

# A±nity, Animosity and Organizational Design

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## Abstract

The behavior of the members of an organization is determined, not only by the objective situation facing them, but also by their attitudes. Thus, the objective of aligning collective goals and individual behavior translates into a problem of alignment of attitudes. An important dimension of the problem of organizational design is, therefore, to choose the organization that best contributes to the alignment of attitudes. This paper shows that the existence of animosity, as opposed to unanimity, affects the optimal organizational design.

# 1 Introduction

The problem of aligning individual behavior and collective goals has been extensively studied under a principal-agent framework<sup>1</sup>. Two main solutions to this problem have been studied in the literature: monitoring and explicit incentive contracts. While these two solutions correspond to changes in the objective situation faced by individuals, behavior is also determined by attitudes<sup>2</sup>. Attitudes can be defined as summary evaluations of objects along a dimension ranging from positive to negative. Since attitudes influence behavior, the objective of aligning collective goals and individual behavior translates into a problem of alignment of attitudes. Thus, an important dimension of the problem of organizational design is to choose the organization that best contributes to the alignment of attitudes.

The evolution of attitudes in an organization depends, first of all, on the organizational structure, defined as the system of formal and informal communication channels that characterizes an organization. Two extreme types of organizational structures are considered: the hierarchy and the network. The hierarchy is 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 the organization members, so that all of them are linked. We also consider an intermediate case, called the hybrid structure, where there is only one type of informal relationship: direct peer contact, i.e., contact between elements in the same hierarchical level.

The organizational structure defines who communicates with whom and, therefore, who influences whom. However, the evolution of attitudes within

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<sup>1</sup>Early contributions include the works of Mirrlees [10], Ross [11] and Spence and Zeckhauser [12]. See, for instance, Hart and Holmstrom [9] and Gibbons [7] for reviews on this topic.

<sup>2</sup>An extensive literature in the field of social psychology studies the relationship between attitudes and behavior. See, for instance, Ajzen and Fishbein [4], Fishbein and Ajzen [6], Ajzen [2, 3]. See also Brief [5] for a recent survey.

the organization depends, not only on who influences whom, but also on the direction of that influence. We say that there is affinity between two individuals who communicate with each other when the fact that one of them has a given attitude induces the other to have the same attitude. In contrast, we say that there is animosity between two individuals when they influence each other in the opposite direction. While the affinity case has been extensively studied in a recent paper [1] in a much more general context, this note considers both the existence of affinity and animosity between peers. It characterizes the optimal organizational structure in both cases and discusses how the type of relationship between peers affects the optimal design.

## 2 The Model

Consider an organization with three levels of authority, where each individual in the first two levels has two subordinates<sup>3</sup>. This organization may be interpreted as consisting of one top manager and two multi-agent departments. There are seven elements in this organization: the top manager, labeled as 1, two managers, labeled as 2 and 3, and two elements in each of the two departments, labeled as 4, 5, 6 and 7. 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.

Each individual has a "positive" or a "negative" attitude, depending on how he/she feels about a certain issue. Let  $s_i = \pm 1; i = 1, 2, \dots, 7$ , 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. As mentioned above, the dynamics through which attitudes evolve depends on the organizational structure. Organizational structure is described by a  $7 \times 7$  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

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<sup>3</sup>This is the simplest organization that captures the features of organizations with multi-agent departments.

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  $J_{ij}$ .

The three organizational structures 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

$$J = \begin{matrix} & \begin{matrix} 2 & & & & & & & & 3 \end{matrix} \\ \begin{matrix} 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ 4 \end{matrix} & \begin{matrix} 0 & u & u & 0 & 0 & 0 & 0 \\ d & 0 & 0 & u & 0 & u & 0 \\ d & 0 & 0 & 0 & u & 0 & u \\ 0 & d & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & d & 0 & 0 & 0 & 0 \\ 0 & d & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & d & 0 & 0 & 0 & 0 \end{matrix} \end{matrix}$$

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 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

$$J = \begin{matrix} & \begin{matrix} 2 & & & & & & & & 3 \end{matrix} \\ \begin{matrix} 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ 4 \end{matrix} & \begin{matrix} 0 & u & u & u & u & u & u \\ d & 0 & e & u & u & u & u \\ d & e & 0 & u & u & u & u \\ d & d & d & 0 & e & e & e \\ d & d & d & e & 0 & e & e \\ d & d & d & e & e & 0 & e \\ d & d & d & e & e & e & 0 \end{matrix} \end{matrix}$$

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 structure 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

$$J = \begin{matrix} & \begin{matrix} 2 & & & & & & 3 \end{matrix} \\ \begin{matrix} 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ 4 \end{matrix} & \begin{matrix} 0 & u & u & 0 & 0 & 0 & 0 \\ d & 0 & e & u & 0 & u & 0 \\ d & e & 0 & 0 & u & 0 & u \\ 0 & d & 0 & 0 & 0 & e & 0 \\ 0 & 0 & d & 0 & 0 & 0 & e \\ 0 & d & 0 & e & 0 & 0 & 0 \\ 0 & 0 & d & 0 & e & 0 & 0 \end{matrix} \end{matrix}$$

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  $\alpha_j$ . 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/her. The change of  $j$ -th attitude is assumed to occur according to the rule<sup>4</sup>

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

<sup>4</sup>This rule and its underlying intuition comes from the seminal paper of Hopfield [8].

Notice that  $s_j$  tends to align with the personal values  $\theta_j$  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  $j$  ( $J_{ij} < 0$ )<sup>5</sup>.

The dynamics of attitude change in the organization depends, not only on the system of communication channels, but also on the timing of information flows. We consider both the simultaneous and the sequential dynamics below. Under the simultaneous dynamics, everybody considers the change of attitude simultaneously. This corresponds to the case where issues are discussed openly and there is a high level of participation. Under the sequential dynamics, attitudes are revised sequentially, according to a prescribed order<sup>6</sup>. This corresponds to the case where information flows slowly from individual to individual. A set of attitudes is said to be in equilibrium when the configuration attains a fixed point under the specified dynamics.

The evolution of attitudes also depends on the initial configuration of attitudes. 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 the leader has an attitude which is different from that which prevails in the organization. In particular, consider  $s_1 = +1$  and  $s_i = -1$  for  $i \neq 1$ . This case allows us to study those situations where an isolated leader tries to change the attitude of the rest of the organization. In the conflicting attitudes case, the leader faces a situation where the organization is split into two significant factions - one that has the same attitude as the top manager and one that has the opposite attitude. In particular, we assume 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. This means that

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<sup>5</sup>For simplicity of exposition below, it is assumed that  $\theta_j = 0$  for all  $j$ .

<sup>6</sup>We consider two prescribed orders: the top-down (TD) and the bottom-up (BU) sequential dynamics. In the TD, individuals revise their attitudes in an increasing order, from individual 2 to individual 7, and then restarting from number 1. The process does not start with the top manager because this individual is the change agent whose impact in the organization we want to study. In the BU, the cycle of revision of attitudes starts with individual 7 and follows a decreasing numerical order to 1, restarting until equilibrium is reached.

$s_i = +1$  for all odd  $i$  and  $s_i = -1$  for  $i$  even. In both initial configurations the objective of the top manager is to choose the organizational structure that favors the alignment of the members' attitudes with his/her own initial attitude.

### 3 Results

We are now in a position to discuss the impact of animosity and animosity on the optimal design of the organization.

#### 3.1 Animosity

Structure	Dyn	$2d_j - e > u$	$2d > u > 2d_j - e$	$2d < u < 2d + e$	$u > 2d + e$
Hybrid	T-D	All (-)	All (-)	Init. Conf.	All (+)
	B-U	All (-)	All (-)	All (+)	All (+)
	Sim.	All (-)	All (-)	All (-)	No equil.
Hierarchy	T-D	All (-)	All (-)	All (+)	All (+)
	B-U	All (-)	All (-)	All (+)	All (+)
	Sim.	All (-)	All (-)	No equil.	No equil.
		$4d_j - e > u$	$4d_j - e < u < 4d + e$		$u > 4d + e$
Network	T-D	All (-)	All (-)		All (+)
	B-U	All (-)	All (-)		All (-)
	Sim.	All (-)	All (-)		All (-) if $u < 3e$ No eq. if $u > 3e$

Table 1: Comparison of the results for the isolated leader in the presence of cooperation.

The results for the isolated leader case are summarized in Table 1. It follows from this table that a necessary condition for the leader to be able to change the prevalent attitudes within the organization is that the dynamics be sequential. It is easier for an isolated leader 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. This result suggests that the degree of participation is a relevant ingredient in the



process of attitude change. 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 the same time and attitudes change simultaneously. In contrast, under a sequential dynamics, issues are discussed within subgroups according to a certain order. This increases the ability of top management to impose its attitude.

It also emerges from Table 1 that the hierarchy is the optimal organizational structure. The reason is that the informal relationships that characterize the network and, to a lesser extent, the hybrid organization lead to the mutual reinforcement of the members' negative attitude. Clearly, this does not happen, at least with the same intensity, in the hierarchy.

Structure	Dynamics	$u < 2d_{je}$	$u > 2d_{je}$
Hybrid	Top-Down	Init. Conf.	All (+)
	Bottom-Up	Init. Conf.	All (+)
	Simult.	Init. Conf.	All (+)
Hierarchy	Top-Down	Init. Conf.	All (+)
	Bottom-Up	Init. Conf.	All (+)
	Simult.	Init. Conf.	No equil.
Network	Top-Down	All (+)	
	Bottom-Up	All (+)	
	Simult.	All (+)	

Table 2: Comparison of the results for conflicting attitudes in the presence of cooperation.

The results for the conflicting attitudes case are summarized in Table 2. From this table, it follows that, as in the isolated leader case, it is easier for the top manager to change the prevailing attitudes within the organization under the sequential dynamics than under the simultaneous dynamics. In the hierarchy, in particular, a necessary condition for the top manager's attitude to prevail is that the dynamics be sequential. The intuition is similar to that presented in the isolated leader case: it is easier for the top manager

to first influence the individuals in one level of the dissident department and then - possibly with the help of those individuals - to influence members in the other level.

It is also evident from Table 2 that, in contrast to the isolated leader case, the network is the optimal organizational structure. This is so because both in the hierarchy and in the hybrid organization there are clusters having a given attitude that 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 sharing the same attitude. The informal relationships that characterize the network organization avoid this situation, allowing for interactions between people from different departments. This facilitates change.

### 3.2 Animosity

Structure	Dynamics	$u < 2d_j e$	$2d_j e < u < 2d + e$	$u > 2d + e$
Hybrid	Top-Down	All (-)	Dissid. Dept.	All (+)
	Bottom-Up	All (-)	Dissid. Dept.	All (+)
	Simult.	All (-)	All (-)	No equil.
		$u < 2d$	$u > 2d$	
Hierarchy	Top-Down	All (-)	All (+)	
	Bottom-Up	All (-)	All (+)	
	Simult.	All (-)	No equil.	
		$u < 4d_j e$	$4d_j e < u < 4d + e$	$u > 4d + e$
Network	Top-Down	Init. Conf.	All (+)	All (+)
	Bottom-Up	All (-)	All (+)	All (+)
	Simult.	All (-)	No equil.	No equil.

Table 3: Comparison of the results for the isolated leader in the presence of animosity.

The results for the isolated leader case are summarized in Table 3. It follows that, as in the animosity case, a necessary condition for the leader to be able to change the prevalent attitude within the organization is that the

dynamics be sequential. Again, it is easier for an isolated leader to influence 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.

It is also apparent from Table 3 that, as opposed to the animosity case, 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 animosity 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.

Structure	Dynamics	$u < 2d$	$2d < u < 2d + e$	$u > 2d + e$
Hybrid	Top-Down	Init. Conf.		All (+)
	Bottom-Up	Init. Conf.		All (+)
	Simult.	Init. Conf.		All (+)
Hierarchy	Top-Down	Init. Conf.	All (+)	
	Bottom-Up	Init. Conf.	All (+)	
	Simult.	Init. Conf.	No equil.	
Network	Top-Down	All (+)		
	Bottom-Up	All (+)		
	Simult.	All (+)		

Table 4: Comparison of the results for conflicting attitudes in the presence of animosity.

The results for the conflicting attitudes case are summarized in Table 4. As in the animosity case, it is easier for the top manager's initial attitude to prevail in the organization under the sequential dynamics than under the simultaneous dynamics. The intuition is the same as above.

In addition, the network is the optimal organizational structure. This is so because, as in the animosity 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,  $u > e$ , this makes it more difficult for the top manager to change the attitude of individuals in level 3 who start with a negative attitude.

## 4 Conclusion

This note shows that the optimal organizational structure depends on the type of the relationship among organization members. Consider the animosity case. Here, when the leader is isolated, the hierarchy is the optimal structure. Informal relationships lead to the mutual reinforcement of the members' attitudes, making attitude change more difficult. Furthermore, in the conflicting attitudes case, the network is the optimal structure. The informal relationships that characterize the network facilitate attitude change. However, even a small degree of animosity may change these results. In particular, it is shown that when there is some animosity between peers, it is no longer optimal for an isolated leader to choose a hierarchy. Due to animosity, the informal relationships that characterize the network may facilitate change. This result has an important implication: one cannot discuss the problem of organizational design without paying attention to the degree of animosity or animosity that characterizes the organization.

However, our analysis indicates that the presence of animosity does not affect two other results presented in [1]. First, the process of attitude change is influenced in the same way by the timing of information flows: the sequential dynamics facilitates attitude change. This means that the top manager may make attitude change easier by decreasing the level of participation, so that issues are discussed within subgroups, in an order corresponding to the formal structure of authority. This is so because it is easier for the top manager to first influence a group of individuals and then - possibly with the help of these individuals - to influence other individuals. Second, as expected, the ability of the top manager to influence the configuration of attitudes depends upon the degree of influence exercised by superiors over subordinates and, in particular, by the top manager.

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