# ▌ AN INTRODUCTION TO PERT . . . OR . . .

## D.E. Yoes

*Now that we've all finally agreed on where we want to go, how we can arrange to get there from here.*

Suppose you wake up on Saturday morning and decide to take the family on a picnic. Going through your head is a jumble of activities and tasks that need doing in order to get the picnic organized. "Coffee. Is the thermos clean? Remember this time to take some fly-spray. Do we have any beer? What kind of sandwiches would everyone like?"

How to accomplish all the preparations? Obviously, you need the help of the rest of the family. But if everybody is involved in the task, how will it be coordinated? How to avoid two people getting the napkins and nobody remembering to get the first-aid kit? How to assign responsibility for the can-opener? And how to decide what must be done first and what can be done at any time?

These kinds of questions *could* all be answered by one person, who would assign tasks and maintain supervision, settle disputes and respond to the inevitable complaints about work-loads, tasks neglected, and so forth.

Or there could be a non-directed kind of process in which the family periodically stops what it is doing to argue about everything from where to go on the picnic to which kind of olives to take.

## *PERT: A BETTER PLANNING METHOD*

There is a planning method that permits a group to accomplish the following things:

- Be mutually aware of the process and subgoals.

- Contribute to and share in the decisions made about how, when and by whom activities are to be done.

- Make more efficient use of resources by concentrating effort and time on the critical tasks rather devoting time to subtasks while tasks of greater priority lack hands.

- Reevaluate the project while it is underway, and reallocate resources to cope with unexpected blocks to task accomplishment, or to take advantage of unanticipated success in meeting some subgoal.

This planning method is called PERT, one of those acronyms to be sure, but no less valuable for that. It stands for Program Evaluation and Review Technique, and it has saved government and industry many millions of person-hours and dollars. A variation of PERT is known as CPM, or the Critical Path Method, a name that expresses something about how the thing is done. In this brief paper, we can only glimpse the bare outlines of PERT/CPM. Please consult the references for more detailed discussions.

## *Group Analysis and Flow Charting*

PERT is a group analysis and flow-charting procedure that begins with identifying the sequences of dependent activities. The process begins, in true Lewis Carroll fashion, at the end: Before we can arrive at the picnic grounds, we must travel there in the car. Before we can travel in the car, we must fill the tank with gas and check the oil. Before we can do that, we must have traveled to the service station. Before we can start out for the service station, we must have loaded all the supplies in the car...except ice, which we can get at the gas station.

So we draw a network of *activities*, each of which ends in an *event*, in this manner:
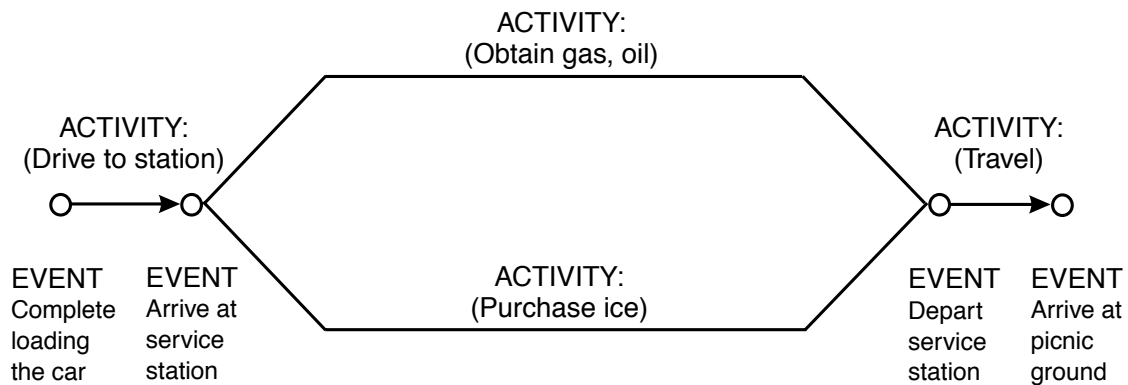


Just to keep it from looking as trivial as you probably think it is, we have shown the purchase of ice as a parallel activity, beginning and ending in the same events as the obtaining of gas and oil.

Now, suppose that you know that you need to arrive at the picnic ground no later than 11:00 a.m. When will you need to start from home?

Just like the radio or television producer, you now must *back-time* each activity. Estimate its duration as well as you can, and label each activity:

- Travel to the picnic ground: 60 minutes.

- Obtain gas and oil: 10 minutes.

- Purchase ice: 15 minutes. (You must also open the ice chest and pack the food and drinks.)

- Drive to the service station: 10 minutes.

Add up the sequence of activities that will take the most time. You discover that you don't need to add the time required for putting gas in the car; obtaining the ice will require five more minutes than getting gas.

You have determined that purchasing ice is on the critical path and putting gas in the car is not.

### Adjusting the Critical Path

You have also discovered that it will take you an hour and twenty-five minutes to reach the picnic ground. If you must arrive there at 11:00 a.m., you must leave no later than 9:35 a.m.

What if you cannot leave by then? You must shorten the time required to accomplish one or several of the activities in the critical path or else revise your plans drastically.

At this point, your oldest boy suggests that the time required to purchase ice could be shortened if he opened the ice chest and partially unpacked the food while his younger brother got the ice bag out of the freezer and their little sister paid the attendant for the ice.

This did not come from you as a command or directive. It came from one of the other planners in response to a perceived need to increase the efficiency of some activity leading to a common goal. And while there may be some squabbling among the children about which child gets to pay the attendant and which gets to carry the ice, there is no caviling at the division of tasks or the necessity for all to share.

Moreover, every party to the enterprise has a means of evaluating how well the timetable is being met and of revising the group performance to meet needs that arise unexpectedly.  Each is able to contribute not merely his or her labor, but the  knowledge of the special task he or she individually performs as it relates to the overall effort.

As boss of the family, you might have been able to come up with the idea of dividing up the task of purchasing the ice . . . or you might not. And if you had thought of it, the family members might not have performed it as ably under your directive as they might had it been their own idea.

### PERT as a Communication Tool

The example given here is thus seen to be trivial, indeed, but at the same time a paradigm of the planning process.

PERT is seen to be a tool of communication, and not just an abstract exercise performed only by staff planners and thereafter executed under duress by grumbling line members.

PERT is a method that permits revision of the plan when things don't work out the way the original plan said they should.

Plans never work out right. But *the planning process is indispensable*.

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# ▌ KURT LEWIN'S "FORCE-FIELD ANALYSIS"

## Morris S. Spier

Change in a group or an organization means essentially an alteration in the way things get done in the system. It may mean changes in compensation methods, sales and production levels, leadership styles, or interpersonal functioning, among others. Kurt Lewin's Force-Field Analysis provides a framework for problem solving and for implementing planned change efforts around a wide range of group and organizational issues. By way of reviewing Lewin's concepts, this paper describes how a group of managers applied the method when they met to discuss their effectiveness as a work team.

In talking to one another, the group members soon recognized that their day-to-day effectiveness and their ability to improve it were hampered by the degree to which they felt constrained in confronting one another on relevant task and interpersonal issues. Having agreed that they needed to talk more openly with each other, each individual member now waited for someone else to "be open." Much of the frustration with this technique was soon summarized in the question "Why can't we change the way we work together?"

## *DEFINITION OF THE PROBLEM*

At first the reason for "no change" seemed to be "that's just the way things are," but as the managers looked more deeply at the climate in which they were operating, they identified some factors or pressures that strongly supported changes in the direction of more openness: (a) the team members wanted to perform effectively for the sake of their own careers as well as the good of the organization; (b) they were functionally interdependent and had to work together to accomplish their goals; (c) there were existing work-related problems that were having an impact on effectiveness (for example, responsibility without authority and unclear job definitions); and (d) some interpersonal tension already existed in the system (for example, destructive competition and passive and overt hostility).

As they continued their analysis, the managers also identified pressures that acted as powerful obstacles to change: (a) many of the group members lacked experience and skills in dealing with conflict and more open feedback; (b) the risk of the "unknown" was high in terms of "What will we open up?" and "Will we hurt one another?"; (c) there was a concern that if certain issues were brought up "things could get worse"; and (d) there were questions about whether top management would support a more open

climate or whether they would respond with "That's not the way things are done around here." In defining the problem, it was recognized that opposing forces like these in the environment determined the existing level of interpersonal functioning in the group.

Figure 1 summarizes this "diagnosis" of the problem. The top and bottom of the figure represent opposite ends of the continuum of a team's interpersonal climate. The environmental conditions and pressures supportive of more openness in the system are the driving forces represented by the arrows pushing upward. At the same time, these forces act as barriers to the forces pushing the team backward toward a more closed system. The arrows pushing downward represent the restraining forces that are keeping the system from moving toward a higher degree of openness; at the same time, they are also driving forces pushing the group toward a climate of lower interpersonal risk.
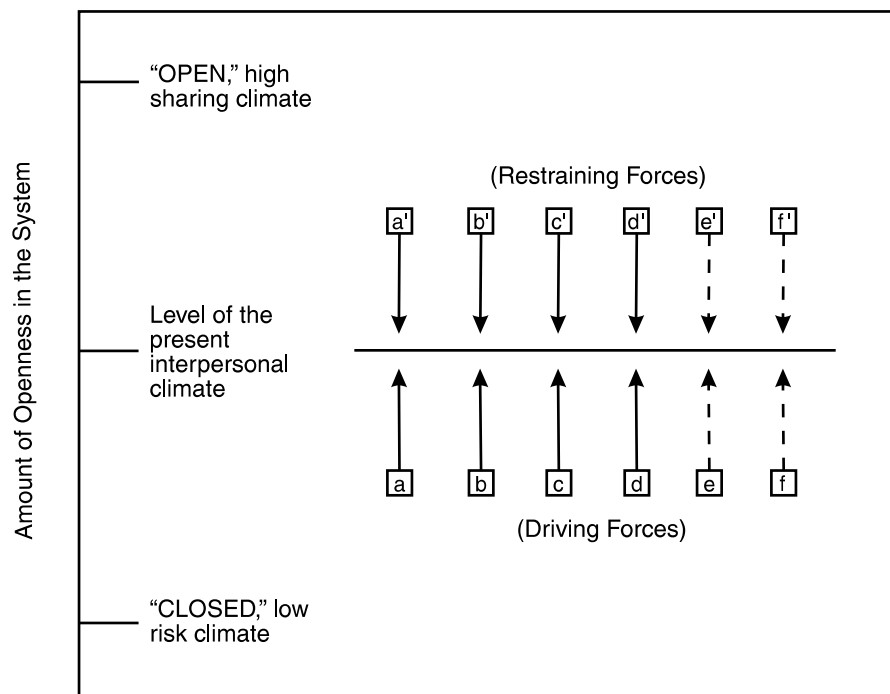


**Figure 1. The Force Field**

## *What Is a Force Field?*

A group of forces such as that shown in Figure 1 may be called a "force field." The length of the arrows in the force field shows the relative strength of the forces: The longer the arrow the stronger the force. For descriptive purposes, the forces in Figure 1 are shown as equal in strength, but a force field can be made up of forces of varying strengths. Indeed, the strength of any single force may itself vary as we get closer to either end of the continuum of openness. A group or organization stabilizes its behavior where the forces pushing for change are equal to the forces resisting change. Lewin called the result of this dynamic balance of forces the "quasi-stationary equilibrium." In our example, the equilibrium is represented in Figure 1 by the line marked "level of the

present interpersonal climate." At this level of functioning, the system is not completely "closed" in its ability to engage in open sharing, feedback, and risk taking, but neither does it enjoy the level of these elements needed for the system to work together most effectively. The arrows meeting at the line indicate that the current state is being maintained by a balance of discernable driving and restraining forces somewhere between the end points on the continuum of team functioning.

## *THE IMPLEMENTATION OF CHANGE*

Since the management team is interacting at its present level because of a balance of organizational and individual needs and forces, change will occur only if the forces are modified so that the system can move to and stabilize itself at a different level where the driving and restraining forces are again balanced. The equilibrium can be changed in the direction of more openness by (1) strengthening or adding forces in the direction of change, (2) reducing or removing some of the restraining forces, or (3) changing the direction of the forces.

Any of the basic strategies may change the level of the team's functioning, but the secondary effects will differ depending on the method used. If a change in the equilibrium is brought about only by strengthening or adding driving forces, the new level may be accomplished with a relatively high degree of tension, which itself may reduce effectiveness. In Figure 1, the line representing the level of the present interpersonal climate will move upward toward more openness under the pressure of strengthened driving forces. The additional pressures upward, however, will be met by corresponding increases in resistance. The resulting increase of tension in the system will be characterized by a lengthening of the arrows pushing upward and downward at the new level.

Attempts to induce change by removing or diminishing opposing forces will generally result in a lower degree of tension. An important restraining force that requires removal in our example is the managers' lack of experience and skills in dealing with conflict. As the managers acquire new interpersonal skills, a key restraining force will be removed. Moreover, changes accomplished by overcoming counterforces are likely to be more stable than changes induced by additional or stronger driving forces. Restraining forces that have been removed will not push for a return to old behaviors and ways of doing things. If changes come about only through the strengthening of driving forces, the forces that support the new level must be stable.

For example, many work groups are stimulated toward new ways of working together by participating in team-building sessions, only to find former behaviors and habits reemerging shortly after group members' return to the day-to-day job. If change is to continue, some other driving force must be ready to take the place of the enthusiasm engendered by the team-building session.

One of the most efficient ways to accomplish change is to alter the direction of one of the forces. If the managers in our example can be persuaded to "test" top

management's support for a more open climate, they might find more encouragement than they previously thought existed. Thus, the removal of a powerful restraining force (expected top management disapproval) could become an additional, strong driving force (actual top management support) in the direction of change.

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