

# Resource context contestability and emergent social structure: an empirical investigation of an evolutionary theory

BARBARA DECKER PIERCE<sup>1\*</sup> AND RODERICK E. WHITE<sup>2</sup>

<sup>1</sup>*King's University College School of Social Work, The University of Western Ontario London, Ontario, Canada*

<sup>2</sup>*Richard Ivey School of Business, The University of Western Ontario London, Ontario, Canada*

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## Summary

Using evolutionary theory as its underlying perspective this research explores the relationship between evolved social behaviors; specifically emergent social structures, and the ecology of the social group; specifically the contestability of the resource context. Contexts where resources are clustered, predictable, and visible, and where consumption is delayed are highly contestable. When resources are dispersed, unpredictable, and concealed and consumption is immediate the context is less contestable. In our ancestral environment this variation in resource context posed differing adaptive problems for the formation and maintenance of social groups. Different social structures evolved to solve these different problems. The relationship between contestability of the resource context and emergent social structure was tested in an experiment employing 114 subjects over 21 trials. Individuals operating in a low contestable resource context perceived a more egalitarian, hedonic-like social structure; those functioning in a high contestable context reported experiencing a more hierarchical, agonistic-like social structure. These findings support the theory that our response to social situations is determined by an endogenous component, our evolved human nature, in combination with an exogenous component, the character of the ecology within which the group forms and functions. While the endogenous component is a product of the evolutionary process and largely beyond the influence of management, the ecological component, the perception of the resource context can be affected by managerial action. Implications for researchers and managers, and areas for continued investigation are explored. Copyright © 2006 John Wiley & Sons, Ltd.

## Introduction

Since the time of Elton Mayo and the studies of workers at Western Electric's Hawthorne Works (Homans, 1950; Roethlisberger, Dickson, & Wright, 1947) managers have known that interactions among people who populate organizations are not narrowly determined by formal design. People

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\* Correspondence to: Barbara Decker Pierce, King's University College School of Social Work, The University of Western Ontario, 266 Epworth Ave, London, Ontario, Canada, N6A 2M3. E-mail: bpierce3@uwo.ca

are social creatures and as such, bring to social situations a set of expectations and a repertoire of behaviors for interacting with others. In combination and over time, repeated patterns of social interaction among individuals constitute stable relationships resulting in the emergence of stable social structures. They are the 'rules and resources, or sets of transformation relations, organized as properties of social systems' (Giddens, 1984, p. 25). It is well accepted that social structures play an important role in influencing the behavior of members of an organization: who interacts with whom; who leads and who follows; what is noticed and what is ignored. We propose that the structuring of social relationships is a basic feature of our human nature with the resulting social forms deeply rooted in the evolutionary history of our species.

Social structure is an emergent phenomenon best described as self-organizing. Through the interactions of its individual elements a system can organize itself into a macroscopic state manifesting in a well-defined structure (Briggs & Peat, 1989; Haken, 1984). Order or structure can emerge without the intervention of an external supervising agent (Dalenoot, 1989). When systems are open to their environment the process of self-organization is also influenced by factors outside the system. Open systems are responsive to their surrounding environment and consequently the environment has profound influence on resulting configurations (Wheatley, 1992). Thus structural patterns that emerge are contingent on the interaction of systems elements, characteristics of the initial environmental starting conditions and feedback concerning alteration of these elements and conditions over time. The resulting structure is not designed or imposed by an external actor such as a manager or supervisor, but arises instead from the 'natural' inclinations of its constituent parts in response to particular contextual cues and conditions (Fiske, 1991).

Emergent structures possess characteristics of their own; properties distinct from those of the individual elements that comprise them. Features such as cohesion, hierarchy, and consensus are examples of properties of a group not of any single individual within the group. Johnston (1999) refers to these macro level traits as emergent properties—arising as they do from a process of self-organization. What determines the nature of these structural traits and emergent properties? Johnston suggests 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 emergent properties constitute a social structure. In particular ecologies certain social structures better sustain the group and thus convey a survival advantage to the individuals within groups exhibiting those structures.

When the elements of the system under consideration are members of an organizational work team, this self-organizing process can produce a stable pattern of social connections, a social structure. These emergent linkages will determine the roles assumed and relationships established among individual team members. The emergent pattern of social relationships is not dependent upon criteria imposed by a central authority, although it can be affected by consciously considered, formally imposed rules. Rather it is fashioned by an 'unselfconscious process' (Alexander, 1987). To understand the emergence of social structure requires an appreciation for both the natural inclinations (endogenous models) people bring to a social situation as well as the contextual cues (exogenous triggers) that influence the outcome of the emergent process.

Because this type of self-organization is sensitive to contextual cues there need not be just one form of social structure. Depending on environmental conditions, structure can manifest in several forms. While much has been done to identify the various forms or typologies of social structure (Burns & Stalker, 1961; Fiske, 1991; MacCrimmon & Messick, 1976; Mead, 1937) less effort has been directed toward identifying the exogenous triggers that influence form. How do environmental or ecological conditions affect the emergence of particular forms of social structure? Pierce and White began

investigating this question by considering the emergence of social structure in non-human primate groups (Pierce & White, 1999). Drawing on existing research in ethology, socio-ecology and evolutionary psychology they developed a theory, using socio-evolutionary arguments, explaining how the contestability of a group's resource context could trigger certain kinds of social relationships and thus the emergence of particular forms of social structure.

Identifying contextual triggers is relevant to management inquiry because while managers can do little to alter the innate or evolved tendencies that people bring to social situations, they do have significant influence over the nature of the work context. Knowing what contextual conditions trigger different forms of social structure can provide powerful insight for managers and direct their attention to those conditions influencing the nature of social relations within their organizational work groups. In this article we revisit socio-evolutionary theory to establish the rationale for the relationship between resource context and social structure. Then we explore the relationship empirically to determine if there is observable evidence to support the theoretical proposition. Do social structures emerge in the forms predicted by the theory? Lastly we consider how managers can influence the emergent form of social structure in organizational work groups.

## A Socio-evolutionary Theory of Social Structure

In our ancestral environment, evolution was about survival and reproductive success; which in turn were about deterring predation and acquiring scarce resources like food, water, mating privileges, and assisted child rearing. In this view evolution concerns the acquisition of resources by self-interested individuals. Yet humans (and proto-humans) evolved as a social species because there are a number of survival advantages to living in groups (Barchas, 1986). However, there is also a major disadvantage—conspecifics (other members of the group) competing for the same resources. Socio-evolutionary theory attempts to understand how evolution has resolved this adaptive problem; the apparent dilemma between cooperation within groups and competition among group members—'competition amongst cooperators' (Campbell, 1983, p. 13).

The solution to this dilemma is found in social structure, but not just a singular social structure. Different resource contexts favor different resource acquisition tactics and therefore present different challenges to the interplay of individual competition and group cohesion. Different social structures evolved to address the challenges to group maintenance presented by different ecologies. Evolved behaviors are not necessarily fixed. Flexible (or facultative) behaviors can evolve whenever the ecological context is variable and this variability can be detected by the organism (Winterhalder & Smith, 2000). This theory proposes that the nature of individual social relationships and thus the group's emergent social structure is affected by the contestability of the resource context within which the group forms and functions.

## Dimensions of Contestability and of Social Structure

Drawing upon the socio-ecological literature Pierce and White (1999) identify four salient dimensions of resource contestability: distribution, predictability, visibility and timing. Ecologies where resources are 1) clustered together in 2) predictable locations with 3) individual acquisition highly visible to

Table 1. Features of agonistic and hedonic social structures

Feature	Agonic	Hedonic
Social cohesion	Continuous (single troop)	Periodic (fission/fusion)
Individual attention	To others within group	Directed at physical environment
Attention to central figure	Singular, dominant leader	Multiple situational leaders.
Responsive to external threat	Group clusters; looks to dominants for protection	Group bolstering; individual response as needed
Arrangements of individuals	Spatially separated (respectful distance)	Close contact (hugging/touching)
Social Interactions	Fight or submit	Tend and befriend
Relationships	Hierarchical (dyadic pecking order)	Egalitarian (network of equals)
Arousal/Social Stressors	Frequent (medium to high)	Infrequent (low to medium)

Source: adapted from Chance (1963) and Pierce and White (1999).

other members of the group, and where 4) consumption is delayed are considered to be highly contestable. Resource acquisition tactics in such contexts necessitate direct competition among group members. In other situations resources are 1) scattered about in a variety of 2) unpredictable locations. Individual members split off from a group to forage for resources often acquiring them 3) outside the view of other group members and 4) consuming them immediately upon their acquisition. Under these ecological conditions resources are much less contestable. Pierce and White (1999) connect the contestability of a group's resource context to the two modes of social structure identified by Chance (Chance, 1963; Chance & Jolly, 1970). After extensive observation of non-human primate (apes and monkeys) communities, Chance described two different types of social structure: agonistic and hedonic.<sup>1</sup> In agonistic groups individuals assume dominant or subordinate roles and resource prerogatives accrue to the dominant, often despotic, leader. Life in such groups, particularly for subordinate members, is full of anxiety and stress (Virgin & Sapolsky, 1997). In hedonic groups members share decision-making, with situational as opposed to positional leadership, the norm. Members of these groups exhibit positive affect concerning group membership, and experience much less stress arising from membership in the group.

The differing features of these social structures are detailed in Table 1.

## Linking Contestability and Social Structure

When resources are highly contestable a hierarchical (agonistic) social structure emerges. Alternatively when resources are less contestable, a social structure emerges that fosters more cooperative egalitarian relationships (hedonic). It is believed humans and the common ancestor we share with other primates evolved in both types of ecology (de Waal, 2001). Consequently our species has the ability to alter social relationships based upon the perception of environmental cues. This theory assumes each individual's perception of the contestability of the resource context affects how group members interact with one another and thus influence the group's emergent social structure. The individual's perception of the resource context is an important consideration because the locus of social relationships is

<sup>1</sup>Using primates to aid in understanding evolved human behavior is well accepted in many of the social sciences (Rodseth, Wrangham, Harrigan, & Smuts, 1991; Wrangham, 1987). And interestingly it is not entirely new to the organizational sciences (Cullen, 1997; White & Pierce, 2000). Maslow's original work was with non-human primates (Maslow, 1940).

cognitive (Fiske, 1991, p. 323). 'The standard for determining what kind of social relationship is operative . . . is the conception each person has of what the relationship is (Fiske, 1991, pp. 18–19).' The dyadic relationship is the foundation of social structure and originates at the individual level of perception. Agonic social structures emerge when individuals perceive the resource context to be highly contestable; hedonic when the perceived cues indicate a less contestable context. In contestable habitats resources are encountered by the whole group and acquired by individuals through direct competition or contest with conspecifics. In less contestable contexts individuals separate from the group and forage to meet their needs. The ecological configuration of a group's resources is the salient characteristic. In a contestable context it is feasible for a dominant individual or a small coalition to exercise power over resource acquisition by other members of the group. The dominants can control concentrated, visible and predictable resources and thereby maintain power over others in the group. In less contestable conditions, where every individual forages for access to dispersed, hidden and unpredictable resources, would-be dominants cannot intercede between the individual and their acquisition of resources.

Both approaches to resource acquisition (contest and foraging) present serious but different problems for the formation and ongoing cohesion of groups (Wrangham & Peterson, 1996). Because of their ultimate consequences for survival and reproductive success these problems are not to be taken lightly. Barchas concludes, 'over the course of evolution, the small group became the basic survival strategy developed by the human species' (Barchas, 1986, p. 212). Group living deters predation and can increase food resources enhancing the likelihood of individual survival. Thus threats to group formation and cohesion diminish individual survival. Consistent with evolutionary theory, it is probable that forms of social adaptation arose to deal with problems of group cohesion, and exploit the survival advantages inherent in group living.

Pierce and White (1999) maintain the explanation for the observed relationship between resource context and social structure is evolutionary. They suggest social structure is an adaptive function (Kummer, 1971) that evolved, at least in part; to solve the problems of creating and maintaining social groups within different resource conditions. 'The agonic mode establishes hierarchical procedures for resource allocation among group members thereby limiting destructive (to the group) competition. The adaptive problem of group maintenance within contestable resource context has been resolved by the agonic mode of social structure.' (p. 886). In forage contexts resource acquisition draws the group members apart. Their adaptive problem is bringing the group back together. Therefore 'in the hedonic social structure members engage in interpersonal bonding activities . . . these rich forms of social interaction evoke positive feelings, increasing the likelihood that even when individuals are separated by resource acquisition activities, they will return to their group on a regular basis.' (p. 886). While there may be a universal need to belong to a group (Maslow, 1943; White & Pierce, 2000), socio-evolutionary theory predicts individuals have very positive affect related to hedonic group membership.

Groups adopt social structures enabling them to resolve the different problems posed by different resources contexts. Group maintenance within a high contestability resource context requires a social structure that ameliorates competition among group members. Low contestability contexts demand a social structure that will bring the members back together. The members of groups adopting a social structure suited to the contestability of their resource context have a survival advantage over groups that do not. Table 2 summarizes the relationship between social structure and resource contestability.

Variations in social structure were selected due to their contribution to individual survival, and retained as endogenous models of social behavior. When thinking of evolution and behavior it is helpful to distinguish between proximate and ultimate (or distal) explanations (Borgerhoff Mulder, 1991). Evolution selects for behaviors that enhance survival and reproductive success. Genes are the biological mechanism by which these behavioral predispositions are retained and passed from generation to generation. An ultimate explanation describes why a particular behavior or set of behaviors would

Table 2. Relationship linking contestability and social structure

	High contestability	Low contestability
Resource are:	Concentrated Predictable Visible Delayed consumption	Dispersed Unpredictable Not visible Immediate consumption
Acquisition Tactics	Contest	Forage
Adaptive Problem	Group Cohesion	Group Formation
Solution	Agonic Social Structure – competitive – hierarchical – despotic decision making – negative affect	Hedonic Social Structure – cooperative – egalitarian – joint decision making – positive affect

have been functional (i.e., provided a survival advantage) in our ancestral environment and thus have the potential to be encoded in the genome. It does not explain the proximate mechanisms and motivators that 'cause' this behavior to be exhibited.

Genes express themselves in our physiology, endocrinology, and cognitive processes thus enabling or predisposing certain behaviors. These biological characteristics are the proximate manifestations of the ultimate explanation. Even though Wilson (1998) points to the future potential for cross disciplinary research to link distal and proximate explanations, all current researchers treat some parts of this process as a black box. In proposing that certain variations in group social structure were selected for because they contributed to the survival of the group members and were retained as endogenous models of social behavior we have adopted the perspective of behavioral ecologists. Our primary interest is to identify the selective forces that shaped behavior (and social structures) in our ancestral environment, leaving the discovery of the genetic mechanisms and proximate motivators to other scientific disciplines (Gafen, 1984).

## From Non-human to Human Primates

The social relations among humans working in modern organizations are likely more complex and textured than those found among apes and monkeys. But the foundations remain and the essence of these modes can be identified in many typologies and descriptions of contemporary human social interactions. Wedgwood-Oppenheim (1988) observed:

The parallel between the classification of modes of social interaction in primates and organizational culture . . . is sufficiently strong to suggest that basic organisational culture types are not just products of industrial society, but may be based on fundamental social forces that human beings share with other primates. (p. 319)

Examples of parallels between non-human primate social structure modes and typologies developed from the investigation of the social interactions of human actors are described in Table 3. Hedonic social structures are similar to the Communal Sharing form of Fiske's relational model (Fiske, 1991) and cooperative/altruistic social relations described by MacCrimmon and Messick

Table 3. Comparison of social structure typologies

	Chance	Burns and Stalker	MacCrimmon and Messick	Fiske
Names for Social Structures	Hedonic Agonic	Organic Mechanistic	Cooperative/ Altruistic Competitive/ Aggressive	Communal Sharing Authority Ranking
Descriptors of hedonic-like type	Sharing, outward focus	Network commitment	Charitable, helping	Cooperative, belonging
Descriptors of agonic-like type	Agonistic display inward focus	Hierarchical obedience	Hurting, get ahead	Dominance, deference
Unit of Analysis	Primate groups	Organization departments	Individual actors	Communities/ Societies
Linked to Ecology	Yes*	Yes	Yes	No

(\*) added by Power (Power, 1988) and Pierce and White (1999).

(MacCrimmon & Messick, 1976) and the organic form identified by Burns and Stalker (1961). Alternatively, echoes of agonic social structure can be heard in Fiske's authority ranking form, MacCrimmon and Messick's competitive/aggressive relations, and Burns and Stalker's mechanistic form.

Social relationships with similar themes are also identified in archeologists' studies of human pre-history (Issac, 1978; Knauff, 1991; Whallon, 1989) as well as anthropologists' descriptions of African hunter-gatherer communities (Cashdan, 1980; Lee, 1979; Lee & DeVore, 1976; Tanaka, 1980) and other traditional societies (Mead, 1937; Testart, 1982; Woodburn, 1982). These commonalities are explicable if social structure has its roots in evolution (White & Pierce, 2000). As Fiske explains '... any model that is fundamental, elementary and universal in human social relationships has to be phylogenetically situated and we must ultimately account for it as a product of natural selection...' (Fiske, 1991, p. 199). All primates, human and non-human, share a common ancestor and human ancestors proved adept at adjusting to different ecologies. Evolution does not discard adaptations but uses them as building blocks for further adaptive adjustments. Whatever the modern day manifestation of social structure, it is likely that vestiges of hedonic and agonic structure remain embedded in the social interactions of modern humans. If so this theory is testable. The theory predicts that different (social) behaviors will be evoked by different resources contexts.

## Testing the Theory

Variation in the contestability of the resource context leading to differing patterns of social relationships and consequently the emergence of different social structures has not been explored empirically in human groups. Testing this theory requires examining the phenomenon of emergent social structure under differing resource contexts in a way consistent with the theory. In order to manipulate the resource context and achieve controlled conditions we conducted an experiment. We knew such a design would limit generalizability. However, we need to demonstrate that the proposed relationship exists at all, in any human group, before being concerned if it is present in complex work groups in real organizations. This trade-off was reasonable given the early stage of development for this theory.

In this initial experiment the independent variable was contestability of the resource context, and the dependent variable was individual perceptions of social relationships (i.e., the precursor to emergent social structure). Our research question was: does resource contestability influence the form of emergent social structure in human groups? Our hypotheses were as follows:

*Hypothesis 1a:* Individuals functioning in a resource context where contestability is low will perceive more hedonic-like social relationships among group members than individuals operating in a resource context where contestability is high.

*Hypothesis 1b:* Individuals functioning in a resource context where contestability is high will perceive more agonistic-like social relationships among group members than individuals operating in a resource context where contestability is low.

## Organizational Context

Students used as subjects for this study attended the University of Western Ontario and its affiliated colleges. Western, founded in 1878, is a large (29,000 students) government supported public institution of higher learning offering a full range (60 programs) of undergraduate, graduate and professional programs. It is located in London Ontario Canada, a community of 325,000 situated in southwestern Ontario. The university draws its student population from across Ontario and Canada as well as attracting a large contingent of foreign students from countries around the world. It has an excellent reputation and in the most recent annual ranking placed third among Canadian medical—doctoral Universities.

Students were recruited from first and second year undergraduate business education classes and volunteered to participate in the study. While we agree that to some extent students were used because they are readily available and inexpensive we also believe the phenomenon under investigation is universal in nature and should manifest in all social groupings. Thus we would argue that for exploratory research evidence of predicted patterns among groups of university students would be of interest. It has been suggested that students are a narrow base upon which to build theories of human behavior (Sears, 1986). However, the students used in this research did reflect a wider demographic profile than students commonly used in the 1970's and 80's. Western and the Province of Ontario's student support systems enable qualified students from a wide range of socio-economic backgrounds to attend post secondary education. Additionally steadily increasing numbers of mature students are attending university now resulting in a broader range of ages being represented in student subject groups.

## Methods

114 undergraduate freshman or sophomore business students participated in the experiment. Subjects were randomly assigned to same-sex groups of either 5 or 6 participants and a check was made to ensure the subjects had no pre-existing social relationships with any of the other subjects in their group. Individuals were then randomly assigned to groups and groups were randomly assigned to

one of two treatment conditions either the forage context or the contest context. Groups were comprised of either all males or all females. We were concerned that mixed-sex groups would introduce competition related to mating resources. We chose same-sex groups because we wanted to eliminate the possibility of this potential confounding effect. The intent was to experimentally manipulate only the resource relevant to the specified task and control for all other resources and tasks.

Before the experiment began, participants were told they would be paid \$15 for their time. As well, subjects were also told that everyone who completed the experimental task would earn an extra \$5 and the first two in each group to complete the task would be awarded an additional \$25. This latter reward was available to all individuals in all groups and associated an individual benefit to the acquisition of resources.

### *Procedure*

The experiment was refined over a series of ten pre-test trials. Pre-testing the experiment helped determine such things as the appropriate complexity of the task, clarity of the instructions, time required for task completion and size of the reward. In its final configuration each experimental trial took the form of a 'game' played by a set of players. While the game took place in a common game room each player had the task of building their own three-dimensional (3D) jigsaw puzzle of a Victorian House (220-pieces). All puzzles were identical.

Prior to the experiment each puzzle had been fully constructed and then divided into four modules numbered one through four. The puzzle pieces for each module were disassembled, the module number written on the back and then all module pieces with the same number were placed in a ziplock bag made of clear plastic. A card indicating the module number was taped to the inside of the bag with the number visible. All the puzzles were divided into exactly the same four modules. Similarly numbered bags were interchangeable for example; any module built from a bag numbered 1 could be added to any module built from a bag numbered 2. Puzzle bags were the 'resources' a player needed to complete their task. In a five-person game there were 20 puzzle bags; four numbered 1, four numbered 2, etc. In a six-person game there were 24 bags. To complete their task each player needed to acquire a set of bags numbered from 1 to 4, construct the modules and combine them into the finished product.

Each trial or game began with the players congregating in the game room. The researcher read a pre-determined text to inform subjects of the nature of their commitment and obtained informed consent. Those who agreed to participate were shown a video-taped presentation of the game rules but players were not informed of the intent of the research until after the experiment was completed. The game was then played in one of two forms depending on the pre-determined manipulation of the independent variable, the contest or forage resource context. Groups were given 2 hours and 15 minutes to play the game. Since most of the trials took place over the dinner hour, the group was provided with juice and cookies after 1 hour of play so that hunger did not distract them from their task. Upon completion of the game, subjects were asked to complete a self-administered questionnaire before receiving their payment.

### *Manipulation of the resource context*

All players had the same task to complete and were offered the same incentives but they played the game in one of two resource contexts. In the high contestability context referred to as the contest context players were seated around a rectangular table. The researcher delivered bags to the game room at

Table 4. Experimental manipulations of the resource context

	High Contestability <i>Contest</i>	Low Contestability <i>Forage</i>
Distribution	<i>concentrated</i> All resources are delivered to players in the game room.	<i>scattered</i> Puzzle bags are distributed within a territory outside the game room.
Predictability	<i>predictable</i> Subjects are told in advance the size and frequency of resource shipments.	<i>unpredictable.</i> Resources are made available at varying time intervals.
Visibility	<i>visible</i> Resources are delivered to the game room thus all players see the shipment at the same time and are aware of who gets what.	<i>not visible</i> Resources are scattered across the territory enabling a player to acquire resources without necessarily being observed by other members of the group.
Timing	<i>delayed</i> Subjects are allowed to delay acquisition for some future benefit (an additional bag).	<i>immediate</i> Subjects can start to build immediately upon acquiring a resource.

known time intervals (every 20 minutes) in pre-determined quantities called shipments. Prior to the game, players were provided with a schedule indicating the size and timing of each shipment. On schedule, the researcher entered the room with the shipment and placed it in the middle of the game table and left without further conversation. If asked, the researcher directed the players to determine the distribution of the bags among themselves. In the first shipment there was the same number of bags as players to make sure each player became engaged in the game. After the first shipment there were always fewer bags than the number of players present. To simulate delayed consumption players had an option after the first shipment. They could obtain a bag from a shipment but chose not to construct the module at that time. If they choose not to construct it they could wait until the next shipment and then be guaranteed a second bag. At that point, they could begin constructing both modules. Thus they could acquire the resource but not 'consume' it until some later stage and be rewarded for doing so.

The low contestability context or forage context games took place in the same room as the contest context games but on a different day. Players were seated around the table at the beginning of the game but the puzzle bags were randomly distributed within a territory outside the game room. Game instructions directed players to leave the room and forage for bags. They were told the bags would be distributed at various sites (not specifically identified) throughout a territory surrounding the game room and distributions would take place at varying time intervals. (In fact bags were made available on the same schedule as the contest context.) To ensure the players returned to the game room after locating resources an artificial scavenger scenario was established. Players were told there was a strong possibility that partially constructed puzzles left outside the game room would be confiscated by game helpers but that the game room was a safe zone. The territory was large enough so bags could be found by individual players without others seeing their acquisition, but not so large that players needed to spend a great deal of time foraging. Players in this form of the game were not given the delay option so 'consumption' was immediate. See Table 4 for a comparison of the two manipulations.

To determine if the players perceived the context in the way intended a check was included in the post-game questionnaire. Subjects reliably perceived the different dimensions of resource contexts, with one exception. Coefficient Kappa values were calculated for the four resource context

Table 5. Factor analysis of social relationships<sup>a</sup> (principal components; varimax rotation with Kaiser normalization)

Item	Factors		
	Hedonic	Agonic (competitive)	Agonic (gaming)
Cooperated with others	0.834		
Showed concern for others	0.791		
Encouraged others	0.785		
Tried to put others down*	0.545		-0.339
Respected the opinions of others	0.484		
Competed rather than co-operated		0.943	
Were helpful to others*		0.893	
Tried to outperform the others			0.762
Tried to be a "winner"			0.687
Turned the game into a contest			0.654
Were hard, tough			0.522
Eigenvalue	3.143	1.229	2.116
Standardized item Alpha	0.7596	0.8648	0.6163

<sup>a</sup>*n* = 114.

\*Reverse coded.

dimensions—distribution (0.62), predictability (0.68), visibility (0.43), and timing (-0.08). All but the 'timing' dimension met fair to good criteria. The source of the misperception about timing appears to be those who played under high contestability conditions. Only slightly more than 50 per cent of these subjects circled the expected response indicating that many did not perceive the timing context in the way intended, or they did not entirely understand the meaning of the question. The former explanation is more likely. It is consistent with anecdotal evidence that the dimension of 'resource delay' was not fully understood. In only two cases did players select the delay option and the most frequent request in the debriefing session was to 'explain the delay option more fully.'

## Measures

The theory developed in this article was based in part on ethological observations of non-human primates. No prior research has explicitly used this perspective to describe human social interaction. Consequently, there are no existing scales specifically designed to measure perception of agonic and hedonic social structures for human groups. However, established scales that assess a range of social interactions should pick-up on the hedonic/agonic distinction (if it exists) in an appropriately designed experiment. Several sub-scales of the Organizational Culture Inventory (Cooke & Szumal, 1993) measure aspects of social relationships consistent with the hedonic/agonic typology (affiliative, humanistic-encouraging, power, and competitive).

The OCI scale items were designed for and tested in workplace settings. Minor modification of wording was required to adapt items to this experimental setting. Subjects were provided with a list of 16 'OCI' items describing various social behaviors. They were asked to report how many people in their group acted in the manner described by each item. The subject's score on each scale was the sum of the number of people who they felt acted as indicated, divided by the number of people in their

Table 6. Mean difference tests of significance

	Resource context				Predicted direction	<i>t</i> statistic
	Contest		Forage			
	Mean	SD	Mean	SD		
Hedonic scale	0.846	0.139	0.895	0.116	yes	-1.99*
Agonic-competitive scale	0.449	0.395	0.224	0.339	yes	3.33**

\* $p < 0.05$ .\*\* $p < 0.01$ .

group. The data from these items were subjected to an exploratory factor analysis using a principal components analysis with a varimax rotation. This procedure identified 3 factors with Eigenvalues over 1 explaining 59 per cent of the variance. Results of this analysis are presented in Table 5. To aid in presentation of results two items were reverse-coded.

The first factor consisted of five items and measured hedonic-like social relationships. The alpha for this hedonic scale was 0.76. While the resulting scale had an alpha level below 0.80, Nunnally suggests that in the early stages of empirical research it is acceptable to relax this stringent criteria (Nunnally, 1967). The two other factors related to agonic-like relationships. One of these (the second factor in Table 5) describes competitive agonistic behaviors and is labeled agonic—competitive. The other (the third factor in Table 5) with items like ‘tired to outperform the others’ and ‘turned the game into a contest’ described more gaming behaviors, and was labeled agonic—gaming. This third factor may have been an artifact of the experimental setting—the game. In addition this factor had an unacceptably low alpha of 0.62. Consequently the second factor was used as the measure of agonic social structure. This agonic—competitive scale had an acceptable alpha of 0.86. All items on each scale (hedonic and agonic) were equally weighted. Both scales were submitted to a confirmatory factor analysis using Principal Components Analysis and yielded one-factor solutions.

The two scales were also submitted to a bivariate correlation analysis. The correlation between the hedonic scale and the agonic scale was very small ( $r = 0.056$ ) and not statistically significant.

## Findings

In total there were 21 experimental trials involving 114 individuals; 10 games involving 55 individuals were played in the high contestability context and 11 games involving 59 individuals were played in the low contestability (forage) context. Table 6 shows the results for the two hypotheses.

As hypothesized individuals in forage resource contexts (i.e., less contestable) perceived more hedonic-like social relationships than those subjects in more contestable resource contexts. The mean score on the hedonic scale for those in the forage context was higher than the mean score of those in the contest context. ( $t = -1.994$ ;  $p < 0.05$ ). The corollary, hypothesis 1b, also held, for agonic—competitive relationships. The mean score on the agonic—competitive scale of those in the contest context was higher than the mean score of those in the forage context ( $t = 3.333$ ;  $p < 0.01$ ). Thus the resource contexts affected the social structures in the expected directions. Configuring the resource context to make it more or less contestable affects the perception of emergent social relationships.

## Discussion

We are interested in the phenomenon of emergent social structure, particularly as it relates to differences in resource context. Socio-evolutionary theory suggests the potential for a deeply rooted relationship between group social structure and resource ecology. The proximate motivators for this behavior may be so ingrained that individuals do not consciously consider their behavioral alternatives; they just 'naturally' emerge (Bernhard & Glantz, 1992). Our study is based on the premise that individual social interactions, and thus the social structure that emerges is not simply the result of individual personality differences or conscious rationale choice. Our research indicates that cues from the environment, specifically the resource context, steers how individuals act and interact within their social context. We believe social structures emerge because individuals are pre-disposed, by evolution, towards certain patterns of interaction in particular resource contexts. These pre-dispositions were selected for because they conferred a survival advantage in our ancestral environment and become part of our evolutionary psychology, rooted in humankind's fundamental biology (Buss, 1997, 1999; Thornhill, Tooby, & Cosmides, 1997). These configurations of interaction persist and have an impact on the way we behave in the modern workplace.

The results of this experiment provide support for a relationship between the nature of a resource context (specifically its contestability) and the emergence of a social structure, hedonic or agonic. Individuals functioning in a highly contestable context; that is, resources are concentrated, predictable, highly visible and consumption is delayed, perceived more agonic-like social relationships; those where resources are less contestable; that is, dispersed, unpredictable, not visible and consumption is immediate, perceived more hedonic-like social relationships.

The test of the theory presented in this article addresses the emergence of social structure in newly forming groups, but we believe the theory can also speak to ecologically-induced structural change in established groups. Changes in the perceived contestability of the resource context should eventually evoke changes to pre-existing social structures. Giddens (1984) acknowledges that social structures can change over time but their adjustment is affected by the recursive nature of the interaction between human agency and structure. 'According to the notion of duality of structure, the structural properties of social systems are both the medium and outcome of the practices they recursively organize' (p. 25). While existing social structures constrain behavior they also enable patterns of interaction and have a certain inertia. Yet social structures are open to change if the human agents sense a need and are willing to alter their relationships (Fuchs, 2003).

This observation raises an important and interesting question. Will an established group's existing social structure adapt to reflect changes in the resource context? Organizations undergo structural change as they grow and mature (Greiner, 1998). We believe this change is induced, at least in part, by changes in the resource context as these organizations progress from entrepreneurial foraging for external resources to centralized allocating of internal resources. To use our language, new venture organizations with few internal resources must forage in their environment for what they need to survive and grow. They have hedonic social structures. More mature organizations with substantial internal resources exhibit a more agonic form.

Greiner (1998) suggests that change in management practice, or social structure is punctuated—long periods of stable structural relationships interrupted by short periods of revolutionary change. If most ecological change is incremental and most structural change is revolutionary then established structures will resist incremental adaptation. This assertion is wholly consistent with structuration theory (Giddens, 1984). Social structures are recursive; they are 'sticky.' Once a set of social behaviors are practiced and learned they have a natural tendency to persist. As well, some social structures have an embedded power dynamic and differential that will cause dominant members to resist change.

How established social structures respond to changes in the perceived contestability of the resource context merits investigation. Does a perceived reduction in the contestability of the resource context lead to the alteration of pre-existing social structure in the direction predicted by the theory? How long does it take? How strong and pervasive do the signals from the resource context need to be? Are susceptibilities to different forms of social structure asymmetric? Power relations formed during agonistic episodes may make that social structure more resistant to change than the hedonic form, that is, making the agonistic form 'stickier' than the hedonic form?

Again empirical study is needed to more fully explore the implications of our model. Many questions like these need to be addressed to more fully explore and develop the model presented in this article. However, it is our belief that looking at organizational phenomena using an evolutionary lens will generate important, significant and novel insights into organizational life.

## Limitations of the Study

This research attempted to establish empirical evidence of a deductively developed theory. The project was exploratory, and as such our expectations were limited. One dimension of the theoretical construct, the delay option in the contest context, was not effectively operationalized. The researcher made repeated efforts during the pre-test phase to simplify and clarify this option. However, in retrospect it is doubtful the timing dimension of the resource context was effectively communicated. Since timing was only one of four dimensions of resource context contestability, this deficiency was not critical.

The subjects used in this experiment were students who volunteered to participate; a requirement of university research policy. Further those who participated in the experimental trials followed through with their initial commitment. It is likely participants were more cooperative than those who did not volunteer or who did not show up for the experiment. This cooperative orientation may have influenced their participation in the game and attenuated competitive, agonistic-like behaviors thereby reducing the influence of the contest context. However, this bias, if it exists would understate the presence of the hypothesized relationship in the general population.

The groups described in the literature utilized to develop this theory had a long history of involvement and interaction. They had long periods of time for their social structure to emerge. Subjects in this experiment had just over two hours to establish a nascent social structure. The amount of time allotted for the experiment was based upon what was a reasonable time commitment to ask of volunteers given the compensation offered. However, research with humans has shown that social structures can form quickly—within the first five minutes (Fisek & Ofshe, 1970). Even so, extending these findings to mature, fully functioning, multi-dimensional social structures among people who have interacted for extended periods of time must be done with caution.

This study is exploratory. As with all such studies this one needs to be replicated and improved upon, and the basic question needs to be explored using other methodologies and with other populations. However, a major contribution of this research has been the experimental testing of a theoretical perspective developed using an evolutionary lens. Laland and Brown (2002) maintain that it is essential to test hypotheses as well as to theorize to avoid the problem of creating justifiably criticized 'just so stories' and engaging in what they term as 'irresponsible biologizing' (p. 6). This experiment demonstrated that it is possible to evoke patterns of social behavior dependent on the manipulation of the resource context in the pattern predicted by socio-evolutionary theory. Having demonstrated a relationship between resource context and social structure in experimental student groups future investigators may choose to conduct ethnographic studies to obtain a deeper understanding of the nature of this contingent relationship in contemporary organizational work groups.

## Implications

The results of this experiment support the theory. The contestability of the resource context influences emergent social structure. Cues from the resource context evoke deeply engrained patterns of social interaction. What are the implications of this conclusion? Why should organizational researchers or managers care that context (contestability) affects (social) structure?

In real organizations the resource context is not something that exists solely beyond the boundaries of the organization. It is not purely a feature of the external environment. From an individual's perspective critical resources are where you find them: both inside and outside the boundaries of the organization. Even though managers cannot affect emergent social structure directly they can influence it by way of the resource context. Managers configure the internal resource context of their organizations (i.e., the resource acquisition/allocation process). How they do so affects social relationships and emergent social structures. If a firm's resources are concentrated and made available in predictable and highly visible ways, then the theory suggests the social structure will be more agonic (hierarchical, inward looking, high stress); alternately if resources are dispersed, less visible and predictable than interactions would be more hedonic (egalitarian, outward directed, balanced affect). Not only can managers influence the actual configuration of the internal resource context, but also they can affect how individuals in their organizations perceive their resource context (both internal and external). And it is the perception that affects emergent social structure. For example, Jack Welch, former CEO of General Electric is credited for promoting the idea of 'boundarylessness' (Tichy & Sherman, 1993) in his organization. By doing so he established the relevant resource context for his employees and signaled the importance of foraging beyond the confines of the firm. Lewin (1999) asserts that an important role for management is to 'facilitate, guide and set the boundary conditions within which successful self-organization can take place' (p. 215). The theory we propose can help managers understand how context affects individual social behaviors and emergent social structure. Affecting the reality of, and perceptions about an organization's resource context and thereby influencing social structure become meaningful managerial tasks when informed by robust theory with extensive empirical validation.

## Conclusions

A contingent relationship between resource contestability and emergent social structure is a thought-provoking idea—thought provoking because it is anchored in an evolutionary explanation for social behaviors. It brings together evolutionary and organizational theories and challenges management researchers to think about social behaviors and organizations in a different way. Some may find this approach disconcerting. It challenges the standard social science model (Pinker 2002; Tooby & Cosmides, 1992), that all significant (social) behaviors are learned, and raises the specter of social Darwinism, nature versus nurture, biological determinism and many other contentious debates associated, rightly or wrongly with Darwinian thinking.

However, organizational theorists ignore this perspective at their peril. Others working in the humanities and social sciences are enriching their fields by employing an evolutionary lens: Pigliucci (2003) in ethics, Masters (1985) in philosophy, Bitzig (1986) in history, Field (2001), Hirshleifer (1985) and Robson (2001) in economics, Buss (1997, 1999) in social psychology, Blasi and Bjorklund (2003) in developmental psychology, Boehm (1999) in anthropology, and Massey (2002) in sociology to men-

tion just a few. With a small number of notable exceptions applying this type of thinking to the investigation of organizational phenomenon is in its relative infancy (Campbell, 1986). The recent work of Fort (2001), Frederick (1995), Lawrence and Nohria (2002), Nelson (1995), Nicholson (1997, 1998), Salter (1995), and Saad and Gill (2000) provide compelling arguments for the potential of joining together organizational and evolutionary theory.

Reisman (1988) and Wilson (1998) maintain that while difficult, developing theory and conducting studies bridging disciplines has the potential to produce major expansions of knowledge. Many of the traditional approaches to understanding human behavior in today's complex organizations have plateaued in terms of generating new understanding. They have lost their ability to inject new energy and insights into the investigation of organizational life. Thinking about organizations from an evolutionary perspective provides new ways of thinking about behavior and opens new territory for exploration and potential new and useful insights for managerial action.

## Author biographies

**Barbara Decker Pierce** is an Associate Professor in the School of Social Work at King's University College at The University of Western Ontario. She teaches research methodology in the undergraduate BSW program and administration at the MSW level. Barbara received her MSW from the University of Toronto and her MBA (with distinction) and PhD from the Richard Ivey School of Business, at The University of Western Ontario. Her current research interests include evolutionary explanations for the emergence of organizational phenomena, particularly the development and maintenance of egalitarian social relationships and the impact of increasing managerialism on the development and effectiveness of human service organizations.

**Roderick E. White** is an Associate Professor in General Management at the Richard Ivey School of Business, The University of Western Ontario. He teaches at the undergraduate, masters and doctoral levels; as well as executive education. Rod received his DBA and MBA (with high distinction) from Harvard University and his Honors Bachelors of Arts (Business) from The University of Western Ontario. His current research interests include the role evolved social structures play in the functioning of organizations, processes of multi-level selection and the biological basis for entrepreneurial behavior.

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