The Manager as Change Agent: Communication Channels, Timing of Information and Attitude Change*

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Abstract

This paper proposes a deductive model to analyze the relationship between organizational context and the dynamic process of attitude change. In particular, we focus on how the system of formal and informal communication channels that characterize an organization and the timing of information flows affect attitudes within the organization. To illustrate how the general approach presented in this paper can be adapted to particular circumstances and is able to generate useful insights, both to researchers and practitioneers, we analyze and discuss the implications of a simple version of the model. Our results suggest that the organizational structure, the timing of information flows and the prevailing configuration of attitudes are all intervening variables when it comes to the selection of the best approach to organizational change. Several illustrations are presented and discussed.

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1 Introduction

The relationship between individual attitudes and behavior is a classical theme in social psychological and organizational studies (Fishbein and Ajzen, 1974; Ajzen and Fishbein, 1977; Ajzen, 1988; Brief, 1998). Attitudes can be defined as summary evaluations of persons, objects, ideas, or activities along a dimension ranging from positive to negative. It is generally assumed that a person's attitude towards an object constitutes a predisposition to respond to the object in a consistently favorable or unfavorable manner (Fishbein and Ajzen, 1974, p.59). Since attitudes are presumed to influence behavior, an important dimension of the problem of organizational design is to choose the organizational structures and procedures that best contribute to the alignment of individual attitudes and collective goals. However, as pointed out by Brief (1998, p.75), the relationship between organizational context and the dynamic process of attitude change has frequently been overlooked.

Based upon the literature, we depart from the assumption that attitudes influence behavior and study the impact of organizational variables on the dynamics of attitude change. This paper is inspired by a growing literature in organization science that views organizations as complex adaptive systems, that is, systems where individual adaptive agents are linked together within interactive networks (Heydebrand, 1989; Burkhart, 1996; see Anderson, 1999, for a recent overview). As pointed out by Simon (1996), every aspect of a complex adaptive system - individuals, their attitudes, and the nature and strength of connections between them - can change over time as the system evolves. In this context, we propose a theoretical model to analyze how organizational design affects the evolution of attitudes within an organization. The concept of organizational design has taken on a variety of meanings and aspects in the organizational literature (Mintzberg, 1983, Pfeffer, 1978). In this paper, we discuss how the system of formal and informal communication channels that characterize an organization, and the timing of information flows influence the dynamic process of attitude change.

We consider three types of organizations, according to the system of formal and informal communication channels: the hierarchy, the network, and the hybrid organization. Hierarchies and networks have been characterized in many ways in the literature (Hummon and Fararo, 1995, and Carley and Lyn, 1997). Here, the words "hierarchy" and "network" are used in a very specific sense. The hierarchy is defined as a system in which the communication channels correspond to the links of authority that characterize the formal structure. The formal structure is composed of the set of positions in the organization, the way these positions are clustered, and the way the formal authority flows among them. In the network, the communication channels corresponding to the formal links of authority are complemented by a complex system of informal relationships between organization members, so that all the members within the organization are linked. The hierarchy and the network correspond to the two extreme cases. We always consider an intermediate structure, the hybrid organization, where some informal relationships exist and others do not.

The evolution of attitudes within the organization depends, not only on the system of formal and informal communication channels that characterize an organization, but also on the dynamic process by which attitudes are revised. This, in turn, depends on the timing of information flows. By influencing who gets the new information first, top management may affect the order in which individuals revise their attitudes. As a consequence, attitudes do not necessarily change all at the same time. Thus, we consider two classes of dynamics of attitude change: the simultaneous dynamics and the sequential dynamics. In the simultaneous dynamics information flows quickly in the organization, so that all the elements adjust their attitudes simultaneously. This scenario may be understood as corresponding to the situation where issues are discussed openly, with a high level of participation, so that everybody gets the same information at nearly the same time and attitudes change almost simultaneously. In the sequential dynamics information flows slowly, in a pre-specified order, so that individuals adjust

their attitudes sequentially. This scenario may represent the situation where issues are discussed within subgroups according to a certain order.

In contrast with the existing literature on organizational change (Kanter, 1983, Kanter *et al.,* 1992, Jick, 1993*)*, which is predominantly case-based, this paper presents a deductive, theory-driven model of change. More specifically, we propose a theoretical framework to analyze the impact of the system of communication channels and the timing of information flows on attitude change. This paper also aims to illustrate that theoretical models like the one presented here may complement the typical inductive approaches to generate relevant insights about organizational change. In particular, we show that the approaches to change management proposed in this paper explain and are largely consistent with ideas generated in the existing management literature on attitudes and on organizational change, as well as with case-based evidence.

The approach proposed in this paper is also related to the literature on social network analysis (Burt, 1992; Krackhardt, 1990; Krackhardt and Hanson, 1993; and Brass and Krackhardt, 2001). Recognizing that much of the real work in organizations happens despite the formal organization, this literature pays attention to the networks of relationships that employees form while interacting. More specifically, network analysis proposes a method to diagnose informal relationships within organizations and discusses how personal interaction patterns are associated with issues such as power, information flows, attitudes, and social support. This paper contributes to this literature. It presents a theoretical model to analyze how, for a given initial configuration of attitudes and a specific map of influences, managers should deal with the problem of organizational design when their objective is to align individual attitudes and collective goals.[1] As we discuss below, although in this paper we only consider some initial

[1]With some notable exceptions (*e.g.*, Friedkin, 1986, 1990, 1991; Friedkin and Johnsen, 1990, 1997; Krackhardt, 1997, Krackhardt and Carley, 1998), the social network literature is predominantly descriptive and empirical. Our paper presents a theoretical model that views the organization as a system of formal and informal communication channels and that is able to generate specific insights about the problem of organizational design when the objective is to affect the attitude profile of the organization. The need to develop theoretical models that complement the existing literature on

configurations of attitudes and patterns of interactions, the approach presented here is able to generate insights about the dynamic process of attitude change for any initial conditions. In this sense, our approach is truly complementary to social network analysis: while network analysis provides a methodology to diagnose the system of communication channels that characterize an organization and how individual members influence each other, our model studies the dynamic process of attitude change generated by such a system of interactions and provides specific insights about how to reshape the organization to attain collective goals.

The paper is organized as follows. In the next section, we present the model and its constituent variables. After that, we discuss the model's implications in terms of the management of attitude change in organizations. We then relate our results to the existing literature on organizational change and illustrate the practical relevance of the model using a few examples. The last section concludes. The formal mathematical model is presented in appendix.

2 The Model

Our model aims to describe how the attitudes of individuals evolve within an organization. At any moment in time, attitudes are determined not only by personal dispositions but also by the attitudes of those with whom the individual interacts. The set of attitudes will, therefore, change dynamically. We consider that, at each step of the underlying change process, each individual revises his or her attitude according to a rule. This rule depends on the four basic ingredients: (1) the relevant set of members that influence each individual; (2) the relative strength of the influence exercised by each member; (3) the members' initial attitude; and (4) the strength of

social networks has already been identified in the literature. For example, as Salancik points out, "To be productive in understanding organizations, network analysts will need to become more theoretical about the things they study. () In short, a network theory of organization should propose how structures of interactions enable coordinate interaction to achieve collective and individual interests." (1995: 345-349).

personal beliefs.

2.1 Neighborhood and Communication Channels

The first ingredient is the description of the set of members of the organization with whom each individual interacts. The attitudes of individuals are related in a systematic way to a number of things, including beliefs, values, personality and past behavior. However, members' attitudes are also affected by the attitudes of co-workers and other organization members with whom they interact (Weiss and Nowicki, 1981; Griffin, 1983). Therefore, by determining who communicates with whom, the organizational form may affect the process of attitude change within the organization.

More specifically, we consider an organization with the following formal structure. Each individual is formally subordinated to an authority individual in the next higher level except, of course, in the case of the individual in the highest position. For the sake of simplicity, we consider an organization composed of three levels, where each individual in the two highest levels has only two subordinates. Such a formal structure is represented in Figure 1. This is the simplest formal structure that captures the typical features of departments. In fact, this organization may be interpreted as consisting of one top manager and two multi-agent departments. Each department has one manager and two elements. Both managers report to the top manager. The numbers have been distributed in such a way that it is possible to refer to the two departments as the odd department (the one including elements 3, 5 and 7) and the even department (including elements 2, 4 and 6).

[Insert Figure 1 about here]

We consider three structural types, according to the communication channels they rely upon: the hierarchy, the network and the hybrid structure. The hierarchy and the network are two extreme structural types. We think of a hierarchy as a system in

which the communication channels correspond to the links of authority that characterize the formal structure. The formal structure is composed of the set of positions in the organization, the way these positions are clustered, and the way the communication is constrained to flow among them. In contrast, in the network, communication channels corresponding to the formal links of authority are complemented by a system of informal relationships between organization members, so that all the members within the organization are linked. The hybrid mode of organizing is an intermediate mode, where some informal relationships exist and others do not. In particular, we consider a specific type of hybrid organization, where the only links beyond those in the hierarchy reflect direct peer contact. In this hybrid organization, the two managers communicate directly with each other and peers working in the same department also communicate with each other. These links may be interpreted as corresponding to the existence of an executive committee and of intradepartmental influence.

We do not claim, of course, that these structural types correspond to all the formats available to organizations. They are merely presented as alternative formats along a given dimension, where the hierarchy and the network correspond to the two conceptual poles and the hybrid structure represents an intermediate case. It should be noted that the general framework proposed in this paper can also be used to study any other type of hybrid organization.

The set of individuals with whom an organization member interacts constitutes his or her neighborhood. In the hierarchy, the neighborhood of any individual is composed of its direct superior and its direct subordinates. In the network, the neighborhood of any individual is composed of all the other six members. In the hybrid type, the composition of the neighborhood of any individual depends on the array of existing informal communication channels.

Attitudes may evolve over time as each individual is influenced by his or her respective neighborhood, partly because people expose themselves to similar others (Hinds

et al., 2000). However, as already mentioned, the attitude of each individual is also affected by individual dispositions. These two types of effects may reinforce each other, if aligned, or have the opposite effect, if they point to different attitudes. In the latter case, the stronger effect prevails. In order to compare these effects and to determine which one prevails, we first have to specify their strength.

2.2 The Strength of Influences

Let us start with the strength of the influences of a neighborhood. Through interactions between pairs of individuals, each one may influence the attitude of the other. We now characterize the set of influences among pairs of individuals. If two individuals influence each other in the same direction, that is, a given attitude of one of the individuals influences the other individual in the same direction, we say that there is affinity between these two individuals. In this case, their influence is given a positive sign. Conversely, there is animosity between two individuals when they influence each other in the opposite direction, that is, a given attitude of one of the individuals influences the other individual in the opposite direction. In this case, their influence is given a negative sign.

Animosity between individuals or groups can be taken as a "fact of life" in most organizations. This is due to the fact that groups, as remarked by McGrath (1991), are loosely coupled by nature: members are loosely coupled to each other, and the group is itself loosely coupled to the social context where it exists. Loose coupling, combined with the abundance and juxtaposition of groups and group memberships, makes intergroup conflict inevitable (Guzzo and Shea, 1992). We can add to this the tendency of people to differentiate themselves according to their group membership, something that Sumner (1906) described as ingrouping or outgrouping, meaning groups to which a particular individual belongs or does not belong. Inter-group behavior, or the interaction between people from different groups (Tajfel, 1979), can thus be

understood as being influenced by two complementary processes: (1) the within-group alignment of members' attitudes (Janis, 1982), which leads to in-group loyalty and out-group derogation, and (2) inter-group competition (Hogg and Vaughan, 1998). Considering that both cognitions and emotions are transferred between group members (Linville and Fischer, 1993; Neumann and Strack, 2000), groups easily become more internally homogeneous and externally differentiated.

The leadership literature illustrates how these processes can occur either between formal groups or within a single formal group, with the emergence of informal sub-groups. The Leader-Member Exchange theory, or LMX (Dansereau, Graen, and Haga, 1975), flashes out this possibility with empirical confirmation, which means that the drive towards differentiation may be a common phenomenon of organizational life. As expected according to the arguments mentioned above, a sharply differentiated in-group is likely to create feelings of resentment and undermine team identification among subordinates who are excluded from the in-group (McClane, 1991).

More specifically, we make the following assumptions. Consider two individuals, A and B, such that A influences B and B influences A. For simplicity, we assume that if the influence of individual A over individual B is positive (negative) then the influence of B over A is also positive (negative). However, the strength of these influences is not necessarily the same. If individual A is placed above B in the formal structure of the organization, and if they influence each other, then the influence of A over B is greater than the influence of B over A. In addition, if the two individuals are at the same organizational level, and if they influence each other, then they influence each other with exactly the same intensity.[2] The strength of the influence between peers is assumed to be less than the influence exercised by superiors over subordinates but

[2]In practice, we may observe much more complex influence structures. In particular, we may observe non-symmetric relationships between any pair of organizational members (*e.g.*, Carley and Karchardt, 1996). While, in this paper, we consider some asymmetric relationships, more complex situations could easily be analysed.

greater than that which is exercised by subordinates over superiors.[3] Furthermore, the strength of the influences received from superiors is the same, no matter from which superiors it comes; and the strength of the influences received from subordinates is the same, no matter from which subordinates it comes. This means that the strength of the influence exercised by superiors over subordinates (and by subordinates over superiors) is the same, no matter to which department the superior and the subordinate belong or which hierarchical level they occupy. The same reasoning applies to the interaction between peers. Whenever there is an influence between individuals in the same level, the strength of such influence is the same, no matter at what level they are.

An individual tends to align with those who have a positive influence and to align negatively (or to misalign) with the attitudes of those who have a negative influence over him or her. The extent to which the individual tends to align or to misalign with each of his or her neighbors is given by the strength of the respective interaction.

Finally, any individual tends to align his or her attitude with his or her personal beliefs. Consider the case where, for a given individual, the strength of such influence is too high, as compared to the influence of superiors. Such an individual will simply not change his or her attitude, unless he or she interacts with a large enough number of organizational members. This person may simply not change his or her attitude, even in a network. On the other hand, consider the case of an individual whose personal beliefs do not influence much his or her attitude. A radical example would be to make such influence equal to zero. In this case, the evolution of the individual's attitude would simply depend on his or her neighbors' attitudes and on the nature of the neighborhood relationships.

[3]Clearly, this assumption may not hold. As Burt (1982) has emphasized, to the extent that co-workers perceive each other to be similar, then they are more likely to influence each other. According to Sailer (1978), two people are equivalent in their roles if they communicate with equivalent others (for a different definition of structural equivalence see Lorrain and White, 1971). As a result, an individual may be more influenced by a peer than by a superior. Notice, however, that the general framework proposed in this paper can also be used to analyze such situations.

2.3 The Change Rule

For an initial configuration of attitudes and a neighborhood structure, the rule according to which a given individual revises his or her attitude can be described as follows. Consider, first, all the influences that lead the individual to assume a positive attitude: neighbors with positive attitudes and positive interactions, neighbors with negative attitudes and negative interactions and, possibly, the influence of his or her personal beliefs, in the event that it points to that attitude. The sum of the strengths of all such influences is to be called the up-field. Consider, now, the influences that lead the individual to assume a negative attitude: neighbors with positive attitudes and negative interactions, neighbors with negative attitudes and positive interactions and, possibly, the influence of his or her personal beliefs, values and personality, in the event that it points to a negative attitude. The sum of the strengths of all such influences is to be called the down-field. The evolution of an individual's attitude depends on the relative strength of his or her up-field and down-field: if the up-field is larger than the down-field, the attitude of the individual will become positive; if the up-field is smaller than the down-field, the attitude becomes negative; and if both fields have equal magnitude, the different influences neutralize each other and the attitude does not change.

2.4 The Dynamics of Change

The structural type, as described above, defines who communicates with whom and, therefore, who influences whom. However, the evolution of attitudes within the organization also depends on the timing of information flows. By influencing who gets the new information first, top management may affect the order in which individuals revise their attitudes. As a consequence, attitudes do not necessarily change all at the same time. Thus, we consider two classes of dynamics of attitude change: the simultaneous dynamics and the sequential dynamics.

In the simultaneous dynamics, information flows quickly in the organization, so that all the elements may adjust their attitudes more or less simultaneously. This possibility is illustrated, for example, by the organizational literature on the social processing of information (Pfeffer and Salancik, 1978) and on shared perceptions (Kozlowski and Hattrup, 1992). This scenario may be understood as corresponding to the situation where issues are discussed openly, with a high level of participation, so that everybody gets the same information at nearly the same time and attitudes change almost simultaneously. The way in which our model incorporates this type of dynamic process is by assuming that everybody considers the change of attitude at about the same time.

In the sequential dynamics, attitudes are revised one by one, according to a pre-specified order. We consider two pre-specified orders: top-down (TD) and bottom-up (BU) sequential dynamics. In the TD dynamics, individuals revise their attitudes in an increasing order, from individual 1 to individual 7, and then restarting from number 1, in repeated cycles until attitudes do not change any more. In the BU dynamics, the cycle of revision of attitudes starts with individual 7 and follows a decreasing numerical order to 1, restarting the updating cycle until attitudes do not need to change.

The TD sequential dynamics typically correspond to situations where change occurs mostly as a formal and planned effort (Galbraith, 2000). In the BU sequential dynamics, information typically flows slowly from individual to individual, with change occurring in a more informal and emergent way (Orlikowski, 1996; Weick, 2000). Most likely, of course, no real organization is correctly described by either of these two extreme specifications of the sequential dynamics, as illustrated, for example, by Sutcliffe and McNamara (2001), who exposed the changing nature of organizational change over time.

In general, we would expect a combination of both the simultaneous and sequential dynamics, with some subgroups changing their attitudes simultaneously and others

sequentially. However, since all the other possible dynamics are combinations of the two extreme cases, the discussion of the simultaneous and sequential dynamics captures the main features of the dynamics of attitude change in organizations.

The system composed of the organization, its members and respective attitudes is said to be in a stable situation when the attitude of each individual is aligned with the total influence exercised over him or her. At a given point in time the system may or may not be in a stable situation. If the system is stable, the set of attitudes is said to be an equilibrium configuration of attitudes in the sense that such configuration does not change through further iteration of the specified dynamics. The relevant issue in this model is to find out whether the system converges to an equilibrium configuration or not, and to characterize such an equilibrium set of attitudes.

2.5 The Objective of the Top Manager

Since attitudes are presumed to influence behavior, the objective of aligning organizational goals and individual behaviors translates into a problem of attitude alignment. Therefore, we assume that the top manager's objective is to choose the organizational processes and procedures that best contribute to the alignment of attitudes.

It is important to stress that in real-life organizations there are situations where the diversity of attitudes is beneficial. This may occur, for example, if the objective is to stimulate innovation. It should be noted, however, that the general framework proposed in this paper to analyze the evolution of attitudes can also be used to generate useful insights about the conditions under which such diversity is produced. For simplicity of exposition, we focus on those situations where the objective of the leader is to align the members' attitudes with his or her own.

For a given initial configuration of attitudes, the final (equilibrium) configuration will depend on the dynamic process of attitude change (simultaneous, top-down, or bottom-up) and on the existing communication channels (hierarchy, network or hybrid

structure). Therefore, to facilitate the alignment of the members' attitudes in equilibrium with his or her own, the top manager may use two instruments. First, he may decide to activate communication channels (or not) beyond those defined by the formal links of authority. Second, by affecting the timing of information flows, that is, who gets the information first, the top manager may influence the order in which individuals revise their attitudes, and, therefore, the dynamic process of attitude change.

The objective of the top manager is to generate an equilibrium that maximizes the number of individuals sharing his or her attitude. Let us assume, without loss of generality, that the top manager has a positive attitude. If this is the case, the less interesting structures, from the top manager's point of view, are those leading to a stable configuration in which all individuals reach a negative attitude. Two intermediate situations may arise. First, the system may reach a stable configuration in which some individuals have positive attitudes and others have negative attitudes. The larger the number of individuals with a positive attitude, the better. Second, the dynamics may not allow the system to reach a stable configuration. We assume that the leader is indifferent among all the situations where no equilibrium is reached.

2.6 Implementing the Model

Our main objective in this paper is to analyze the problem faced by a top manager when choosing the organizational processes and procedures that facilitate the dissemination of his or her attitude in the organization. Therefore, it makes sense to assume that the top manager maintains his or her attitude throughout the whole dynamic process. This corresponds to assuming that the top manager has strong personal beliefs. Furthermore, we assume that the individual values and beliefs of the other organizational members are relatively weak, in order to allow the influences of neighborhoods to play a relevant role. It is fairly obvious that if those personal values and beliefs are relatively strong, individual attitudes will not change.

In our model, the top manager can intervene at two levels: (1) the choice of the structural type, that is, the formal and informal communication channels that characterize an organization, and (2) the definition of the dynamic process of information flows, which determines the order according to which individuals revise their attitudes. In order to characterize the optimal choices, we study all the combinations of the three types of structures described above - the hierarchy, the network and the hybrid structures - with the three types of dynamics just identified - the simultaneous dynamics, the TD sequential dynamics and the BU sequential dynamics.

The optimal choice of the top manager along these two dimensions clearly depends on the initial configuration of attitudes. In fact, the way in which attitudes evolve within an organization depends not only on the communication channels and on the timing of information flows, but also on the initial configuration of attitudes. Two extreme initial configurations of attitudes appear to be particularly interesting: the isolated leader case and the conflicting attitudes case.

The first initial configuration corresponds to the situation where an isolated leader tries to change the attitude of the rest of the organization, which is opposed to his or her own. This captures important elements of the situation often faced by top managers when initiating a radical change process in their organizations. As mentioned by Kotter and Heskett (1992), effort toward major change is often initiated by leaders who "either came into their positions from outside their firms, came to their firms after an early career somewhere else, 'grew up' outside the core of their companies or were unconventional in some other way" (1992, p.89). As a result, these leaders tend to bring with them perspectives, personal values and attitudes that are different from those that are dominant within their organizations. The organizational change literature is replete with case-based evidence of 'change masters' (Kanter, 1983) who have been able to transform their organizations despite initial resistance and opposition. Jack Welch and Percy Barnevik illustrate how initially negative attitudes (reflected in their

nicknames, 'Neutron Jack' and 'Percy the Axe', respectively) may actually be changed.

The second initial configuration corresponds to the situation where the organization is split into two equally important factions - one that has the same attitude as the top manager and one that has the opposite attitude. In our formal structure, we simulate this situation assuming that one department (the odd department) has the same attitude as the top manager and the other department (the even department) has the opposite attitude.

Finally, the optimal structural type and dynamic process of attitude change depends on the existence of affinity *versus* animosity between organizational members. We study both situations: one where there is affinity between peers and one where there is animosity. More specifically, by the *affinity case* we mean, below, the situation where there is affinity between all individuals that interact; and by the *animosity case* we mean the situation where there is animosity between peers.

3 Results

We are now in a position to discuss the relationship between the organizational context and the dynamic process of attitude change under the conditions just specified. The formal mathematical model used to derive the results presented below is described in appendix. All the conclusions are obtained from simulations of this model. The results summarized below are robust to different relative strengths of influences from superiors, peers and subordinates.

3.1 Affinity

For convenience, we first discuss the results for the affinity case, that is, the case where individuals influence each other in the same direction, and then analyze the animosity case, that is, the case where peers influence each other in the opposite direction.

3.1.1 Isolated leader

The results for the isolated leader case in presence of affinity indicate that a necessary condition for the leader to be able to change the prevalent attitudes within the organization is that the dynamics be sequential. This result suggests that the degree of participation is a relevant ingredient in the process of attitude change. As already mentioned, the simultaneous dynamics may be understood as corresponding to a situation in which issues are discussed openly, with a high level of participation, so that everybody gets the same information at about the same time and attitudes change simultaneously. In contrast, under a sequential dynamics, issues are discussed within subgroups according to a certain order. This slow diffusion of ideas increases the ability of top management to implement his or her attitude.

The intuition is the following. When the top manager has an attitude which is different from the attitude of all other members, it is easier for him or her to influence first the individuals in one level of the formal structure and then - possibly with the help of those individuals - to influence individuals in the other level. To illustrate this point, let us contrast the simultaneous dynamics and the TD sequential dynamics. In the simultaneous dynamics, it is more difficult for the leader to change the attitudes of the individuals in level 3. In fact, when individuals 4, 6, 5 and 7 revise their attitudes, managers in level 2 have not yet revised their attitudes. The influence exercised by these managers makes it more difficult for the top manager to change the attitudes of the individuals in level 3. In contrast, in the TD sequential dynamics, managers in level 2 revise - and possibly change - their attitudes before individuals in level 3. Therefore, when individuals 4, 6, 5 and 7 revise their attitudes, managers in level 2 may have already changed their attitudes, helping the top manager in changing the attitudes of individuals in level 3.

It also emerges that the hierarchy is the optimal organization because in equilibrium it maximizes the number of individuals who share the top manager's attitude for any

given circumstance. To understand the intuition for this result, it is important to distinguish between informal relationships including the top manager, and informal relationships not including the top manager.

Consider first the informal relationships including the top manager. These relationships have two different effects. First, the greater the number of relationships, the stronger the influence of the organization as a whole on the top manager. Second, the greater the number of relationships, the stronger the direct influence of the top manager on the lowest level of the organization. These two effects seem to be contradictory. While the first effect apparently makes it more difficult for the initial attitude of the top manager to prevail in the organization, the second effect seems to have the opposite impact.

Interestingly, however, the second effect does not make it easier for the initial attitude of the top manager to prevail in the organization. To understand why this is so, consider first a sequential dynamics. In a sequential dynamics, either the top manager is able to change the attitude of the individuals in level 2, or it is not possible for the top managers' initial attitude to prevail in the organization. Furthermore, if the top manager is able to change the attitudes of the two managers, the attitude of individuals in level 3 will also change, independently of any additional links beyond the formal structure. Therefore, it is possible for the initial attitude of the top manager to prevail in the organization if and only if she is able to influence the attitudes of the two managers. This means that, for a sequential dynamics, the fact that the top manager is able to directly influence individuals in level 3 cannot help. Now consider the simultaneous dynamics. In this case, as opposed to what occurred in the previous case, all individuals within the organization revise their attitudes at the same time. There is no gradual convincing process as in the case of the sequential dynamics. Thus, even if the top manager has enough influence over individuals in level 2 to make their attitudes become positive, his or her own attitude will certainly become negative. Any

additional links of the top manager with individuals in level 3 simply reinforce this mechanism and, clearly, do not help the top manager in his or her original attempt.

Consider now the informal relationships which exclude the top manager. These relationships lead to the mutual reinforcement of the initial negative attitude of the members involved. Therefore, they can only make it more difficult for the top manager to influence the organization's attitude profile.

3.1.2 Conflicting attitudes

The results for the conflicting attitudes case in the presence of affinity suggest that the ability of the top manager to diffuse his or her initial attitude does not depend on the dynamics under consideration. Clearly, the importance of the dynamics depends upon the distribution of attitudes among different levels of the organization. In the conflicting attitudes case, as opposed to the isolated leader case, positive and negative attitudes are evenly distributed in levels 2 and 3. Thus, the degree of participation is a less-relevant ingredient in the process of attitude change.

The network is the preferential mode of organizing for attitude change under these circumstances. The intuition is the following. In the conflicting attitudes case, the informal relationships that characterize the network help the top manager in imposing his or her initial attitude. In the hierarchy, there are clusters of individuals with a given attitude who do not interact with other clusters having the opposite attitude. In other words, there are individuals with a given attitude who interact only with people having the same attitude. This makes attitude change more difficult. The informal relationships that characterize the network avoid this situation, allowing everybody to interact with everybody. Since half of the members in levels 2 and 3 have the same initial attitude as the top manager, his or her initial attitude prevails.

This result contrasts with that obtained for the isolated leader case. While in the isolated leader case the informal relationships between individuals in levels 2 and 3 lead to the reinforcement of the members' common negative attitudes, here the opposite

effect is produced. The interaction between individuals from different departments makes it easier for the top manager to diffuse his or her initial attitude.

3.2 Animosity

We now discuss the results for the animosity case, that is, the case where peers influence each other in the opposite direction.

3.2.1 Isolated leader

The results for the isolated leader case in the presence of animosity are not quite the same as above. It follows that, as in the affinity case, a necessary condition for the leader to be able to change the prevailing attitude within the organization is that the dynamics be sequential. Again, it is easier for an isolated leader to first influence the individuals in one level of the formal structure and then - possibly with the help of those individuals and eventually forming a powerful coalition (Kotter, 1998) - to influence individuals at the lower levels.

Unlike the affinity case, however, the network is the optimal organizational structure. The intuition is the following. Let us first compare the hierarchy and the hybrid. In contrast to the affinity case, where the informal links which characterize the hybrid organization lead to the mutual reinforcement of the members' negative attitudes, here the animosity between peers facilitates attitude change. Interestingly, the network amplifies this effect, because when an attitude becomes positive there is a chain-reaction impact on all the other members of the organization.

3.2.2 Conflicting attitudes

Results for the conflicting attitudes case in the presence of animosity suggest that it is easier for the top manager's initial attitude to prevail in the organization under the sequential dynamics than under the simultaneous dynamics. In fact, in the absence of strong personal values, the attitudes converge as easily with the sequential dynamics

as with the simultaneous dynamics. However, in the presence of strong personal values of the dissident manager, the top manager's attitude prevails under the sequential dynamics, but not under the simultaneous dynamics. Therefore, the sequential dynamics is preferred. The intuition is the same as above.

In addition, the network is the optimal organization. This is so because, as in the affinity case, in both the hierarchy and the hybrid organization there are individuals in level 3 who interact only with people having the same attitude. Since, by assumption, the influence from superiors is stronger than that from peers, this makes it more difficult for the top manager to change the attitude of individuals in level 3 who start with a negative attitude.

Figure 2 below summarizes the conclusions and graphically depicts the major conclusions of the model.

[Insert Figure 2 about here]

Before closing this section, it is important to note that the four cases discussed above should be seen as archetypal. As such, real organizations may in fact blend several of the characteristics we have discussed, either sequentially or simultaneously. For example, they can sequentially introduce hierarchy-driven change, and network-induced change (Abrahamson, 2000); and it is admissible that companies may aptly synthesize top-down and bottom-up approaches, as argued by Beer and Nohria (2000).

4 Illustrations

Attitude change is a fundamental ingredient of organizational change, which means that the results obtained in this paper may have practical implications for management practitioners. Furthermore, the results summarized in Figure 2 imply that, depending on the circumstances, different approaches to the problem of how to manage change should be adopted. The model presented in this paper clearly suggests that universal

approaches to the management of change may be reductive approximations to the subtleties of change management.

In spite of including only a limited number of variables and of analyzing the relationship between organizational context and attitude change in a very simple and specific setting, this paper provides useful insights for managers about how to change the attitude profile of an organization under different circumstances. Furthermore, the ideas presented in this paper are consistent with case-based evidence. To illustrate this point, we present two specific examples.

4.1 Example 1: GE's Aircraft Engine Business Group

This example illustrates the situation where the leader's attitude towards change is different from the one of the subordinates. This may occur, for instance, when the organization has undergone several unsuccessful change processes. In such cases, the arrival of a new leader often means embarking upon another change process. The need for change diagnosed by the leader frequently collides with the subordinates' motivation.

This is precisely what happened in the restructuring process of GE's Aircraft Engine Business Group, analyzed by Borucki and Sollazzo (1990). The situation at the Group was quite turbulent, with four successions in *18* months. The fourth division manager, however, was perceived differently by the employees: "He was an extremely capable, talented individual (...) staff expectations were that he knew how he wanted to restructure the business and that it would simply be a matter of time before a change would be announced" (Borucki and Sollazzo, 1990, p.19). In general, the organization members' did not have the same attitude towards change as the new division manager, but his influence over them was positive.

Our model predicts that in this type of situation the success of attitude change will depend upon the leader's ability to conduct change in cascade: individuals should be

conquered in sequence, and act as change agents for those levels below them. As such, it seems more appropriate to conduct the change process in a top-down approach with a progressively enlarging base of participation. This seems to be what occurred in the case of the Aircraft Engine Business Group: participation was only granted after a "stage setting" phase where parameters for change were provided on a top-down basis.

4.2 Example 2: Ford Motor Company

This example corresponds to the situation where the organization is split into two factions, one that has the same attitude as the top manager and one that has the opposite attitude. As discussed above, the model predicts that the network is the structure that best facilitates attitude change. This result may be one of the reasons accounting for the recent popularity of horizontal structures, where the formal elements of the hierarchy give way to a more complex and intricate web of formal and informal relationships (Ostroff, 1999).

The idea that the network is the structure that best facilitates attitude change in the conflicting attitudes case is illustrated by the transformation of Ford Motor Company orchestrated by Jacques Nasser (Wetlaufer, 1999). In this case, an intensive education program involved every employee: the company's most senior managers were held responsible for stimulating their own direct subordinates in the effort of transformation. These, in turn, were charged with spreading the change direction to the lower levels. In order to achieve this, more than a purely hierarchical approach, Ford's change program involved informal, network-like teaching styles, including small group discussions of strategy and competition, 360-degree feedback and stints of community service, all aimed at helping people in attitude change: "every manager, every designer, every engineer, every person in the plants had to change his or her way of thinking (...) In both formal and informal settings, they share their perspectives on strategy and competition, for instance, or they coach individuals to build their skills." (Wetlaufer,

1999, p.81). As such, more than a top-down, hierarchy-driven formal approach to attitude change, this change process consisted of "people teaching people the why and how of Ford's new direction" (p.81).

5 Conclusion

This paper studies the relationship between the organizational context and the dynamics of attitude change. This contribution can be viewed as responding to Ryan *et al.*'s (1996) call to extend the study of attitudes to levels of analysis other than the individual. More specifically, we present a formal mathematical model to analyze how two important dimensions of organizations, that is, the formal and informal communication channels that characterize an organization and the timing of information flows, affect the evolution of attitudes.

In contrast with the existing literature on organizational change, which is predominantly inductive, this paper presents a deductive, theory-driven model of attitude change. The model presented here should be seen as a general framework that can be easily adapted to particular purposes and circumstances. We used a simple version of the model to illustrate how this approach is able to generate relevant insights about the impact of the organizational context on attitudes. The simple model studied in this paper relies on specific assumptions about the nature of the organization, the communication channels, the strength of the influences, the timing of information flows, the initial configuration of attitudes and the objective of the top-manager. Nevertheless, it has some relevant implications. First, it shows that organizational structure affects the ability of the top manager to influence the configuration of attitudes in the organization. Second, it indicates that the optimal organizational structure depends on the type of relationship among organization members, that is, the level of affinity or animosity among them: Third, it suggests that the process of attitude change is influenced by the timing of information flows.

Given the complex nature of the problem of organizational change, our model is, of course, a simplification. For example, we distinguish the hierarchy, the network and the hybrid organizational structures along only one dimension, namely the formal and informal communication channels. Clearly, this simplification considers neither the subtleties nor the multiple possibilities of structuring, as abundantly exemplified in the literature on social and organizational networks (Gargiulo and Benassi, 2000; Burt, 1992; Miles and Snow, 1992). This weakness, we believe, is largely off-set by the strengths of mathematical modeling, namely the ability to isolate specific effects and to carefully analyze their implications. In particular, our formal modeling provides new insights into attitude change processes based on balance theory and different paths of communication. In general, the mathematical treatment can open new insights into the dynamics of attitude change in organizational settings, as illustrated, for example, in Poole *et al.* (2000). This paper contributes to this literature.

This paper clearly implies that there is no such thing as one best model of organizational change. The organizational structure, the timing of information flows and the prevailing configuration of attitudes are all intervening variables when it comes to the selection of the best approach to organizational change. While other variables could, of course, have been added to our model, this paper suggests that deductive research may have a relevant role to play in the construction of a contingency theory of organizational change management. The efforts of such scholars as Van de Ven and Poole (1995) have illustrated the theoretical complexity of the change theme, as reflected in the variety of approaches from which it can be studied. This paper confirms that this complexity can be approached from a more theoretical perspective and that such a perspective may help to clarify the practitioner's path toward effective organizational change.

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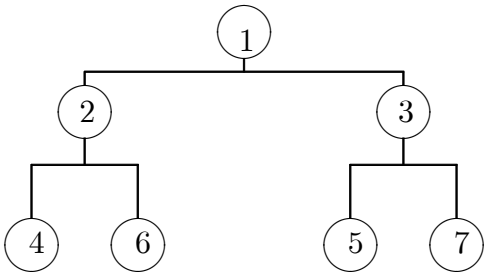

Figure 1: Formal structure

	Affinity	**Animosity**
Isolated Leader	Hierarchy Sequential	Network Sequential
Conflicting Attitudes	Network Dynamics is Irrelevant	Network Sequential

Figure 2: Summary of the Results

A The Formal Model

Consider an organization with the formal structure defined above. Let each individual have a "positive" or a "negative" attitude, depending on how he or she feels about a certain issue. Let $s_i = \pm 1, i = 1, 2, \cdots, 7$, represent the attitude of each individual.

The initial set of attitudes is not necessarily stable: attitudes evolve in time as individuals are influenced by other members of the organization. The dynamics through which attitudes evolve depends on the structural type. The structural type is described by a 7×7 matrix J, where each element J_{ij} describes the influence of individual i over individual j. A positive value of J_{ij} means that there is affinity between individuals i and j: a given attitude of i tends to influence j's attitude in the same direction. Conversely, a negative value of J_{ij} means that there is animosity between the two individuals: a given attitude of i influences j's attitude in the opposite direction. The intensity of the influence of i over j is given by the absolute value of J_{ij}.[4]

The three structural types are characterized as follows. In the hierarchy, the communication channels correspond to the formal links of authority. In particular, we define a matrix of influences J given by

$$J = \begin{bmatrix} 0 & u & u & 0 & 0 & 0 & 0 \\ d & 0 & 0 & u & 0 & u & 0 \\ d & 0 & 0 & 0 & u & 0 & u \\ 0 & d & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & d & 0 & 0 & 0 & 0 \\ 0 & d & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & d & 0 & 0 & 0 & 0 \end{bmatrix}$$

This matrix assumes that each element influences its subordinates equally, with intensity $u > 0$. For instance, the influence of the top manager on managers 2 and 3 is expressed by $J_{12} = J_{13} = u$. It is also assumed that the subordinates influence their direct superiors with an intensity $d < u$. For example, the top manager is influenced

[4]Notice that different assumptions about the pattern of interactions and the intensity of influences, as those cited in footnotes 2 and 3, would lead to different matrices J.

by the two managers but with less intensity. This is expressed by $J_{21} = J_{31} = d$, with $u > d > 0$.

In the network, the communication channels corresponding to the formal links of authority are complemented by a complete system of informal communication. In these informal channels, individuals bypass the formal authority system in order to communicate directly. In particular, we define a matrix of influences J by

$$J = \begin{bmatrix} 0 & u & u & u & u & u & u \\ d & 0 & e & u & u & u & u \\ d & e & 0 & u & u & u & u \\ d & d & d & 0 & e & e & e \\ d & d & d & e & 0 & e & e \\ d & d & d & e & e & 0 & e \\ d & d & d & e & e & e & 0 \end{bmatrix}$$

This matrix assumes that each element influences all the elements in lower levels equally, with intensity $u > 0$. For instance, the influence of the top manager on both managers 2 and 3 is the same as his/her influence on individuals in the lower level. This is expressed by $J_{12} = J_{13} = J_{14} = J_{15} = J_{16} = J_{17} = u$. It is also assumed that every element influences all individuals in upper levels equally, with intensity $d > 0$ and $d < u$. Finally, since all relationships are considered, we include the influence among individuals within the same hierarchical level. Whatever level is considered, their reciprocal influence is assumed to be given by $e > 0$ with $e < u$.

We also consider a hybrid organization where there is only one type of informal relationship: direct peer contact. More specifically, assume that the two managers communicate directly with each other and that peers working in the same department also communicate with each other. These links may be interpreted as corresponding to the existence of an executive committee, and of interdepartmental influence. In

particular, we define a matrix of influences J given by

$$J = \begin{bmatrix} 0 & u & u & 0 & 0 & 0 & 0 \\ d & 0 & e & u & 0 & u & 0 \\ d & e & 0 & 0 & u & 0 & u \\ 0 & d & 0 & 0 & 0 & e & 0 \\ 0 & 0 & d & 0 & 0 & 0 & e \\ 0 & d & 0 & e & 0 & 0 & 0 \\ 0 & 0 & d & 0 & e & 0 & 0 \end{bmatrix}$$

The dynamics of attitude change is modeled as follows. For a given set of attitudes at time t, the j-th attitude is updated at time $t+1$ based on three factors: the attitudes of the other members at time t, the influence of each of them on j, and the strength of j's personal beliefs, values and personality. This last factor is represented by a variable α_j. The sign of this variable gives the attitude of j in the absence of influence from any of the other members. Its magnitude allows us to compare the impact of j's personal beliefs, values and personality with the strength of the influence of the others over him or her. The change of j-th attitude is assumed to occur according to the rule

$$s_j(t+1) = \text{sign} \left[\sum_i J_{ij} s_i(t) + \alpha_j \right].$$

Notice that s_j tends to align with the personal values α_j and with the attitudes of those who have a positive influence over j ($J_{ij} > 0$). In addition, it tends to align negatively (or disalign) with the attitudes of those who have a negative influence over j ($J_{ij} < 0$). As discussed in the text, we assume that $\alpha_j = 0$ for all j, except for α_1, assumed to be large enough, so that the top manager does not change his or her attitude.

The total influence over element j at time t is measured by

$$h_j(t) = \sum_{i=1}^{N} J_{ij} s_i(t).$$

If $h_i(t)$ is positive, the j-th element will have a positive attitude at time $t+1$; if $h_j(t)$ is negative,the $j-th$ element will have a negative attitude at time $t+1$.

In the simultaneous dynamics all the individuals revise their attitudes at the same time. Hence, at time $t+1$

$$s_j(t+1) = \text{sign } h_j(t).$$

A sufficient and necessary condition that characterizes the equilibrium configuration of attitudes at time t is given by $s_j(t)h_j(t) > 0$, for all j.

In the top-down sequential dynamic, those in the top of the organization revise their attitudes first. Let $j = t+1-7\left[\frac{t}{7}\right]$ where $[a]$ denotes the integer part of the real number a. For an initial configuration $\{s_1(0), s_2(0), \ldots, s_7(0)\}$, this dynamic implies that the configuration of attitudes at any future time t is given as follows.

$$s_j(t) = \text{sign } h_j(t-1) \text{ and } s_i(t) = s_i(t-1), \forall i \neq j.$$

Equilibrium is reached at the first time t such that $s_i(t)h_i(t) > 0$, for all i. At this point in time the attained configuration becomes invariant under the specified dynamic, by construction.

In the bottom-up sequential dynamics, the elements who first revise their attitudes are those in the lower level. we illustrate this type of dynamics as follows. Let $j = 8-t+7\left[\frac{t}{7}\right]$. For an initial configuration $\{s_1(0), s_2(0), \ldots, s_7(0)\}$, the configuration of attitudes at any future time t is given as follows.

$$s_j(t) = \text{sign } h_j(t-1) \text{ and } s_i(t) = s_i(t-1), \forall i \neq j.$$

As before, equilibrium is reached at the first time t such that $s_i(t)h_i(t) > 0$, for all i.

In order to implement these dynamics, we consider two extreme initial configurations of attitudes considered in this paper: the isolated leader and the conflicting attitudes case. The isolated leader case corresponds to the situation where $s_1(0) = +1$ and $s_i(0) = -1$ for $i \neq 1$. In the conflicting attitudes case, $s_i(0) = +1$ for all odd i and $s_i(0) = -1$ for i even.