the resource context and it is under the direct control of management.

However, money is not the only resource that is distributed within the firm. For example, choices concerning information systems affect the distribution of the information resource within a firm. Is information access and flow centrally controlled or is all information readily available to everyone in the organization? Some firms are supporting the work of their organizations through the technology of Lotus Notes. This type of software program allows many individuals to share and contribute to communal databases.

How do the employees of a firm spend their time at work? In many organizations the time commitments of employees are centrally managed and tightly controlled by management — making this resource concentrated, predictable and visible. However, as with money and information, other configurations are possible. For example, at 3M individual research scientists control anywhere from 15 to 20 percent of their time and are encouraged to spend it on projects of their own choosing — making this resource dispersed, unpredictable and hard to discern. Clearly, management can intervene to fashion a resource context and the context created will have an effect on the resultant social structure.

The effect of resource context on social structure has considerable implications for organizations experimenting with new organizational forms to improve performance. Managers can design and implement a new organizational structure but the theory predicts that if they do not adjust the resource context to complement this new structure, strong behavioural predispositions, based on evolutionary forces, may reduce its effectiveness. For example, management may choose to re-organize their employees in decentralized, non-hierarchical teams. But unless resources are perceived to be dispersed, and foraging and not competition determines access, they will continue to behave as if they were functioning within a hierarchical structure. This may suggest why so many organizations are having difficulty deriving the expected benefits of team based initiatives.

Since the theory suggests it is the perception of a resource context that affects emergent social structure, then managing the perception of the relevant resource context can have profound effects on social behaviours at work. For example, Jack Welch, CEO of General Electric, has promoted the idea of "boundarylessness" (Tichy & Sherman, 1993). It can be argued that this perception expands an employee's perception of the relevant resource context, encourages foraging behaviours and results in a more hedonic-like social structure. By effecting employees' perceptions of their resource context, leaders can influence the emergent social structures in their organizations. Providing such a potentially powerful theory to managers directs their attention to what was previously considered an uncontrollable feature of an organizational life. Having a greater understanding of social structure, what it is and how it can be influenced, will provide managers with a powerful lever to influence the nature of the social structures that emerge in their organizations.

It is important to state at this point, that the theory does not speak to the best form of social structure or to the relationship between social structure and organizational performance. The theory is silent on these matters. All it can suggest is that managers are able to effect the nature of informal social structures that emerge in their organizations by influencing employees' perceptions of the resource context but it does not address to what end? To make recommendations in this regard would require further research particularly in the realm of contingency theory as suggested above. In a similar vein, Burns and Stalker maintain "there is not one optimum type of management system" but rather " an appropriateness of each system to its own

conditions" (1961:125). They do suggest however, that performance of high volume repetitive tasks in stable conditions can be enhanced by mechanistic systems whereas tasks requiring flexibility and innovation in uncertain conditions would be better attempted by organic systems. This seems almost intuitive — that hierarchical social systems are more suited to highly standardized routine tasks and egalitarian-like work teams better undertake fast paced innovative work.

If further evidence can be found to support a link between social structure and organizational performance then the theory advanced in this dissertation will provide managers with direction on how to influence social structure to enhance performance.

FUTURE RESEARCH

Despite the advantages of increased laboratory control it is possible that laboratory experimentation is not the most appropriate way to study this phenomenon given the stage of its theoretical development. It may be necessary to move the investigation to more naturalistic settings where groups have functioned together for a longer period of time than is reasonable to expect in an experiment. In the real world of mature groups, processes have unfolded over time and both evolutionary and cultural elements have had an opportunity to mold a fully emergent form of social structure.

Also in the real world of modern organizations individual incentives are much more meaningful. Outcomes of group processes in real world settings are such things as compensation, reputation and advancement. Outcomes that are much more meaningful to participants than the possibility of $45 for an evening's worth of involvement. The groups studied by Burns and Stalker (1961) and Saxenian (1994) met these criteria and appeared to manifest the predicted patterns of social structure.

I had originally intended to conduct a field study but was not able to enlist suitable research sites. This difficulty led to abandoning the naturalistic approach for the more controllable laboratory experiment. Williams (1992) feels that traditional research (experimentation) is not a reliable way to demonstrate adaptation. He argues that non results can always be interpreted in two ways 1) the proposed adaptation does not exist or 2) it exists but the data show a show a restriction in its compass; i.e.; "adaptations perfected in the stone age are not expected to solve today's problems" (1992:39). Thus one could not make a convincing argument for the falsification of a theory on the basis of on non-results.

Symons (1989) recommends that adaptations be studied through ethnographic methods. To use this approach the researcher takes her understanding of the adaptation and deduces a "social engineer's ideal design" (1989:140) for fitness maximizing behaviours based on this understanding. The research question then becomes "given the particular circumstances in which the ethnographic subjects find themselves, and given the range of options available to them, how closely do their

actions approximate the engineering ideal" (1989:140). Also, if what we are trying to establish is the universality of this adaptation, that is, it is part of an innate human nature, then it would be preferable to conduct this investigation in more demographically and culturally diverse settings (Sherman & Reeves, 1997).

Thus the next research task in this program of research might be to work at more clearly defining the two forms of social structure and then conducting field based naturalistic research in a diverse number of settings to determine if the predicted relationship between resource context and social structure does manifest. This would contribute more to the understanding of social structure and its occurrence in real world work settings.

Dubin (1969), in his classic book on theory building, discusses a phenomenon he calls the paradox of power. He asks the question "why is it that we can create models of social behaviour that are powerful in contributing to understanding without providing, at the same time, precision in prediction" (1969:18). This is the opposite problem of being able to accurately predict outcomes without being able to explain why. Dubin suggests that the paradox of power is due in part to the necessity of focusing and simplifying to generate understanding and the developmental process of doing science. In our attempts to increase understanding by focusing on a narrow spectrum of a phenomenon and restricting our investigation to a few variables and relationships, we eliminate or disregard other variables crucial to the generation of precise predictions.

The issue of causation in the realm of human behaviour is, as noted above, complex. "Every organic system is so rich in feedback, homeostatic devices and potential multiple pathways that a complete understanding is quite impossible" (Mayr, 1961:1505). One element in a chain or a web of causation may be necessary but it may not be sufficient to account for a final observable outcome. Mayr (1961) also reminds us that "predictability is not a necessary component of causation" (1961:1506). Poor prediction could be an artifact of early theoretical development. Accurate predictions increase as models are refined and extended and early failures should not dictate the abandonment of early understanding. Results from this dissertation did not support the predicted outcomes. However, even if the experiment had met stringent validity standards it is still possible that the study's results would have been similar. They do suggest that additional variables such as gender need to be considered to further enhance the model. Further work needs to be done to begin to understand the mechanisms involved but the results of this dissertation clearly suggest these two areas as important.

CONCLUSION

There are many different ways to approach the completion of a doctoral dissertation. In this particular case an attempt was made to develop a new theoretical lens from work in areas that have not traditionally been considered by management researchers and to use this lens to view a phenomenon of interest to those who study

organizations. With the help of this lens and existing knowledge derived from research in a broad range of other disciplines, a theory was developed to explain why resource context might effect the nature of a group's social structure. This theory was then tested and in doing so future refinements and research approaches were identified.

Seeking knowledge in other disciplines and using this knowledge to understand a phenomenon of interest to practicing managers may not be the most traditional nor, in view of some, the safest strategy to follow (Reisman, 1988) but it does open up new vistas for the study of relevant issues. The bridging approach used in this dissertation has the paradoxical outcome of both opening up and bringing together. Adopting such a strategy to research is an attempt at "consilience" (Wilson, 1998); in this case, an attempt to forge connections between the natural and organizational sciences by proposing a link between evolutionary biology and social behaviour in organizations (White & Pierce, 1999). Wilson believes, and this dissertation demonstrates that:

> Most of the issues that vex humanity daily ... cannot be solved without integrating knowledge from the natural sciences with that of the social sciences and humanities. Only fluency across the boundaries will provide a clear view of the world, as it really is ... (Wilson, 1998:13).

This investigation is not a stand-alone research project but the beginnings of a larger and more challenging program of ongoing research. It is a fascinating proposition that resource context evokes social structure and the management of organizational resources and the influencing informal social structures are important managerial issues. Both this program and this researcher will continue to cross boundaries and build on a more integrated knowledge base to understand the origins of our social behaviour and the influence that humanity's deep history has on the successful functioning of modern organizations.

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EXHIBIT 1

PILOT PHASE GAME SCHEDULE

	Form	**Sex**	**# of Players**	**Puzzle**
September 29	Contest	Female	6	Pagoda
October 7	Contest	Female	5	House
November 9	Forage	Male	5	House
November 11	Forage	Female	6	House
November 16	Contest	Male	6	House
November 17	Forage	Male	5	House
November 18	Contest	Female	5	House
November 19	Contest	Male	6	House
November 23	Contest	Female	6	House
November 25	Contest	Male	5	Pagoda
December 2	Forage	Female	5	House

EXHIBIT 2

VICTORIAN MANSION - PICTURE

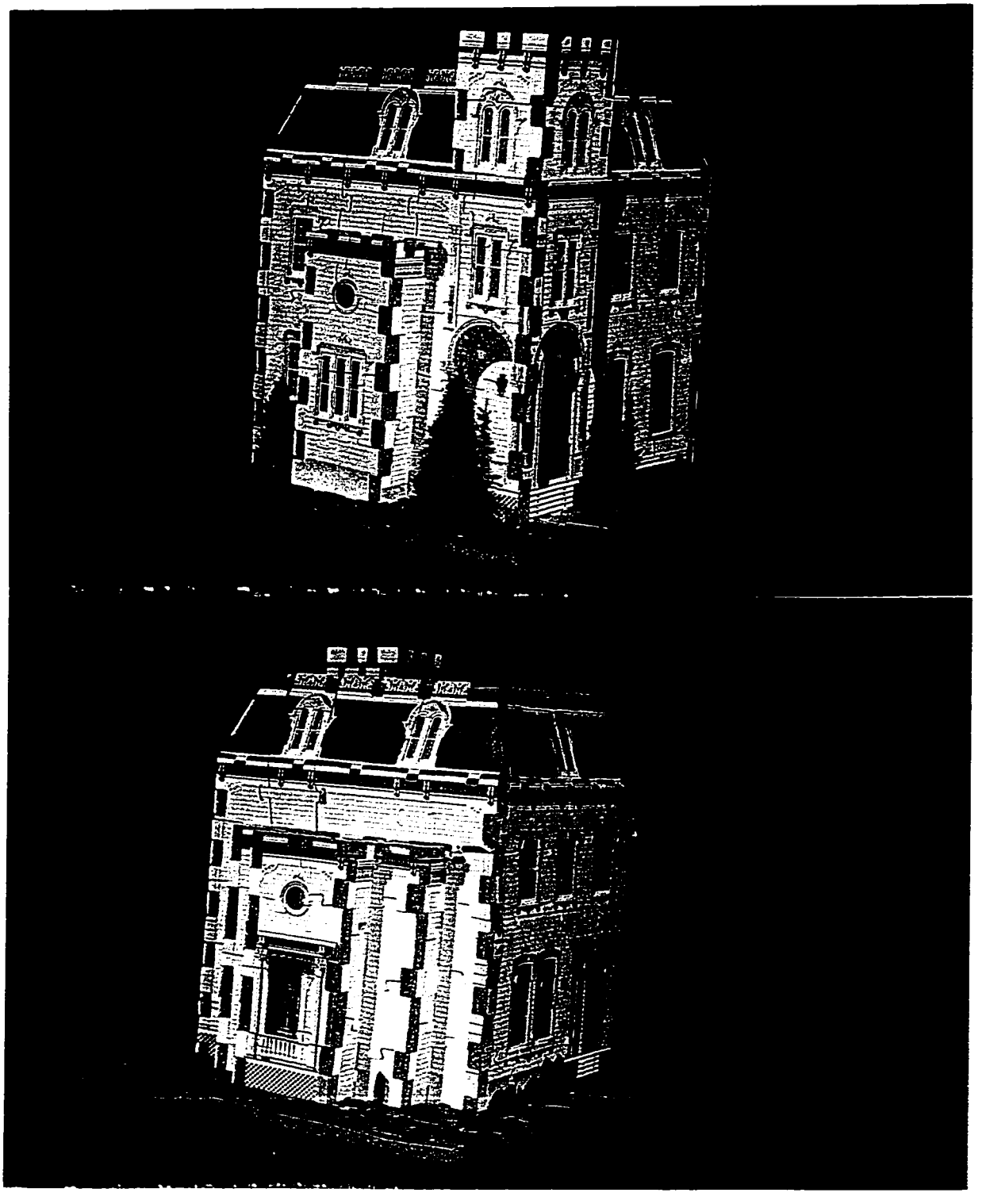


EXHIBIT 3

SHIPMENT SCHEDULE

5-Player Game

Time	Number of Bags in Shipment	Type of Bag
5:20	5	5(#4's)
5:40	3	3(#2's)
6:00	3	2(#2's) + 1(#3)
6:20	3	2(#3's) + 1(#1)
6:40	3	2(#3's) + 1(#1)
7:00	3	3(#1's)

6-Player Game

Time	Number of Bags in Shipment	Type of Bag
5:20	6	6(#4's)
5:40	3	3(#2's)
6:00	3	2(#2's) + 1(#3)
6:20	4	2(#3's) + 1(#2) + 1(#1)
6:40	4	3(#3'S) + 1(#1)
7:00	4	4(#1'S)

EXHIBIT 4

OCI SCALE ITEMS

Affiliative	
	Co-operate with others
	Deal with others n a friendly, pleasant way
	Think in terms of the group's satisfaction
	Show concern for people
	Use good human relations skills
	Treat people as more important than things
	Share feelings and thoughts
	Motivate others with friendliness
	Be open, warm
	Be tactful
Humanistic-Encouraging	
	Show concern for the needs of others
	Involve others in decisions affecting them
	Resolve conflict constructively
	Be supportive of others
	Help others to grow and develop
	Be a good listener
	Give positive rewards to others
	Take time with people
	Encourage others
	Help others think for themselves
Power	
	Act forceful
	Play "politics" to gain influence
	Be hard, tough
	Maintain unquestioned authority
	Stay on the offensive
	Build up their power base
	Personally run everything
	Conform
	Use the authority of their position
	Never relinquish control
Competitive	
	Out-perform their peers
	Be a "winner"
	Maintain an image of superiority
	Turn the job into a contest
	Compete rather than co-operate
	Be the center of attention
	Never appear to lose
	Always try to be right
	Be seen and noticed
	Win against others

EXHIBIT 5

SOCIAL STRUCTURE SCALES

AGONIC SCALE

tried to be a "winner"

acted forcefully, wanted their own way

were hard, tough

tried to outperform the others

competed rather than co-operated

tried to put others down

tried to dominate the discussion

turned the game into a contest

HEDONIC SCALE

cooperated with each other

dealt with each other in a friendly, pleasant way

showed concern for others

were helpful to others

encouraged others

respected the opinions of others

got along with others in the group

listened to the suggestions of others

EXHIBIT 6

SINGLE ITEM QUESTIONS

Item	Characteristic
I would work with this group again	Feelings
We made decisions as a group	Leadership
I felt uncomfortable playing the game	Feelings
I worked on my own	Leadership
Decisions were made by a few individuals in the group	Leadership
My friends should play this game	Feelings
People argued over what to do	Leadership
One or two individuals assumed a leadership role	Leadership
I felt at ease playing the game	Feelings
I worked with everyone in the group	Leadership
I had fun	Feelings
This was an unpleasant experience	Feelings

EXHIBIT 7

RECRUITMENT SCHEDULE

PILOT STUDY

September	21
October	9
	26
	27
	28
	29
	30
November	2
	4
	11
	13
	16

RESEARCH TRIALS

January	13
	14
	18
	19
	20

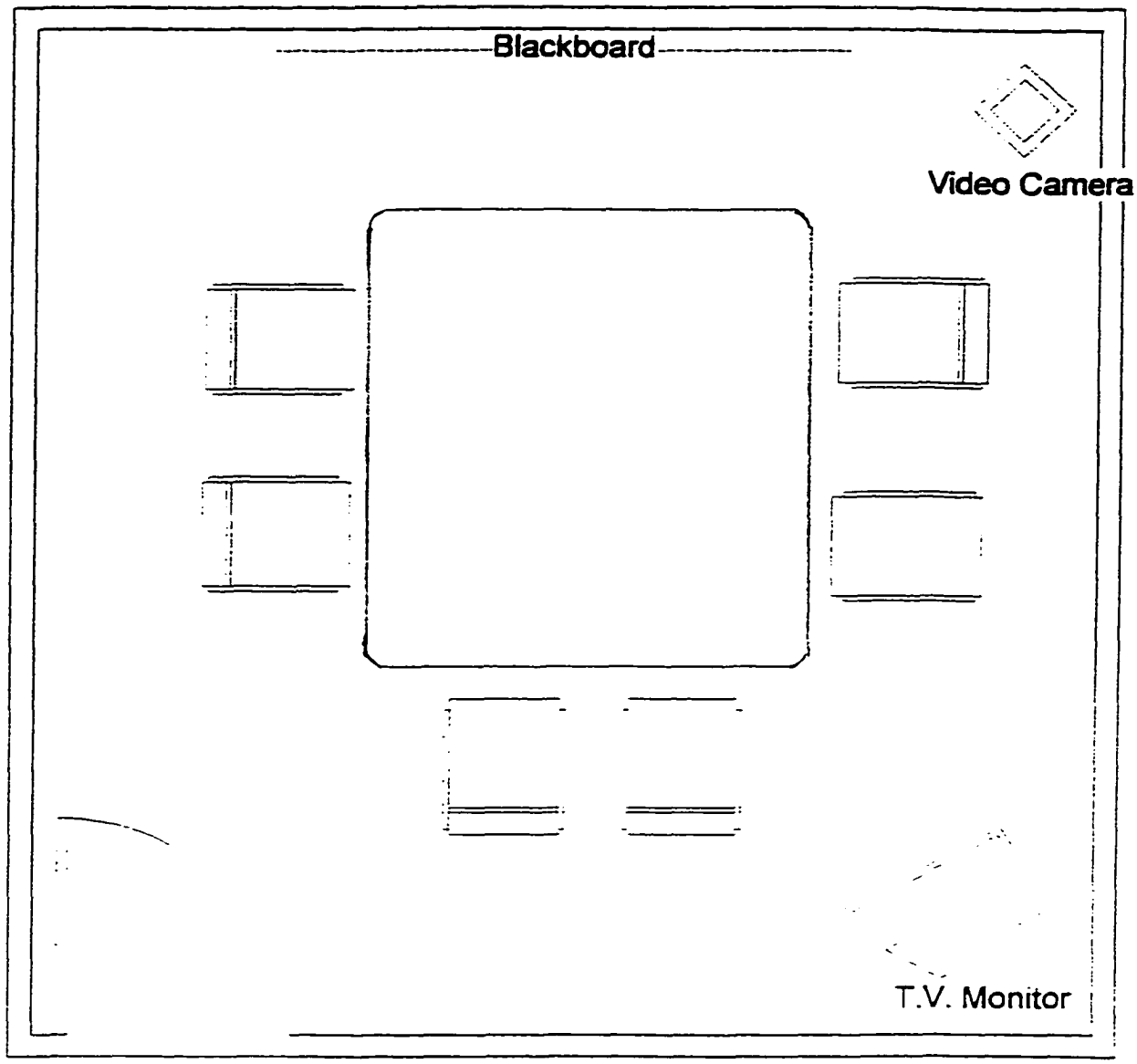
EXHIBIT 8

RESEARCH TRIAL GAME SCHEDULE

	Form	Sex	Number
January 18	Contest	Female	5
January 20	Forage	Female	6
January 21	Forage	Male	5
January 24	Contest	Male	5
January 25	Contest	Female	5
January 26	Contest	Male	6
January 28	Forage	Female	6
January 30	Forage	Male	5
January 31	Forage	Female	5
February 1	Contest	Male	6
February 2	Contest	Female	5
February 6	Forage	Male	5
February 7	Contest	Female	6
February 8	Forage	Male	5
February 9	Contest	Female	5
February 11	Forage	Female	5
March 3	Forage	Male	6
March 8	Forage	Female	5
March 9	Contest	Male	6
March 10	Forage	Male	6
March 11	Forage	Male	6

EXHIBIT 9

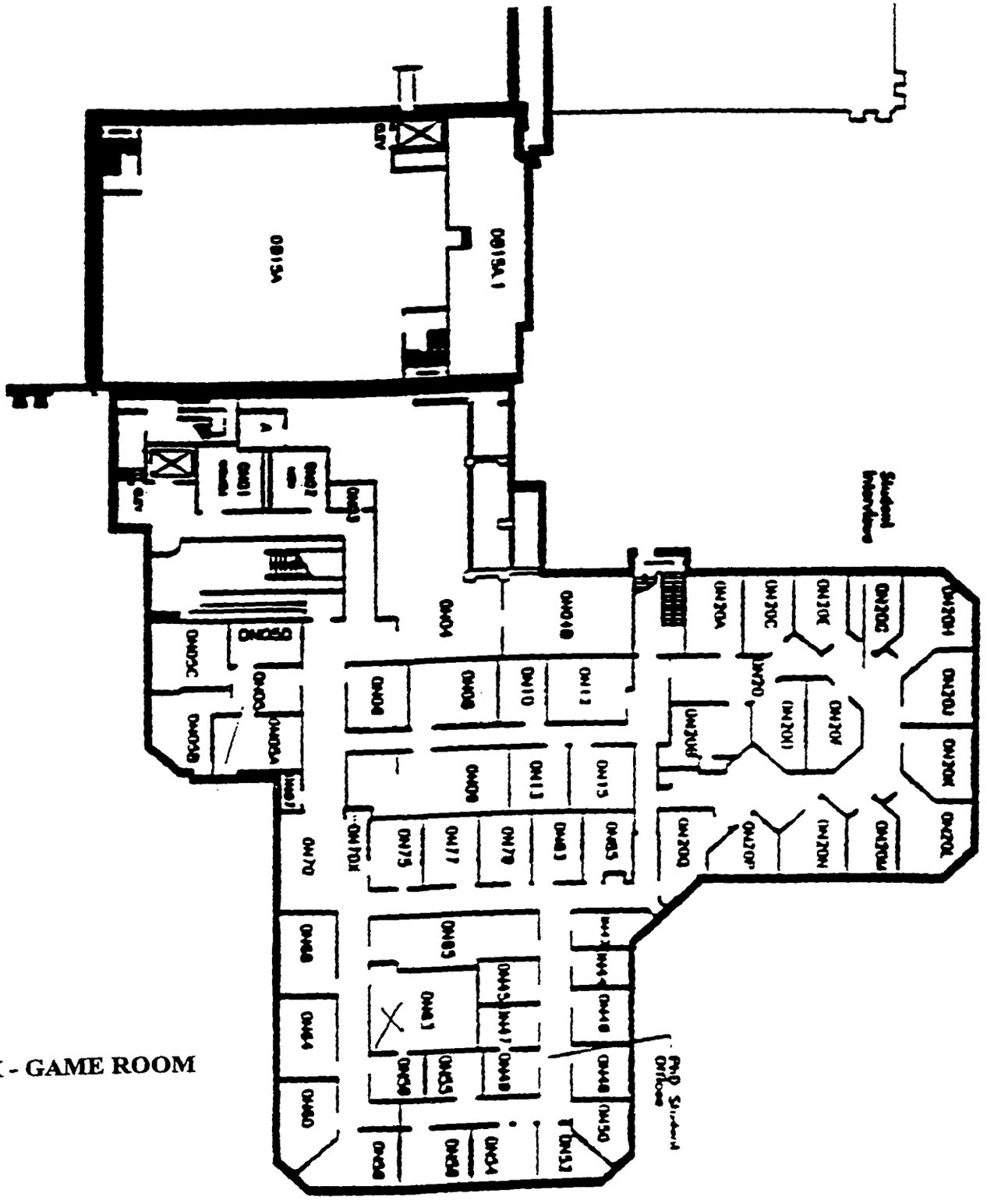
GAME ROOM SET UP



Interior Dimension
14ft 10in X 15ft 7in

EXHIBIT 10

FORAGE TERRITORY



X - GAME ROOM

APPENDIX A-1

RECRUITMENT ANNOUNCEMENT

Jigsaw Puzzle Game
Earn a little money - Have a lot of fun

- The game is played in groups of 6 players and involves constructing 3D jigsaw puzzles. You will be asked to play the game and to complete a short post game questionnaire.

- Everyone who plays the game is paid $15 for their time. Additional rewards of up to $25 are possible as part of the game.

- Games are played at the business school week-day evenings from 5:00pm to 8:00pm or week-end afternoons from 2:00pm to 5:00pm. You only play once.

Participation is not a requirement of this course and there is no connection between playing the game and your grade in this course.

APPENDIX A-2

PARTICIPANT INFORMATION SHEET

Jigsaw Puzzle Game - Participant Information

Name: _____

E-mail: _____

Local Phone Number: _____

Please Circle --- Male or Female

APPENDIX A-3

SESSION PREPARATION SHEET

Session Preparation - Construction Game

Session Date: _____
Gender: _____

Participants	Phone	OK
1. _____	_____	___
2. _____	_____	___
3. _____	_____	___
4. _____	_____	___
5. _____	_____	___
6. _____	_____	___
7. _____	_____	___

Game Room Set Up

- ◊ Video Recorder _____
- ◊ TV Monitor _____
- ◊ Names/time on chalk board _____
- ◊ Blank video tapes

Pre-game materials

- ◊ Puzzle pieces _____
- ◊ Contest instruction video _____
- ◊ Assignment sheets _____
- ◊ Game rules _____
- ◊ Boxes/instructions _____

◊ Pens _____
◊ Name tags _____
◊ Pop & Cookies _____

Post-game materials

◊ Post-game questionnaire _____
◊ Money _____
◊ Receipt form _____

APPENDIX B-1

ASSIGNMENT SHEET

Puzzle Construction Game
The Assignment

1. Thank-you for agreeing to help us develop this behavioural simulation. The main activity of the simulation involves playing a game. The objective is for each person to construct his or her own 3-Dimensional jigsaw puzzle. The rules of the game establish how you go about acquiring the puzzle pieces you will need to complete your puzzle.

2. If you participate in the game, you will receive a payment of $15. If you complete your puzzle within the time allotted for the game, you will receive an additional payment of $5 (for a total of $20). Completion money, the $5, is only paid to an individual for his or her completed puzzle, not to the group. If you are one of the first two players to complete the puzzle, you each receive a bonus payment of $25 (for a total of $45).

3. In a few minutes, you will receive a printed copy of the rules for your reference. Then you will be shown a video tape which reviews the game rules.

4. For the purposes of project development, activities in the game room will be video taped.

5. When the game is over you will be asked to answer a short paper and pencil questionnaire that is intended to help us in developing and refining the game.

6. Information collected in the post-game questionnaire is strictly confidential. No one will have access to questionnaire data or videotapes except the game developers; Professor Rod White and Game Director Barbara Pierce.

7. It is important that you do not know any of the other members of the group before starting the game. If you do please let the Game Director know now.

Participation in this game is not a requirement of any university program and there is no connection between playing the game and your grade in any course. You have the right to withdraw from the game at any time. If you decide to cease playing please advise the game director in room ON48. Compensation for those who withdraw is reduced to $5.

8. During the development phase of this simulation, a number of forms of the game are being tested. It is important that you not discuss the rules of the game that you played or what went on during the game with others that might play at some future time. We ask for your cooperation in this matter, as it is important to our results.

9. Payment for participation and puzzle completion will be provided when the post game questionnaire is submitted. If you feel you have completed your puzzle, the Game Director will check it. Approval of the Game Director is required to receive "completion" money. Bonus payments are determined based on the recorded times of puzzle completion and will be mailed to the two successful players.

10. Please complete the Consent Form below and hand it to the Game Director before beginning to play the game.

Rod White
Associate Professor
Richard Ivey School of Business
Room 1N33

Barbara Pierce
Game Director
Richard Ivey School of Business
Room 0N48

Puzzle Construction Game

- I have read the assignment sheet and agree to participate in the game.

- I understand that participation in the game is not a requirement of any course and there is no connection between playing the game and my grade in any course.

_____

Name (please print)

Signature _____ Date: _____

APPENDIX B-2

GAME RULES - CONTEST CONTEXT

Puzzle Construction Game - Rules
(6players)

1. Your task today is to complete an approximately 200 piece 3D jigsaw puzzle of a Victorian House. Each person is required to build his or her own House puzzle.

2. Each House puzzle has been divided into 4 sections or modules. Each module is 'stand-alone', in other words, it can be constructed independently of the other modules. The 4 modules fit together to form a completed House. You have been provided with pictures of the finished product which will assist you with your task.

3. The puzzle pieces for each module have been placed in a plastic bag and the bags labeled from 1 to 4. To complete your House you will need to acquire a set of bags numbered from 1 to 4, construct each module, and then combine the modules into the finished product.

4. All the puzzles are identical (i.e. a Victorian House). Since there are 6 people building puzzles, there are 6 puzzles each divided into 4 modules. This means that there are a total of 24 bags. Six labeled 1, six labeled 2, ..., six labeled 4.

5. The contents of every similarly numbered bag are exactly the same and therefore interchangeable i.e.; all bags numbered 1 have the same set of puzzle pieces. This means that any module 1 can be added to any module 2, to any module 3 ...etc. The pieces have been color-coded but this is not relevant to the game.

6. Beginning at 5:20PM, a shipment of 6 bags will be delivered to the game room. Subsequent bags will be delivered every 20 minutes according to the following schedule:

Shipment #	Time	# of Puzzle Bags
1	5:20	6
2	5:40	3
3	6:00	3
4	6:20	4
5	6:40	4
6	7:00	4

7. When you acquire a bag, you may (1) begin to *construct* the section or (2) choose to *delay* construction.

8. If you choose to delay, do not begin constructing the module. Instead, wait until the time of the next shipment and present your puzzle bag to the Game Director. You will receive an additional bag selected at random from the bags of that shipment. If you select the delay option you are trading off puzzle building time for the assurance of additional puzzle pieces. You may choose the delay option only for bags acquired from the first two shipments (5:20PM and 5:40PM).

9. Players may also choose to trade bags at any time.

10. Building a 3D puzzle can be a challenging task. Our experience so far is that from 1/2 to 2/3 of the players complete the task in the allotted time.

11. If you finish your puzzle before the game ends, please note the time of completion on the blackboard.

12. The game is declared ended when all the players have finished their puzzles or at 7:30 PM which ever comes first. Please advise the Game Director if all the players finish before 7:30PM.

APPENDIX B-3

GAME RULES - FORAGE CONTEXT

Puzzle Fabrication Game - Rules
(6players)

1. Your task today is to complete an approximately 200 piece 3D jigsaw puzzle of a Victorian House. Each person is required to build their own House puzzle.

2. Each House puzzle has been divided into 4 sections or modules. Each module is 'stand-alone', in other words, it can be constructed independently of the other modules. The 4 modules fit together to form a completed House. You have been provided with pictures of the finished product which will assist you with your task.

3. The puzzle pieces for each module have been placed in a plastic bag and the bags labeled from 1 to 4. To complete your House you will need to acquire a set of bags numbered from 1 to 4, construct each module, and then combine the modules into the finished product.

4. All the puzzles are identical (i.e. a Victorian House). Since there are 6 people building puzzles, there are 6 puzzles each divided into 4 modules. This means that there are a total of 24 bags. Six labeled 1, six labeled 2, ..., six labeled 4.

5. The contents of every similarly numbered bag are exactly the same and therefore interchangeable i.e.; all bags numbered 1 have the same set of puzzle pieces. This means that any module 1 can be added to any module 2, to any module 3 ...etc. The pieces have been color coded but this is not relevant to the game.

6. Module bags can be found within the game territory which is identified by the yellow area on the attached map. There are no bags in private offices.

7. Not all bags are available at the start of the game. At varying intervals additional bags will become available. However, by 7:00 PM all the bags will have been put into play.

8. Those responsible for placing the bags (game helpers) are mischievous and may re-locate bags. This means that there is no guarantee that bags found but not claimed will remain at their original site.

9. It is important to note that if partially completed puzzles are left unattended outside the game room, there is a strong possibility that they will be confiscated by the game helpers.

10. However, the game room is a safe zone and puzzles constructed there are not at risk from the game helpers.

11. Building a 3D puzzle can be a challenging task. Our experience so far is that from 1/2 to 2/3 of the players complete the task in the allotted time.

12. If you finish your puzzle before the game ends, please note the time of completion on the blackboard.

13. The game is declared ended when all players have finished their puzzles or at 7:30 PM which ever comes first. Please advise the Game Director if all players finish their puzzle before 7:30PM.

APPENDIX C-1

POST GAME QUESTIONNAIRE

PUZZLE GAME - 6 PLAYERS
POST-GAME QUESTIONNAIRE

QUESTION A

The following statements describe how people in a group might act. Please read the statements below. On a scale where "1" indicates "**No players**" and "6" indicates "**All players**" circle the number that best describes your feelings about the number of those in your group who acted in the manner described . For example, if you felt that 3 of the 6 players in your group "seemed interested in the game" you would circle "3" as below:

	No Players						All Players
1. Seemed interested in the game	0	1	2	3	4	5	6

Statements:

	No Players						All Players
1. Cooperated with each other	0	1	2	3	4	5	6
2. tried to be a "winner"	0	1	2	3	4	5	6
3. acted forcefully, wanted their own way	0	1	2	3	4	5	6
4. dealt with each other in a friendly, pleasant way	0	1	2	3	4	5	6
5. showed concern for others	0	1	2	3	4	5	6
6. were hard, tough	0	1	2	3	4	5	6
7. tried to outperform the others	0	1	2	3	4	5	6
8. were helpful to others	0	1	2	3	4	5	6

	No Players						All Players
9. tried to put others down	0	1	2	3	4	5	6
10. competed rather than co-operated	0	1	2	3	4	5	6
11. encouraged others	0	1	2	3	4	5	6
12. respected the opinions of others	0	1	2	3	4	5	6
13. got along with others in the group	0	1	2	3	4	5	6
14. listened to the suggestions of others	0	1	2	3	4	5	6
15. tried to dominate the discussion	0	1	2	3	4	5	6
16. turned the game into a contest	0	1	2	3	4	5	6

QUESTION B

Please read the statements below and on a scale where "1" indicates **Strongly Disagree** and "7" indicates **Strongly Agree**, circle the number that best describes your feelings. For example, if you strongly agree that "3D Puzzles are difficult to build" you would circle "7" as below:

	Strongly Strongly Disagree			Neither Disagree or Agree			Agree
1. 3D Puzzles are difficult to build	1	2	3	4	5	6	7

	Strongly Disagree			Neither Disagree or Agree			Strongly Agree
1. I would work with this group again	1	2	3	4	5	6	7
2. We made decisions as a group	1	2	3	4	5	6	7
3. I felt uncomfortable playing the game	1	2	3	4	5	6	7
4. I worked on my own	1	2	3	4	5	6	7
5. Decisions were made by a few individuals in the group	1	2	3	4	5	6	7
6. My friends should play this game	1	2	3	4	5	6	7
7. People argued over what to do	1	2	3	4	5	6	7
8. One or two individuals assumed a leadership role	1	2	3	4	5	6	7
9. I felt at ease playing the game	1	2	3	4	5	6	7
10. I worked with everyone in the group	1	2	3	4	5	6	7
11. I had fun	1	2	3	4	5	6	7
12. This was an unpleasant experience	1	2	3	4	5	6	7

THE GAME

Please **circle** the number that most closely represents your opinions on the following:

1. Game instructions - video	Very clear	1 - 2 - 3 - 4 - 5	Hard to understand
2. Game instructions - written	Very clear	1 - 2 - 3 - 4 - 5	Hard to understand
3. Group size	Too small	1 - 2 - 3 - 4 - 5	Too large
4. Difficulty of task	Too difficult	1 - 2 - 3 - 4 - 5	Too easy
5. Interest in the task	Interesting	1 - 2 - 3 - 4 - 5	Boring
6. Game room	Too large	1 - 2 - 3 - 4 - 5	Too small

We are interested in how you perceived the allocation of puzzle bags. Consider the two phrases on each line and **circle** the one phrase that most clearly captures your perception:

bags were all in one place	or	bags were scattered in many places
bags arrived at regular intervals	or	never knew when bags would arrive
saw each bag acquired	or	didn't see all bags acquired
when I got one I could build	or	when I got one I could wait and be assured of additional bags in the future

Do you have any suggestions that would help us improve the game:

_____
_____
_____
_____
_____
_____
_____
_____

We will be testing our game format with a number of students and adjusting the game as we go along. It is important therefore that you do not discuss the game or your experience with others until we have finished our testing. At that time we will send you a letter with information about the results.

Thank you for your participation! We hope you had an interesting and enjoyable time.

Barbara Pierce
Rod White
Principle Game Developers.

Date Played _____

Code Number _____
(to be assigned by game director)

Please print

Player name: _____

Address: _____
(school) _____
_____

Postal Code: _____

APPENDIX C-2

RECEIPT

Participation Payments

On _____ I received the following payment for participating in the Puzzle Game development project.

Name	Amt.	Signature
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

APPENDIX C-3

POST GAME LETTER

April 8, 1999

Hi!
Thanks for participating in the Puzzle Game. It was very helpful for me and I hope enjoyable for you. As promised I am writing to let you know more about the design of the research and what I was trying to determine. I study organizational social structures, that is, the roles and relationships which develop in work groups or teams. Social structures are emergent phenomena which cannot be deigned. They develop as people work together. My interest is in understanding contextual factors which contribute to the form of social structure which develops. There are two predominant forms of social structure - hierarchical and egalitarian. My theory predicts that the form of social structure which emerges depends on the way in which managers configure resources.

The puzzle game had two resource configurations. In one form of the game, resources were brought to the game room at regular intervals. Since there was often fewer resources (puzzle bags) than players, the situation (context) evoked competition. In this case, a hierarchical social structure should emerge. In the other form of the game, players had to scavenge for resources. They were scattered at locations outside the game room. In this resource context a more egalitarian social structure should emerge.

This research is the basis of my doctoral dissertation. We will not be using the game as a behavioural simulation. The data is being analyzed now and I should have preliminary results soon. Any who are interested or would like to discuss this with me further are encouraged to contact me here at Ivey.

Thanks again and best luck in your exams.

Sincerely,

Barbara Pierce
679-2111 x-5546

APPENDIX D

ETHICS APPROVAL

Richard Ivey School of Business
The University of Western Ontario

IVEY

Research and Development Office

March 1, 2000

To whom it may concern:

The Ethics Committee has approved the ethics submission for Barbara Pierce. The title of the proposal is: An Investigation of the Relationship Between Resource Context and Social Structure.

Sincerely,

Daphne Stevens

Daphne Stevens
Director, Research and Development

[illegible] Richmond Street North
London Ontario Canada N6A 3K7
E-mail: info@ivey.uwo.ca
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APPENDIX E

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EPILOGUE

"So I have come to recognize that the reason I devote myself to research, and to the building of theory, is to satisfy a need for perceiving order and meaning, a subjective need that exists within me. I have, at times, carried on research for other reasons – to satisfy others, to convince opponents and sceptics, to get ahead professionally, to gain prestige, and for other unsavoury reasons. These errors in judgement and activity have only served to convince me more deeply that there is only one reason for pursuing scientific activities, and that is to satisfy a need for meaning which is in me."

Carl Rogers
On Becoming a Person
1961

VITA

Name:	Barbara Decker Pierce
Place of birth:	London, Ontario
Year of birth:	1949
Post secondary Education and Degrees	The University of Western Ontario London, Ontario 1968-1971 B.A.
	University of Toronto Toronto, Ontario 1971-1973 M.S.W.
	The University of Western Ontario London, Ontario 1991-1993 M.B.A.
	The University of Western Ontario London Ontario 1993-2000 Ph.D.
Honours and Awards	Social Sciences and Humanities Research Council Doctoral Fellowship 1994 - 1997
	The University of Western Ontario Admission Scholarship1994-1997
	Richard Ivey School of Business Special University Scholarship 1994-1997
	Citibank Award 1992
	Dean's Honour List 1992 & 1993
	European Foundation for Management Development (efmd) 1995 Case Writing Competition 1st - European Strategy Management Sabena Airlines (series of 5 cases & teaching note) co-author with Professor Mary Crossan
	1997/98 - Dean's Honour Roll for Teaching Excellence King's College

Related Work

1997-1998 Instructor
Richard Ivey School of Busines

1996-1998 Instructor
King's College, School of Social Work

Publications

Note: The Evolution of Social Structure: Why Biology Matters
Barbara Decker Pierce & Roderick White
Academy of Management Review
October 1999.

Rebuttal: From Apes to Academics: A Bridge Under Construction
Roderick White & Barbara Decker Pierce
Academy of Management Review
October 1999

Book Review: *Staying Human in the Organization* and *Emotions in Command*
Managerial and Decision Economics
Barbara Pierce & Roderick White
1998

Multicultural Research: A Lesson in Cultural Diversity
Book Chapter In: Internationalizing Doctoral Education in Business
S. Tamer Cavusgil & Nancy E. Horn (eds.)
Michigan State University Press
1997

Publishing International Business Research: A Survey of Leading Journals
Barbara Pierce & Garnet Garven
Journal of International Business Studies
First Quarter 1995

Educating for Change
Roderick White, Barbara Pierce & James Rush
Business Quarterly, Winter 1994