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ORGANIZING ON THE EDGE:
HEADING TO MOUNT EVEREST

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ORGANIZING ON THE EDGE: HEADING TO MOUNT EVEREST

Abstract

The paper analyzes complexity in organizations facing threatening environments. Such contexts are characterized by very high levels of risk and uncertainty that challenge organizational survival: fire-fighting, aerospace projects, high-tech research programs, etc. A paradox of these contexts is that although they remain stable, organizations operating within them are often transitory, single-project, and with a wide variety of skills and knowledge. These organizations show a peculiar way of organizing complexity that deserves special attention.

This paper is built upon a longitudinal case study of successive attempts to climb Mount Everest by Chilean expeditions. After three failed attempts (1984, 1986, 1989) the summit was finally reached in 1992 via one of the hardest routes. Each expedition was an independent organization, and structural arrangements as well as participants were different, except for a small permanent core.

Organizing on the Edge: Heading to Mount Everest

Introduction

What Farmer claims is that a common framework is necessary to distill out the essence of complexity models, because, ultimately, all of them discuss the same issue: the emergence of connections and its dynamics. Or to put it another way: the search for laws of self-organizing. In this paper, we are going to focus on how a social network emerges and evolves.

This paper is a humble attempt to build theory in order to explain how order emerges in a field all of whose constituents (people and organizations) are transitory agents. We want to develop theoretical explanations of the complex evolution of a particular type of project-based organization: mountaineering expeditions to Mount Everest.

This is a very threatening environment, with very high uncertainty and risk. An extreme case. This makes it an ideal setting for research, as in classical anthropology, where the essence is the idea that we can isolate the social context in which the organizations are enacted (one country: Chile), and trace the evolution of individuals and the development of patterns through the successive projects or expeditions that attempt to climb mount Everest (five projects, 36 members, 12 years). Additionally, we will try to address a very important and neglected research theme: how organizations are managed "on the edge". In these cases, people are at the limit of their capabilities, and organizational design becomes crucial and dependent on the past experiences of group members.

We also believe that this is a very exciting setting for the application of evolutionary and complexity ideas to organizations. We want to study how social patterns evolve, especially in the development of effective organizing patterns. We believe that a set of common understandings and ways of doing things that are more effective than former patterns, and that are inherent in the tacit rules that bind the group's members, are at the core of successful organizations working on the edge.

Using Farmer's quote, we will discuss the successive process of each expedition, and the links within and between its people and organizations, as a "neural network" in which agents play the game of adaptation and learning. Patterns are embodied in people, and are brought through people to each project. People enact a new pattern within each expedition, and then return to the market with new experiences and a new reputation, waiting for the next project. We want to understand and try to model this evolution using an information-genetic

metaphor, to see how patterns and people co-evolve through their network of successive interaction.

Key elements of this framework are connections, the ties among people. When a bundle of stable connections between people and organizations creates a generic subjectivity, we call it an organization (Wiley, 1988). Or to express the same reality: a dense network. Then, roles and rules emerge to enable individuals to act and, with little disruption, to perform along the ongoing pattern of interaction.

Organizing is a set of interlocking behaviors (Weick, 1979), routines structured by organizational members to give order to support collective action (Nelson and Winter, 1982). These processes are what really constitute the essence of any organization, what make it alive and meaningful, so we should be more interested in processes of organizing (patterns) than in stationary states with clear and defined boundaries (Weick, 1995).

The basic data of the case study on which this paper is based are the following: Five mountaineering expeditions were launched from one country –Chile– to the highest mountains in the world over a period that went from 1982 (when preparations for the first expedition began) to 1996 (when the fifth, and last, expedition took place). The first three expeditions to Mount Everest failed, and at the fourth attempt the summit was finally reached. The fifth expedition –to the second highest mountain, K2– also succeeded. However, after this triumph the core group unraveled because the core relations seemed no longer meaningful to the main agents –the entrepreneurs and managers of the previous projects.

Mountaineering expeditions are project-based organizations: a small number of people operating for a limited period of time, usually no more than two years. Each expedition is a new organization. And most of the variables change in each project. The variables for the 1984, 1986, 1989, 1992, and 1996 expeditions (in that order) were: Route (Normal, Normal, Very difficult, Extremely difficult, Difficult); Number of people (13, 9, 15, 7, 10); Government, institutional and media support (Very high, Medium, Very high, Low, Very high); External sponsorship (High, Medium, Very High, Low, Very High); Knowledge and skills (Medium, Low, High, Very High, High) (see Tables 1 and 2 in the Appendix).

In sum, our data come from five organizational episodes along 12 years, in which 36 individuals took direct part as expedition members. These people had very different profiles, coming from different institutional backgrounds, some with conflicting cultural traditions. How we can theoretically model the evolution of the whole set of relations? Does the selected model –based on evolutionary and complexity approaches– explain more than other analytic approaches? Does this research shed light on how to manage on the edge? We will try to deal with these questions.

The Everest case

The purpose of this paper is to build a theory to contribute to the theoretical understanding of organizing "on the edge": transitory organizing under conditions of very high uncertainty and risk.

An important source of research in this field is the literature on accidents (Weick, 1993), incident management (Flin, 1996), and high reliability systems (Perrow, 1984). There

is, however, a lack of theoretical understanding of the processes that take place in this kind of high-risk organizational settings. One possible explanation is that all efforts have been directed towards the easiest and most high-profile areas for research: accidents with a disastrous outcome, and in organizations with high normative structures.

Accidents are only one particular outcome –the most evident– of a general case of organizing on the edge of survival. Our case, in contrast, uses experiences of success and failure in a context of low normative structuring. Additionally, it is centered not only on people aspects (micro), but also on an analysis of the evolution of organizations within a social context (macro). We also focus on the design and effective management of short-term organizations.

The empirical setting of this paper is a multiple case study (5 expeditions), grounded on longitudinal research into successive expeditions that attempted to climb Mount Everest and K2, the second highest mountain in the world. The first three attempts on Mount Everest failed while the fourth succeeded, reaching the top through one of the hardest routes. Subsequently, in 1996, a new organization was created to climb the second highest mountain in the world (K2); again they succeeded, but the organization unraveled when the whole situation stopped making sense to the core constituents. Through the Everest case we want to understand the process of building a high-performing organization which is capable of coping with such threatening and difficult tasks as climbing the highest mountains in the world. Our research is aimed at exploring the fine-grained dynamics of complex organizing, where small changes account for most of the causes of organizational failure or success.

Of the several expeditions, the successful 1992 expedition to Mount Everest will be discussed in detail in this paper.

The case could be summarized as follows:

In 1984, the first Chilean National Expedition attempted to climb Mount Everest by the normal route on the North face: Rombuk Glacier. It was institutionally sponsored by several government agencies and private institutions, and raised full support. The organization was strictly hierarchical, and followed the traditional pattern of a big, "nationalistic", bureaucratic expedition, with clear roles and formal lines of command. The group was large (17 members) and clearly differentiated in its roles, basically staff and line. Staff were technical people such as physicians, authorities, trainers, and others, whose role was "X, but not to climb the mountain". Line people were the mountaineers, who were informally split into two groups: group "A" ("holy cows"), people preselected to make the final push to the top; and group "B" ("dogs"), who were in a support role, which meant opening the route, setting up camps, and carrying loads to equip the camps. Cultural diversity, originating in the associations of the two group's clubs or in leadership affiliation, was another important source of informal differences. The knowledge and skills these two groups had for climbing a mountain like Everest were very limited, and they made several mistakes in placing and equipping altitude camps. The most serious mistakes occurred in the domain of people relations. Relations became critical owing to the political divisions within the group, and to the fact that tensions increased when the expedition started to run out of time while the top still looked a long way off.

One example of a critical situation was when the expedition leader (Oyarzun) ordered a team member (Cassassa) to stay at the base camp, and the latter disobeyed. His solo climb to a nearby mountain coincided with a desperate final assault on Everest by the main group, which ended in failure. They failed before the final push, with just one day of work

remaining below the top. The leader almost died and fierce conflicts arose. The soloist was used as a scapegoat in the media when they came back home. In the end, the group bitterly disbanded.

In 1986, a second expedition was organized to climb Everest over the same normal route. The rationale this time was the idea that the first group failed because they were not friends, and that the lack of mutual trust acted as a drag on motivation and the ability to work as a team. In this second expedition, therefore, friendship and motivation were to be stressed. However, the traditional bureaucratic model (people in staff doing the organizing, and people in line doing mainly muscular work) and institutional approach –in this case not governmental but strong university support– was similar. The expedition was made up of nine members. Although skills and knowledge were lower than in the first expedition, this was supposed to be counterbalanced by greater commitment.

After the accidental death of one member, the group failed when most of the members did not want to remain on the mountain. Friendship, the glue that held the group together, was in this case the main potential strength, but also a powerful weakness (the pain was so intense that they were unable to communicate openly). Again the group disbanded –in this case, without conflicts– and some of the members gave up mountaineering for life. Nevertheless, a core of five people, including the leader, remained committed to arranging a third expedition.

In 1989, this core group organized an ambitious third attempt, through a difficult route (West Ridge). It became the biggest of all Chilean expeditions to Everest, in terms of number of people, sponsors, staff, media coverage, etc. A full endowment of resources (i.e. time, money, people, etc.) was supposed to be a guarantee of success. The basic rationale here was not friendship but professionalism: division of labor, recruitment of the best people, and strong organizational support. This expedition stayed on the mountain longer (72 days) than either of the previous two, and when the difficulties increased and time started to run out, the group was split between committed and uncommitted people. They failed, like the first expedition, amidst fierce conflicts. Yet the core group –basically Jordan and Garcia– remained convinced that the goal was possible for them, and that the main obstacle was organizational rather than technical, physical or financial.

On the way back home, the CEO (Jordan), on his own, applied to the Chinese authorities for permission to climb the mountain in 1992. He was told that there were no permits left for that season, except for an extremely difficult route on the East side. He was also told that another Chilean expedition would be launched in the same season, to attempt the mountain by the easy normal route on the west-Nepali side. Relations between the two Chilean groups were very bad, and competition would be intense because the new group had much better sponsors and media coverage. Moreover, by attempting the mountain through an easy route and working with one of the top sherpas to lead the group, the other group's chances of reaching the top were very high. Also, fund-raising for Jordan's expedition to Everest would be almost impossible.

In 1990, Jordan finally accepted the difficult route on the east side of the mountain, named Kangshung Face or the "forgotten face" of Mount Everest because it was the most distant and least explored side of the mountain, and also one of the hardest to climb. In 1992, a new seven-member expedition launched the fourth Chilean attempt to climb the mountain, while a separate and "opposed" group of Chileans was doing the same by the normal route.

Conditions for the 1992 Kangsung expedition were appalling. They included a very tight budget, no media coverage, serious logistic constraints due to the remoteness of the route, and the intrinsic difficulties of the route, with serious objective danger of avalanches. Only one person had reached the top by this route previously –with several injuries. Because of these difficulties, the organization was reduced to the essential minimum: only six climbers and one doctor; no line and staff division (climbers would do the management, too); the toughest training program (every day and weekend for a year and a half); all group members borrowing money from the bank to pay for their expenses; minimum sherpa support (two high altitude porters and one cook); no "goodies" such as satellite telephones, medical equipment, etc. Only the necessities for climbing the mountain were carried.

The route was very dangerous, with frequent avalanches, demanding a very technical approach. The group finally succeeded and three of its members reached the top (Garcia, Jordan and Montes). It was the smallest of the Chilean expeditions to Everest and it made it through the hardest route by far. By international standards it was a great achievement, still unrepeated today. The leader of the other Chilean expedition also reached the summit on the same day, using the normal route from Nepal (Khumbu).

After the Everest success, the group formally dissolved. In spite of the success of the expedition, personal conflicts once again arose back in Chile; but some ties still remained among core members, enough to start a new venture. After a few planned projects that did not work, a new expedition was launched to reach the top of K2 in 1996, in which some members of the previous group took part: the CEO (Jordan), the COO (Garcia) and the doctor (Diaz). The organizational strategy returned to that of the hierarchical, heavily sponsored, large-scale expedition (because this was Jordan's traditional way of doing things and matched the organizational pattern of his mountaineering club). They succeeded, but the interests of the core constituents (CEO - COO) could not remain aligned.

In 1998, the core participants recognized that the organization was exhausted. The relationship between the CEO and the COO was broken, mainly because of the external orientation of the former and the internal orientation of the latter. On the one hand, external relations were necessary to support the expedition funding and image. At that time, Jordan's expedition was quite famous in his country. On the other, hierarchical forms were implemented within the expedition, all of which was fostered by the higher differentiation among members in terms of knowledge and skills. The overall organization became more complex, and making sense of it more difficult to the main constituents. People ended up moving to different cities, and are currently engaged in a variety of different professional projects (e.g. the expedition leader is currently the CEO of the main TV station in Chile).

The above is a brief outline of the empirical part of the case (1), which attempts to uncover the fine-grained relations that explain the dynamics of these successive organizations.

The main objective of this research, however, is to build a theoretical understanding of these organizing processes. The focus of our study could be summed up in two questions: How do organizing patterns emerge and evolve? How are project-based organizations managed "on the edge"? We will start with the first macro question, using a genetic metaphor

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(1) Data supporting this discussion include more than twenty semi-structured interviews, audio, films, diaries, and archival data, which have been collected and analyzed using an ethnographic approach (Garfinkel, 1967; Geertz, 1973). It is a longitudinal multiple case study (Yin, 1994).

rooted in complexity theory to assess the evolution of the successive projects and the self-emergent order arising from them. Finally, we will make a few suggestions about the second micro question in order to give some insights on how to manage and design effective organizations to cope with threatening environments.

The genetic evolution of social order

Individuals are constituted of genes containing a wide variety of information. Thus, people could be conceived of as embodied information. Human behavior depends on a particular and unique configuration of such information. However, our information is incompletely structured by our biological constitution; we have to socially construct –intentionally or not– our information in order to make our living. Life is a form of nonlinear computation of such information.

Animals live in closed worlds whose structures are predetermined by the biological equipment of the species. In contrast, man's relationship to his environment is characterized by world-openness. In other words, the process of becoming a human being unfolds in an interrelationship with an environment. This environment is both natural and cultural. That is, the developing human being not only interrelates with a particular natural environment, but also with a specific social order, which is mediated to him by significant others (Berger, 1966 #119, Ch. 2). Man's life is a sort of ontogenetic process mediated by others (Mead, 1934).

The fact that man is partly a self-production with an immense variety is due not only to the infinite possible combinations of biological information (DNA embodied in genes), but also to the varied social environments in which human beings find themselves. We cannot understand people apart from the particular social contexts in which they are shaped.

World-openness, while intrinsic to man's biological make-up, is always pre-empted by social order. In other words, human existence is in fact bounded because social order gives us a relative world-closedness. Consciously or not, we get locked in by our decisions, and especially by the social context in which we live and work. Paradoxically, this social order only exists as a product of human activity. We create organizations and institutions, and they shape us.

Where is the driving force of this process? Human beings must continuously externalize themselves in activity. We are essentially "doers" and "makers". We need action in order to survive and sustain social order. The emergence, maintenance and transmission of social order is the focus of several theories of institutionalization (Berger and Luckmann, 1966; Powell and DiMaggio, 1991). We believe that evolutionary theory and complexity theory could add to our understanding of these important processes.

Genotypes and Phenotypes

People could be seen as a bundle of genes, information codes, programs that race to trigger human action. Biologists have traditionally used the distinction between *genotype* –the genetic blueprint encoded in the individual's DNA– and *phenotype* –the structure that is created from those instructions. A genotype can be thought of as a collection of little computer programs executing one program per gene in parallel. When activated, each of

these programs enters into the logical fray by competing and cooperating with all the other active programs. Collectively, these interacting programs carry out an overall computation that is the phenotype: the structure that unfolds during an organism's development (Waldrop, 1992, p.280).

Working on artificial life modeling, Langton (1992) coins the term "generalized genotype" to refer to any collection of low-level rules. "Generalized phenotype", on the other hand, is used to refer to the structure and/or behavior that results when those rules are activated in a particular environment. All this constitutes the specific individual rules and overall pattern, as an internal model that enacts behavior.

Through these terms, people working on the foundations of complexity theory establish a link between life and computation. Living systems are biochemical machines, genetic algorithms that locally control the organism from its genotype with a few simple rules. There is, though, room for surprise and spontaneous behavior through phenotype varied response.

We believe that these notions can be applied to our successive project-based organizations. How can we understand the way people are recruited for such projects? What was their endowment at the time they were recruited? How did this genetic charge evolve over the course of the project? Which patterns, symbols and connections survived and which were displaced?

Individuals are biologically and culturally charged with a unique configuration of information. This information load is what is encoded in genes. Common information enables people to act and interlock behavior with others, which in turn leads to further interaction, learning, adaptation and, in sum, co-evolution of people, especially through participation in organizations. The initial genetic endowment, the personal "stock of knowledge" (Schutz, 1962), is the "genotype"; and when this is shared with others, as when a person is part of an organization, he or she acts and interprets the world as if his or her experiences and those of the others were identical for all practical purposes. People in organizations think that the same algorithm runs through all of the organization's members. The bundle of collectively constructed algorithms could be called a "collective genotype". Genotypes are the blueprints (recipes of knowledge) of individuals and organizations.

In computer simulations, complexity theorists model genotypes as "classifier systems," like digital chromosomes that carry a program with information in the form: "If ......(A), then ......(B)." The classifiers are not permanent; they evolve through reproduction, reshuffling their digital building blocks by sexual exchange to produce a pair of offspring. The offspring will replace a pair of weak classifiers; and then they will have a chance to prove their worth and grow stronger through the new "bucket-brigade" genetic algorithm, as Holland calls it (quoted in Waldrop, 1992, p.188). Classifiers and organizations co-evolve over time, not in Darwin's random way, but within a bounded self-emergent order generated by complex historical interactions.

Evolutionary psychologists also stress the importance of classifier rules. We tend to think in terms of "ins and outs," "friends and enemies," "low and high status," etc. This is a very primitive and economic way of thinking; very fast and sharp (Nicholson, 1998). Also, it is a very collective way of thinking and, consequently, very powerful. When the environment is uncertain and risky, this kind of behavior is enhanced.

Thus, we can model the content of a genotype with a few simple rules (classifiers). These rules, when confronted with a particular context, evoke a particular response, and this is the phenotype. When collective behavior exhibits a common pattern, we could call it a "collective phenotype". This is the case when an organization has a dominant interpretive frame, with low or non-significant variance among its members. When people use the same language, humor or jargon, have the same heroes or scapegoats, etc., all are expressions of a collective phenotype: an observable and shared pattern of collective behavior.

In contrast, what could be called a collective genotype emerges from the individual repetition of the external patterns that constitute the collective phenotype, though genotypes are not directly observable. Genotypes lie behind external forms, and are the genetic algorithms that encode the deep causes and relations that sustain collective behavior. A genotype is a set of programs that run in the back-stage of behavior. A person can even replicate behavior (phenotype) without a particular genotype. Genotypes are more difficult to create and transform, and at the collective level their evolution resembles what organization theorists have called the process of institutionalization (Selznick, 1957; Powell and DiMaggio, 1991).

It is interesting to note that in animals the link between genotype and phenotype is deterministic and narrow. In human beings, however, phenotypic responses are wide and intertwined by more degrees of freedom. That is why the individual genotype can be only loosely coupled with the collective phenotype. However, there are social mechanisms to enhance this connection, with role-set boundaries for acceptable ranges of behavior, but not thoughts or feelings (Hackman, 1976). People may be formatted to react in a certain way, but if the social pressure is strong enough, the individual will repress his or her own natural response in exchange for social acceptance.

The relationship between individual and collective genotype and phenotype is presented in Graph 1 below.

Graph 1. Individual and Generalized Genotypes/Phenotypes
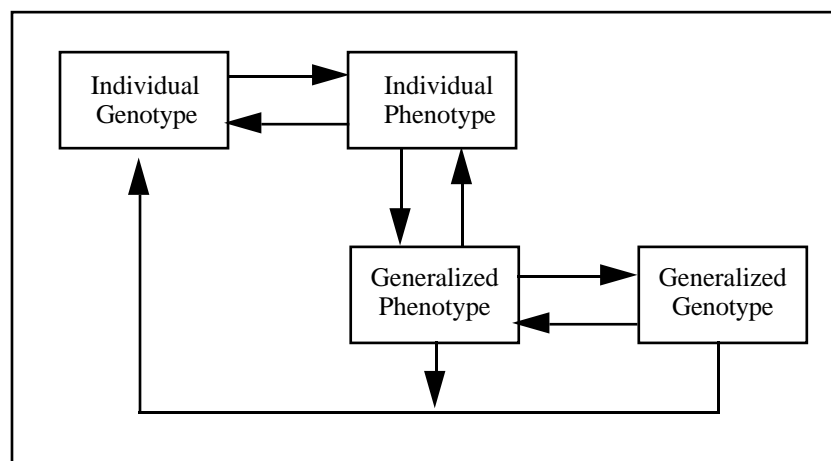
People and organizations normally are established when routines emerge, when they are hardwired in their genotypes. If a particular action or series of actions is repeated or simply accepted by an individual, it becomes part of the individual genotype, like a script or schema for future responses. This is what the double arrows between boxes 1 and 2 illustrate.

Nevertheless, genotypes evolve. When responses do not fit or the agent dislikes his or her current responses, negative feedback information increases the chances of mutation (as well as individual anxiety); and if the inertia that supports the attachment to the traditional pattern is overcome, then change may occur. A change is like a genetic mutation: when a new schema becomes dominant or active, the remaining information is passively stored, waiting for a new call from the agent's environment. In changing and threatening conditions, adaptive agents search hard for new scripts with which to confront the new environment. The new script is usually built upon a mix of new and old experiences (genes or programs). This is similar to what Argyris has referred to as single and double loop learning (Argyris, 1992).

On the other hand, individual phenotypes enact a "generic subjectivity," that is, organizing patterns. Organizations, and to an even greater extent institutions, are constituted by the sedimentation process of such patterns. Individual phenotypes build up collective phenotypes, often in a de-coupled or non-linear way. For example, if the first person to enter a conference room sits in the last row, the probability that the next entrants will sit in the last rows increases; this is how the distribution pattern emerges (Schelling, 1960). There is neither a direct causal effect nor a random process, but a self-emergent order of non-linear origin. Out of casual origins, patterns will find a way to self-organize interaction.

Organizations could be conceived as shared meanings, interpretive ways, symbols and language (Berger and Luckmann, 1966; Weick, 1979; Hatch, 1997), which closely resemble programs or Holland's genetic algorithms. These are not things that anyone can easily manipulate, because, like genes, they are dispersed within the population, locally-based and controlled in each individual, and hard to see and measure. Without individuals, the game of organizational life would be simply impossible; but through their existence and co-evolution the game perpetuates itself beyond the frame of the individual's life.

At this point we might easily perceive a problem with time: the temporal differences between the formation of both collective and individual phenotype and genotype. Phenotypes are easily enacted and changed. They are like low-term memories; but if they persist, they have the power to create, transform, or even displace genotypical features. This takes time, however, and the agent should remain exposed to organizational socialization (van Maanen and Schein, 1979) as a way to acquire new roles, as new algorithms are incorporated –and eventually mutate– into its former genotype base.

Each organization or work environment develops its own phenotype, which contains a particular way of doing things, a bundle of routines with its own rhythms, rewards, relationships, demands and potentials. This phenotype could strongly affect individuals. As Van Maanen and Schein point out, "social research has yet to discover a work setting which leaves people unmarked by their participation" (Van Maanen and Schein, 1979, p. 210). And here we come to a central point in social science as well as in our research: the transmission of patterns from one generation or project to the next. Social transferability is a very important area that needs a lot more research. The transmission of information and its evolution –variation, selection, retention– in social affairs is fundamentally a cultural matter, and this is one of our basic tenets (Mead, 1934; Goffman, 1959; Becker, 1970). Personal change within this framework always requires the analytic occasion of a surprise, a kind of disengagement from the current situation, which, until that crucial moment, is often taken for granted (Shutz, 1970) .

Transitory Project-based Organizations: an ideal setting

The basic characteristics of this kind of organization could be the following:

– *"The organization is enacted..."* It is a social construction (Berger and Luckmann, 1966).

– "*...to accomplish a finite performance standard...*" It has a single objective with a binary outcome that is simple to measure: failure or success.

– *"...with a fixed –and often small– amount of resources and people (minimalist logic)..."* Lean organizations foster coordination, sharing, and an innovative and challenging internal environment. Like start-up firms.

– *"...and with a short frame of time to accomplish its purpose."* Transitory organizations usually do not last more than two years.

In literature on organizations and on careers (Starbuck, 1992; Arthur and Rousseau, 1996), we find references to this kind of organizing under the heading of "single project organizations" (Baker and Faulkner, 1991), "project-based enterprises or temporary organizations" (DeFillippi and Arthur, 1998), "project-based labor markets" (Bielby and Bielby, 1999). There are a number of empirical studies in different fields or industries, such as construction (Eccles, 1981), semiconductors (Saxenian, 1994), films, and what is referred to as the "Hollywood organization" (Baker and Faulkner, 1991; Jones and DeFillippi, 1996). Research into networks and social capital (Powell, 1990; Burt, 1992) may also be useful for understanding these environments, where the field is permanent but organizations are not.

This phenomenon is a manifestation of a new economy (Bell, 1973; Hamel and Prahalad, 1996), in which time pressures are very severe. Currently, a number of industries are experiencing dramatic changes, and environmental uncertainty makes transitory organizations the most appropriate solution for overcoming organizational inertia and for meeting the demands of complex and unique environments.

An example of this would be a film project. In films, there is little consensus on what constitutes competence among creative personnel. In carrying out a given project, the people involved stake a great deal on a particular structural arrangement (i.e. who is in and who is out; ties; funding; distribution; contracts; and sharing of potential rents and losses). Also, they accept an important opportunity cost –if they are in this project, they cannot be in another project at the same time (adapted from Bielby and Bielby, 1999).

This happens in many fields of social and economic life, and structuring is characterized by a high degree of human and social capital, constant change, and uncertain conditions, where many people put their careers at risk. These organizations are no longer hierarchical or based on command and control, but specialized and autonomous, shifting among projects, and building upon reputation rather than on permanence and fidelity to one organization.

Of course, these organizations operate in a special kind of environment: complex, non-routine, knowledge or skill-intensive, and with wide diversity. This type of setting is common in professional service firms (such as management consulting, law or architectural firms), high technology industries, entertainment, and others.

Participants in this kind of organizations know that they are not involved for life. Inclusion is only partial, and reputation is based mostly on the apparent objectivity of a person's external performance on projects –false attribution could play tricks. So they have to work extremely hard and creatively to develop their skills and obtain a better starting position in the next round of another project.

In project-based (single goal) organizations performance is easier to measure than in other (multiple goal) organizations because project-based organizations are aimed at one challenging goal that they either accomplish or not (i.e. the success of a project will mean a new pharmaceutical patent, a blockbuster film or, in our case, reaching the top of the mountain). On the other hand, projects do not usually last longer than two years, after which people are back in the market, where they hope to be recruited for another project, enact their own project, or else leave the field.

The fact that people are in the market –usually they stay in another organization that serves as buffer– means that they are available in the network. They wait with their genotype charged with previous experiences, which sometimes constitutes a more or less ambiguous signal to be interpreted by recruiting agents in the network. The only way for them to increase their genotype base is to take part in projects. If a project succeeds, their personal reputation increases and their signal weight too. But if the project fails, or the person becomes the scapegoat for the group, his or her reputation and signal is affected accordingly. Signals are not clear messages; they are scanned by different agents through different frames and interests. A signal that is bad for one group of agents could easily be good for others. Signals do not have an objective value, but a relative one.

When people are recruited and selected for a project, they may be core agents of the network (the ones who rule the project or people known from good previous relations), or they may be newcomers to the core. In this latter case, information asymmetries may be important, and may be bridged only by sharing action: a socialization process through sharing experiences, symbols, and real work in the field, especially during the preparation phase before the real task begins.

If people are finally accepted into the project, they become members. They then have to behave within certain organizational boundaries, and show a correct and effective individual and collective phenotype. If action is the driver here –not feelings or thoughts– external acceptance is the way to assess whether people are compatible.

The relationship between genotype and phenotype may be expressed in terms of degrees of divergence or convergence. If the individual genotype is convergent with the individual's action or phenotype, then things run smoothly and personal anxiety decreases. The next test is how the individual phenotype fits the collective phenotype, and here perceptions across the group involve a very serious and complex process. In tough projects, the exit door is always open for people who do not fit. People get fired for many reasons, some of them fair and rational, others not.

Additionally, in any organization, even a start-up, institutionalization processes rapidly unfold in parallel with power dynamics. In the case of our expedition to Mount Everest, these processes are associated more with technical legitimacy. When a dominant pattern of doing things is established, it is immediately expanded, especially as a way to socialize newcomers and sustain a social order. When this happens, a collective genotype, or set of rules that gives organizational meaning, is formed. This genotype evolves, even independently of its founders, and becomes the cultural environment that newcomers must confront and incumbents must serve to master their game.

Evolution and complexity at Mount Everest

In applying the above theory to our Everest research, we have reached the following four conclusions:

First, effective organizing patterns take time to emerge and are the products of historical as well personal circumstances. If we were to study each expedition in isolation from the others, we might eventually gain insight into interesting psychosocial processes, but we would have nothing relevant to say about how these patterns emerge and evolve.

From Table 1 in the Appendix we can see that the dominant groups in Chilean mountaineering at the beginning of the 1980s had their roots in institutions linked to the public sport system (Fed) and university clubs (UCH and UC). The environment was highly politicized, and the main requirement for being a member was a personal relationship with the head of the club (Oyarzun and Lucero). This pattern seems like a block, where variety is not allowed. The university expeditions are the dominant genotype logic in the first two attempts. Genotypes and phenotypes converge, are easy to evaluate, and outsiders are excluded or become an easy scapegoat in case of failure. The gene pool is very homogeneous and, as a consequence, offers a limited response portfolio for dealing with uncertainties and surprises on the mountain.

When the first two expeditions to Mount Everest unraveled, the organization almost completely disintegrated. Ties did not stick. Knowledge and skills were lower than necessary to cope with the mountain, even by a normal, easy route, and leadership was not clear enough (Oyarzun and Lucero).

In contrast, the last three expeditions adopted a mixed model, bringing together people from different origins. Ideological variety made these organizations more difficult to lead but more effective and more adaptable to the environment; and this was why they chose to attempt difficult routes. Also, the leaders of the first two expeditions were clearly leaders of monotonic cultures from their respective university clubs –Oyarzun in UCH, and Lucero in UC. In the last three expeditions, however, the leader (Jordan) was more eclectic and less culturally dependent. His social and cultural profile was higher than that of the other leaders, as was that of his closest collaborators (Garcia, Diaz).

Second, an effective self-emergent order arises as a result of small variations, and leadership is an essential component of this dynamic. At the end of the second failed attempt, the future CEO (Jordan) commented to the future COO (Garcia) that he really did not know why they were abandoning the mountain, and that he really wanted to climb the mountain. When they mutually agreed, they established the initial conditions for a relationship that would enable them to lead other more ambitious assaults on the mountain –their self-confidence was reflected in the choice of harder routes.

This core agreement is what gave rise to the initial block on which the next three projects were built, yet it appeared almost by chance. The two men were not close friends; in fact they were very different, and there were times when one could feel threatened by the other. They kept their conversation secret from the others, and there was not even an explicit agreement between them, it was just a sense of sharing the same perspective about the context. Not friendship but professionalism is what determined the emergence of an effective pattern. In this case, the CEO (Jordan) took care of external relations, while the COO (Garcia) was in charge of establishing the physical standards of performance (he was the strongest man in the group).

Third, what makes things happen is action. Members were always doing things to push the project ahead (even several months before a number of strategic issues, especially funding, had been sorted out). Although people worked in the knowledge that there were structural voids, they assumed with supreme confidence that all the difficulties would be overcome. Everything was collected and assembled when the project was already on the move, and it was running because the CEO (Jordan) said so. Members believed in his capacity to make things happen (particularly raise the funds to pay the fees to the Chinese authorities). At any given moment, there were things happening. People in the last three expeditions, especially in 1992, were constantly training and managing their own areas of the expedition's administrative and logistic work (i.e. collecting information, buying food, gear, etc.), in a very independent and autonomous way, and they did it with a very high degree of commitment and efficiency.

Each member (they were not professional sports people) trained every weekday from 21:30 to 23:30, and on weekends they went to the Andes, trying to hike to high altitudes in short periods of time. Usually they climbed non-stop day and night in pairs, groups of three, or even alone. Nobody was merely supervising, nobody was excused from doing his share of the work. Every Monday, each person explained to the group what he had done, and the one who had done the most challenging training set the standard for the following weeks. The physical work was clear to see and easy for the others to evaluate, as they were experts on mountaineering.

Additionally, each person was in charge of at least one administrative task (i.e. medical, food, gear, logistics, fund-raising, etc.), and usually helped another member in some of his administrative duties. If at any time during the training, which included an informal daily meeting, a group member did not have any administrative work, the others would say "do something!". This phrase was a collective motto to elicit action.

Another characteristic of the effective 1992 pattern was that the structure was very flat, action was very visible, and reciprocal control and a lot of autonomy and trust was embedded in collective work. Although the CEO (Jordan) was in charge of fund-raising and external relations, other expedition members (Montes), helped him in this task and he was not exempted from physical work. If he did not perform up to the physical standards set, he was directly and openly criticized. Also, the COO (Garcia) and the other members went to interviews and performed external relations and administrative tasks without complaint.

Problems arose regularly, especially on the mountain, but there was a lot of open communication. This meant that the environment was highly competitive, as well as cooperative. At times, conflicts turned people angry, but there was always direct and open negotiation, and once a decision was made the debate ended and the matter was closed. A very efficient decision-making process was built, one that preserved variety and at the same time increased the robustness of action. This created a strong sense of autonomy and respect for personal and technical capabilities. When the genotype and phenotype variety of the members of an organization increases, the collective response portfolio also increases –like the mutation of genes– but this situation is hard to manage, and it takes time and managerial ability to achieve coordination.

Fourth, organizing patterns are built up at the core of the group in the form of a tacit agreement ("how we do things"), made up of a few simple rules (collective genotype). Once it is established it usually does not change, and inertia grows. People get locked in by the understandings they themselves have constructed. Once the few and minimal rules of organizing are settled, the system acquires its own dynamic (collective phenotype) and people behave accordingly.

Collective phenotypes and genotypes are often perceived by members as external to themselves. Sometimes, people criticize the collective phenotype but, once established, the program works by itself, even though in fact this collective program only exists inside concrete individuals. A clear example of this is the collective construction of scapegoats and heroes (role models): it is clear that particular individuals start movements against or in favor of others, but once this attitude is shared –mainly through political and genotype similarities among agents through the network– the future perception of the individual easily gets locked into a certain phantom role. In Goffman's terms, face-to-face negotiation among members is a collective game that reduces dissonance between collective and individual characteristics.

In organizations that confront uncertain environments, the capacity to manage variety and create internal mutations in their genotypes and phenotypes is essential to cope with environmental variability. Too much variety could make it impossible to manage the organization, and too little reduces the response portfolio. Therefore, to be efficient, organizing should be positioned on the edge, and members at the core should be able to manage this critical balance.

In 1992, in part due to the appalling conditions, the people at the core of the expedition had to behave on this critical edge. Nobody owned full knowledge and skills, and each depended on the others' technical expertise (Montes, Delgado, Buraccio, Diaz) or experience (Garcia, Jordan, Lucero). Even the formal leader (Jordan) had to accept criticism and open debate and negotiation, all of which he often complained about. Once the rules for accepting variety were settled –mainly after the selection of members was closed in the initial phase of preparing the expedition in 1990- people had to live with this variety and collective dissonance (Burgelman and Grove, 1996).

All of this means that the initial conditions (self-constructed environments) are very important because they establish the frame within which collective action takes place. To be sensitive to this process is critical for leaders who enact organizing because, once enacted, the organization becomes something in part external, against which agents must match their needs and sense of belonging. This crucial problem was a fundamental reason why, although the 1996 expedition was successful in external terms –they reached the top without accidents– the people at the core (CEO - COO) felt that the whole project and the evolution of their relations did not make sense any longer. This was the point when the successful organizing pattern started to fragment. Individual genotypes that sustain collective action could not reach acceptable bargaining terms any more. This experience should have been the expected initial condition for a further project, but this was not acceptable for people at the core.

Implications for design: The logic of action

Imagine organizing in a threatening environment:

– A tough and very challenging single goal with low probabilities of success (uncertainty) and high risk for the members (career risk, or even physical risk).

– Time constraints (the clock is racing toward the project deadline).

– Resource scarcity. "Do more with less." The organization has a certain, almost fixed, endowment of physical resources, which may be the best in the world, but are in short supply. Furthermore, these resources do not provide an

advantage, because others may have the same or better resources (they are not rare and are replicable).

And now, the project-based organizing must run. How? There is only one answer: action.

Weick's recipe is useful here: "How can I know what I think until I see what I say?" (Weick, 1979; Weick, 1995). In uncertain conditions, to move on the edge you have to act (a voice calling: "do something"), and for this no accurate map is necessary. A good excuse, even a flawed one, like a map borrowed from another place, may be enough (Weick, 1987).

Starting and sustaining action is the crux to enacting the first loop. Adaptive action and learning constitute the second loop, but it is not feasible without the first one (Argyris, 1992).

The impulse for action starts with the people at the founding core. That is where the project is initially enacted, where organizing takes its initial, and often inert, form. It is worth noting that this founding enactment is plagued by intentions that are followed by often decoupled actions, a lot of trial and error, improvisations, and sudden events that push organizing in one direction or another. After the initial framework gets settled, action gets bounded.

Here agency and entrepreneurship skills are critical. Once someone is convinced about the project, he starts making calls, connecting people, working out the structuring of the project: When? Who is going to be invited? Who is not? What kind and amount of resources (time) will the project demand? How are they going to be negotiated? What will be the outcome of the project for everyone in the network? What are the key success factors?

People at the core are always pushed to find the right answers for all of these problems; but accuracy is not the most important thing, and drive for action is the key factor to enact the project. Usually there is no strategic planning, no staff of thinkers, just a draft, a photograph, a few words in a notebook, a message in the mail and, ultimately, nothing whatsoever or, rather, a tiny piece of nothing for most people, but a world of dreams for a few, who are the ones who should be recruited to the project (i.e., most of the expedition members accepted the invitation to join the project as soon as they were invited, making strong commitments such as leaving their current job, with almost no information and without worrying about professional or family conflicts).

Accurate perceptions take time and do not necessarily provide answers –especially when the problem is new and must be managed by changing the premises of previous action (double loop –Argyris, 1992). Weick points out that "accurate perceptions have the power to immobilize" (Weick, 1995, p.60). To live on the edge, you need energy, confidence, focus, and motivated response.

Action rationality could be contrasted with decision rationality, in terms of the norms and rules which guide choice as opposed to those that inform conduct (Brunsson, 1982). Action is often loosely coupled with intentions. Biased noticing may be bad for deliberation, but it could be enough for action. In a world that is changing, having confident, bold, and enthusiastic action –even if it is based on positive illusions–can be adaptive (Taylor, 1989).

Bold action is adaptive because its opposite, deliberation, is futile in changing a world where perceptions, by definition, can never be accurate. By the time people notice

something, it has become something else and no longer exists. People on the edge are not driven by risk aversion, or by the fear of failure and loss. They are usually experts in the art of failing. This is not the problem. The real fear is of missing the opportunity, the elusive chance to do something great, to have the best experience. This challenge is the driver for living on the edge, and the logic of action is the right and only path for effective management (Weick, 1995, p.60).

People are permanently constructing the worlds they live in, and what they build is what they perceive. Both perception and construction reflect assumptions about the capacity of agents to move the world out there. Deliberation tends to persuade the agent to accept the world "as it is" (itself a construction from the analysis). Action is disruptive: it assumes, first, that power lies "inside" the agent, and then takes the world and previous experiences as raw materials to construct a new world. On the edge, people act and think at the same time (e.g., combat situations), but in a very different form than deliberative thinking.

In a threatening environment people should behave rationally, not following the linear and sequential rationality of clear cause and effect. People will search for the appropriate behavior, mainly through fast classificatory rules, and will not try to calculate accurately the consequences. Actions are matched to situations by means of rules organized as identities. In the end, it is challenge, not a mere routine, that sustains meaningful action in a threatening environment, and in that kind of context, decisions are taken to fulfill an identity (March, 1994, ch. 2)

Identity implication in the task is clear when we realize that, on the edge, action blends the turbulent waters of three rivers that characterize human nature: physical, emotional, and intellectual flows. Their combined strength is absolutely necessary to succeed in high demand environments. Threatening environments are tough, and most of the time cold, and in order to survive, people have to fight with all the strength they can muster: long hours of work, isolation, frustration at failed attempts, anxiety at the size of the challenge, eccentrics as teammates, and living in a very singular constructed reality that from the outside most people could barely understand. People need more than intellectual capabilities to deal with such environments. Skills, and not only knowledge, are fundamental to build organizational capabilities (i.e., a person may understand the need for continuous change and stress, but may not be able to endure it).

Improvisation is another prominent characteristic of living on the edge. Traditionally, improvisation tends to be seen as a dysfunction, an unintended outcome or a design failure. However, improvisation is related to human capital flexibility and the adaptive capabilities of the organization (Lewin, 1998). Effective improvisation skills are based on a depth of experience and discipline (you cannot improvise on nothing, you need something to build on), a fact that is often camouflaged by the spontaneity of the performance. The notion of spontaneous behavior overlooks the heavy investment in practice and study –listening, seeing, and copying the skills and roles of others– that often precedes a stunning performance. Like a jazz musician, who is aptly described as a highly disciplined "practicer" (Weick, 1998).

Deliberate improvisation is much tougher, much more time-consuming (time consumed *before* not *during* the performance), and places greater demands on resources –human and physical– than the simple replication of a model or routine. This explains why, in projects, improvisation tends to be frequent in the initial stages, and reduced at the organizational –but not at the individual– level. When the project is established, rules of interlocking behavior are settled.

Improvisation highlights the importance of small variations in the system, which is one of the concerns of complexity theory. These tiny variations provide the pretext for assembling diverse elements, which are not neutral. They encourage certain lines of development and exclude others.

A threatening environment is always, in some sense, a constructed environment that directs attention and action to some variables rather than others. Thus, adaptation in a non-threatening environment could mean that adaptation is, at least in part, a social construction of a certain environment (match and fitness are endogenous factors).

In threatening environments, interpretation of the context is more ambiguous, and uncertainty lies in how to assemble the resources for success. So, adaptation is not "accommodation" but the opposite: disruption, breaking through the current order and premises. Adaptation in threatening environments is not a linear evolution, but a non-linear causation in order to manage complexity. Furthermore, the idea of fitness becomes a self-fulfilling prophecy, as it can only be assumed looking backward, rationalizing the already known outcomes, and not looking forward, as a normative prescription for effective management on the edge.

Organizations are interpretive systems. Daft and Weick (1984), building on Miles and Snow (1978), sustain that building up interpretations about the environment is a basic requirement for individuals and organizations. Their model describes four models of organizational interpretation: enacting (prospector), discovering (analyzer), undirected viewing (reactor), and conditioned viewing (defender). Each mode is determined by: 1) management beliefs about the environment, and 2) organizational intrusiveness. Interpretation modes are hypothesized to be associated with organizational differences in environment scanning, equivocality reduction, strategy, and decision making.

The "enacting organization" is the most proactive and creatively interpretive of its organizational circumstances. It assumes that the environment is unanalyzable, but is active in intruding in it. These are the organizations we are interested in here, because they are the forms that survive on the edge –a place that they have to construct.

March (1988) argues that the ongoing attempts of organizations to creatively adapt to environmental pressures require a combination of rationality and "foolishness". Such organizational "playfulness," from which novelty emerges, is not the result of a conscious strategy but "is embedded in such familiar organizational anomalies as slack, managerial incentives, symbolic action, ambiguity and loose coupling" (1988:168). For all of them, foolishness is vital for organizational life (Chia and King, 1998).

Interpretation and the combination of rationality and playfulness are critical elements of a context very different from those envisioned by rational theories of organization and decision making.

To live in threatening environments demands strong commitments. Weak commitments make it more likely that the organization will accommodate will the environment. Strong commitments make it more likely that the environment will accommodate to the organization. In revolutions, agency really matters, because environment must be enacted (Weick, 1995, p.161).

A turbulent environment is not satisfactorily explained by traditional theories of decision making and strategic rationality. This is a world for sensemaking and contextual

rationality. Inherent in a turbulent environment are vague questions, muddy answers, and negotiated agreements. These attempt to reduce confusion and to clarify possible solutions, which may, however, be impossible in such situations (Weick, 1993, p. 636).

What is critical in organizing on the edge is building reliable and resilient structures. These structures should be able to absorb shocks, to learn and react rapidly; or, in terms of complexity theory, they should be "Complex Adaptive Systems".

One critical dimension in such structures is a role system that enables communication, changeability among agents, and, basically, reliability. The first main task of any small organization confronting a massive challenge is to establish structuring role attribution and recognition. How? By acting, not by thinking. By talking, laughing, gossiping, negotiating and, in the end, working and living together, at least for a short period of time, with strong but partial personal implication.

Weick argues that what makes organizations more resilient are the following four characteristics, which are fully appropriate to threatening environments (Weick, 1993, p.638): 1) improvisation and bricolage (generation of role improvisation); 2) virtual role systems; 3) the attitude of wisdom (in a fluid world, wise people know that they do not fully understand what is happening right now; openness is crucial in complex sensing); 4) respectful interaction (face-to-face, and intersubjective meaning). Structuring resilience means giving meaning to personal interaction. Frameworks, ties, and roles do not work alone. Furthermore, there is an inverse relation between meaning and structure: less meaning, more structure, and vice versa.

It is interesting to note that accidents, which are the context in which the reliability of systems and sensemaking is usually theorized, happen within environments and institutions characterized by highly normative and formally structured organizing, such as ocean navigation, air traffic control or space exploration (Perrow, 1984; Weick, 1993; Vaughan, 1996). Here, tight coupling and the chain reaction against meaning when formal structure collapses reveal a critical lack of organizational resilience. As a way to improve our knowledge of high reliability systems, further research should be done in the context of low normative and low formal structuring, such as occurs in transitory project-based organizations.

Our research attention should be redirected from structures, which are easy to see, to meanings. This does not mean forgetting structures, or even behaviors, but interpreting them in a context of meanings and interpretive filters, which are the real tools for understanding the content and direction of actions.

What is it like working on the edge? As an example, imagine a smokejumper outfit, a combat unit, or a mountaineering expedition. Few recommendations can be offered [Weick, 1969/1979 (2nd. ed.) #86, p.243]:

– Don't panic in the face of disorder.
– Never do one thing at once.
– Chaotic action is preferable to orderly inaction.
– The most important decisions are often the least apparent.
– There is no solution.
– Stamp out utility.
– The map is the territory.
– Rechart the organizational chart.
– Visualize organizations as evolutionary systems.
– Complicate yourself!

A final argument about managing relations and emotional ties in threatening environments deserves comment. How should these relations be handled? Coolly and without emotions or ties, or warmly with intense emotional ties?

One solution could be pooled interdependence. What is significant about pooled interdependence is that it can function without much cohesion (Bass, 1990). This sometimes resembles what Eisenberg (1990) calls nondisclosive intimacy, that is, relationships rooted in collective action that stress "coordination of action over the alignment of cognition, mutual respect over agreement, trust over empathy, diversity over homogeneity, loose over tight coupling, and strategic communication over unrestricted candor". The problem in this kind of "cool" world is that emotional ties are not developed, and then opportunities for organizational unraveling increase. Emotional ties ("know each other") keep panic under control in the face of obstacles, and provide trust for smooth organizing.

The latter point is very important because one might expect that the less threatening the environment, the less important relational issues will be in transient groups. Creating social systems to face uncertain conditions means managing emotional and relational issues in depth. Here lies the intragroup ability for structuring itself in a resilient form. On the other hand, too much emotion running through such ties could handicap objective thinking, detachment and, ultimately, professionalism. Once again, the right position is a balance.

Some projects look fancy and full of romantic surroundings, when in the end they are constituted by very heavy work and cold relations. High standards are not usually good conditions for friendship, and the fancy elements are no longer as fancy for insiders. However, such contexts imply emotion. Emotional lack could lead to anxiety and lack of resiliency. Too much emotion could lead to a dearth of professionalism, and difficulties in remaining detached and avoiding the trap of overdependency on past experience.

Developing emotional ties in a context of strong commitment but partial implication is one of the central paradoxes that people have to manage on the edge.

Conclusions

This paper is just an attempt to develop theory in order to explain how order emerges and evolves through a particular case of project-based organizations: mountaineering expeditions to climb Mount Everest.

This is a case of transitory organizing in a very threatening environment, with conditions of very high uncertainty and risk. This is what makes it an ideal setting for research, as in classical anthropology, where the basic methodological structure is the idea that we can isolate the social context in which organizations are enacted and trace the essential evolution of individuals and the development of social patterns.

Additionally, we could try to understand a very important and neglected research theme: how organizations are managed on the edge. In these situations people must act at the limits of their capabilities, and organizational design becomes crucial and dependent on the past experiences of core members.

We also believe that this is a very interesting setting in which to study how evolutionary and complexity ideas can be applied to organizations. We want to discover how

social patterns evolve, especially in the form of the enactment of effective organizing patterns, i.e. a set of common understandings and ways of doing things that are more effective than former patterns, and that are located in the tacit rules binding the people who are at the core of such organizations.

There is a lack of theoretical understanding of the processes that take place in this kind of organizational setting. Our case, in contrast to the available literature on accidents, uses experiences of both success and failure, in a context of low normative structuring. Additionally, it is centered not only on individual aspects (micro), but also on an analysis of the evolution of organizations in the social context (macro). We also focus on the design and effective management of project-based organizations.

The focus of our study could be summarized in two questions: 1) How do organizing patterns emerge and evolve? and, 2) How are project-based organizations managed on the edge? We used a genetic metaphor rooted in complexity theory and biology (geno/phenotype) to assess the evolution and the self-emergent order that arises from the social network of projects. Finally, we made a few suggestions about the second micro question, giving some insights on how to manage and design effective organizations to cope with threatening environments.

In further research, when our work on the series of expeditions is finished, we would like to investigate how people are recruited for such projects. What was their endowment at the time they were recruited? And how did their genetic charge evolve through the project? Which patterns, symbols and connections survived and which were displaced?

We believe that more research is needed on new organizational forms, which are a manifestation of a new economy. Transitory project-based organizations were chosen because they offer what we think is an ideal setting to pursue this kind of research.

A fine-grain methodology such as ethnographic and longitudinal research is also necessary to explore such contexts. The insights from evolutionary and complexity theory for studying organizing are encouraged by this paper, and the conclusions about patterns are consistent with these approaches: effective organizing patterns take time to emerge, and are the product of historical as well as personal circumstances; an effective self-emergent order arises as a result of small variations where leadership is an essential prompting element; what makes things happen is action; organizing patterns are built at the core of the group in the form of a tacit agreement ("how we do things") made up of a few simple rules (collective genotype). Once established, it usually does not change, and inertia grows.

Finally, we added some implications for design, based on what we called the logic of action. Action rationality is linked with adaptive behavior, identity, sensemaking and social construction. People living and working on the edge –turbulent and threatening environments characterized by very high uncertainty and risk– need to develop special skills and attitudes, and through our discussion we have tried to contribute to that development.

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Appendix

Table 1

#	MEMBERS	1984	1986	1989	1992	1996	TOTAL	INSTITUT.	SPECIALITY	TECH. LEVEL	EDUCATION	SOCIAL
1	G. Oyarzun	1	0	1	0	0	2	FED-UCH	M+	4, 3	3, 0, 3	2
2	C. Lucero	1	1	1	1	0	4	FED-UC	M+	5, 5, 4, 4,	3, 3, 3, 3	2
3	I. Vigoroux	1	0	0	0	0	1	FED-UCH	M	2	3	2
4	C. Galvez	1	0	1	0	0	2	FED-UCH	M	2, 2	3	2
5	G. Cassassa	1	0	0	0	0	1	CI (I)-UCH	C+/M	4	4	3
6	N. Muñoz	1	0	0	0	0	1	FED	N/M	1	2	1
7	N. Rivera	1	0	0	0	0	1	FED-UCH	N/M	1	2	1
8	L. Garcia	1	0	0	0	0	1	FED	N/M	2	2	1
9	J. Pardo	1	0	1	0	0	2	FED-UCH	N/M	2, 2	3	2
10	D. Peña	1	0	0	0	0	1	FED-UCH	N/M	1	3	2
11	C. Parvex	1	0	0	0	0	1	FED-UCH	M/C	3	3	2
12	J. Bassa	1	0	0	0	0	1	FED-UCH-P	P	1	4	2
13	S. Pablovic	1	0	0	0	0	1	Journalist	N	0	4	2
14	R. Jordan	0	1	1	1	1	4	UC	M+	2, 3, 5, 5	4, 5, 5, 5	3
15	P. Straub	0	1	0	0	0	1	UC	M	1	3	3
16	P. Bralic	0	1	0	0	0	1	UC	N	1	3	3
17	F. Garcia-H.	0	1	1	0	0	2	UC	M	2, 3	3	3
18	C. Garcia-H.	0	1	1	1	1	4	UC	M+	2, 4, 5, 5	4, 4, 5, 5	3
19	VH. Trujillo	0	1	0	0	0	1	UC	N	1	3	2
20	M. Grifero	0	1	1	0	1	3	UC	N	1, 1	3	2
21	JA. Marambio	0	1	1	0	0	2	UC-P	T (P)	1, 2	4	3
22	I. Canales	0	0	1	0	0	1	UC	J	1	3	2
23	C. Buraccio	0	0	1	1	1	3	CI (D)	C+/M	3, 4, 3	4, 4, 4	3
24	T. Purcell	0	0	1	0	0	1	J	N	2	5	3
25	K. Abell	0	0	1	0	0	1	J	N	1	5	3
26	A. Diaz	0	0	1	1	1	3	I-J-P-	T (P)/M	2, 2, 3	5	3
27	D. Aravena	0	0	1	0	0	1	I-T	T (C)	1	3	1

Appendix (continued)

Table 1 (continued)

	MEMBERS	1984	1986	1989	1992	1996	TOTAL	INSTITUT.	SPECIALITY	TECH. LEVEL	EDUCATION	SOCIAL
28	JS. Montes	0	0	0	1	0	1	CI (D)	C+/M	4	4	3
29	D. Delgado	0	0	0	1	0	1	CI (D)	C+/M	4	4	2
30	W. Farias	0	0	0	0	1	1	CI (D)	C+/M	4	3	2
31	M. Purcell	0	0	0	0	1	1	I-J	N	2	3	3
32	M. Alvial	0	0	0	0	1	1	I	M+	4	2	1
33	A. Boitano	0	0	0	0	1	1	CI (D)	C+/M	3	4	3
34	A. Gana	0	0	0	0	1	1	J-UC	N	2	4	2
35	T. Grifferos	0	0	0	0	1	1	J-T	T (T)	1	3	2
36	R. Oberti	0	0	0	0	1	1	T	T (C)	1	3	2

EXP. 84'

13	MEMBERS	1984	1986	1989	1992	1996	TOTAL	INSTITUT.	SPECIALITY	TECH. LEVEL	EDUCATION	SOCIAL
1	G. Oyarzun	1	0	1	0	0	2	FED-UCH	M+	4, 3	3, 0, 3	2
2	C. Lucero	1	1	1	1	0	4	FED-UC	M+	5, 5, 4, 4	3, 3, 3, 3	2
3	I. Vigoroux	1	0	0	0	0	1	FED-UCH	M	2	3	2
4	C. Galvez	1	0	1	0	0	2	FE-UCH	M	2, 2	3	2
5	G. Cassassa	1	0	0	0	0	1	CI (I)-UCH	C+/M	4	4	3
6	N. Muñoz	1	0	0	0	0	1	FED	N/M	1	2	1
7	N. Rivera	1	0	0	0	0	1	FED-UCH	N/M	1	2	1
8	L. Garcia	1	0	0	0	0	1	FED	N/M	2	2	1
9	J. Pardo	1	0	1	0	0	2	FED-UCH	N/M	2, 2	3	2
10	D. Peña	1	0	0	0	0	1	FED-UCH	N/M	1	3	2
11	C. Parvex	1	0	0	0	0	1	FED-UCH	M/C	3	3	2
12	J. Bassa	1	0	0	0	0	1	FED-UCH-P	P	1	4	2
13	S. Pablovic	1	0	0	0	0	1	Journalist	N	0	4	2

EXP. 86'

9	MEMBERS	1984	1986	1989	1992	1996	TOTAL	INSTITUT.	SPECIALITY	TECH. LEVEL	EDUCATION	SOCIAL
9	C. Lucero	1	1	1	1	0	4	FED-UC	M+	5, 5, 4, 4	3, 3, 3, 3	2
14	R. Jordan	0	1	1	1	1	4	UC	M	2, 3, 5, 5	4, 5, 5, 5	3
15	P. Straub	0	1	0	0	0	1	UC	N	1	3	3

Appendix (continued)

Table 1 (continued)

#	MEMBERS	1984	1986	1989	1992	1996	TOTAL	INSTITUT.	SPECIALITY	TECH. LEVEL	EDUCATION	SOCIAL
16	P. Bralic	0	1	0	0	0	1	UC	N	1		3
17	F. Garcia-H.	0	1	1	0	0	2	UC	M	2, 3		3
18	C. Garcia-H.	0	1	1	1	1	4	UC	M	2, 4, 5, 5	4, 4, 5, 5	3
19	VH. Trujillo	0	1	0	0	0	1	UC	N		3	2
20	M. Grifero	0	1	1	0	0	2	UC	N	1, 1	3	2
21	JA. Marambio	0	1	1	0	0	2	UC-P	T (P)	1, 2	4	3
	EXP. 89'											
	MEMBERS	1984	1986	1989	1992	1996	TOTAL	INSTITUT.	SPECIALITY	TECH. LEVEL	EDUCATION	SOCIAL
	R. Jordan	0	1	1	1	1	4	UC	M	2, 3, 5, 5	4, 5, 5, 5	3
	C. Lucero	1	1	1	1	0	4	FED-UC	M+	5, 5, 4, 4	3, 3, 3, 3	2
	F. Garcia-H.	0	1	1	0	0	2	UC	M	2, 3		3
	C. Garcia-H.	0	1	1	1	1	4	UC	M+	2, 4, 5, 5	4, 4, 5, 5	3
	M. Grifero	0	1	1	0	0	2	UC	N-J	1, 1	3	2
	I. Canales	0	0	1	0	0	1	UC	N-J	1	3	2
22	C. Buraccio	0	0	1	1	1	3	CI (D)	C+/M	3, 4, 3	4, 4, 4	3
23	T. Purcell	0	0	1	0	0	1	J	N-J	2	5	3
24	K. Abell	0	0	1	0	0	1	J	N-J	1	5	3
25	JA. Marambio	0	1	1	0	0	2	UC-P	T (P)	1, 2	4	3
26	A. Diaz	0	0	1	1	1	3	I-J-P	T (P)	2, 2, 3	5	3
27	D. Aravena	0	0	1	0	0	1	I-T	T (C)	1	3	1
	EXP. 92'											
	MEMBERS	1984	1986	1989	1992	1996	TOTAL	INSTITUT.	SPECIALITY	TECH. LEVEL	EDUCATION	SOCIAL
	R. Jordan	0	1	1	1	1	4	UC	M+	2, 3, 5, 5	4, 5, 5, 5	3
	C. Lucero	1	1	1	1	0	4	FED-UC	M+	5, 5, 4, 4	3, 3, 3, 3	2
	C. Garcia-H.	0	1	1	1	1	4	UC	M+	2, 4, 5, 5	4, 4, 5, 5	3
	C. Buraccio	0	0	1	1	1	3	CI (D)	C+/M	3, 4, 3	4, 4, 4	3
28	JS. Montes	0	0	0	1	0	1	CI (D)	C+/M	4	4	3
29	D. Delgado	0	0	0	1	0	1	CI (D)	C+/M	4	4	2
	A. Diaz	0	0	1	1	1	3	I-J-P	T (P)/M	2, 2, 3	5	3

Appendix (continued)

Table 1 (continued)

	EXP. 96' MEMBERS	1984	1986	1989	1992	1996	TOTAL	INSTITUT.	SPECIALITY	TECH. LEVEL	EDUCATION	SOCIAL
	R. Jordan	0	1	1	1	1	4	UC	M+	2, 3, 5, 5	4, 5, 5, 5	3
	C. Garcia-H.	0	1	1	1	1	4	UC	M+	2, 4, 5, 5	4, 4, 5, 5	3
30	W. Farias	0	0	0	0	1	1	CI (D)	C+/M	4	3	2
31	M. Purcell	0	0	0	0	1	1	I-J	N	2	3	3
32	M. Alvial	0	0	0	0	1	1	I	M+	4	2	1
33	A. Boitano	0	0	0	0	1	1	CI (D)	C+/M	3	4	3
34	J. Gana	0	0	0	0	1	1	J-UC	N	2	4	2
	C. Buraccio	0	0	1	1	1	3	CI (D)	T (C)/C/M	3, 4, 4	4, 4, 4	3
	A. Diaz	0	0	1	1	1	3	I-J-P	T (P)/M	2, 2, 3	5	3
35	T. Grifferos	0	0	0	0	1	1	J-T	Y (T)	1	3	2
36	R. Oberti	0	0	0	0	1	1	T	T (C)	1	3	2

Appendix (continued)
Table 2. Expedition characteristics

	1984	**1986**	**1989**	**1992**	**1996**
Number of people	12	9	5	7	9
Power Structure	One dominant coalition (Fed-UCH)	Tight dominant coalition (UC)	Mixed model	Mixed model	Mixed model
Government Support	High	Low	Medium	None	Medium
Media Support	High	Low	High	None	Very high
Sponsoring	Medium	High	Very High	Medium	Very high
Budget	Medium	Medium	High	Very low	Very high
Knowledge & Skills	Medium S.D. Med	Low S.D. Low	High S.D. High	Very high S.D. Low	High S.D. High
Control	Vertical & Clan	Vertical & Clan	Line & Staff. Vertical	Flat. Self-control	Vertical. Line & Staff.
Selection Criteria	Formal. "National Selection"	Club Membership Selection	By invitation	By invitation	By invitation