

structure, a class? Are they all in logical order: time order if the source is a process, structural order if the source is a structure, ranking order if the source is a class.

Once you know the grouping is valid, you are in a position to draw a logical inference from it, as explained in Chapter 9.

8

QUESTIONING THE PROBLEM-SOLVING PROCESS

As you saw in Chapter 7, one of the reasons people group together ideas in writing that do not have a clear logical relationship is that they have unconsciously drawn them haphazardly from a preconceived structure. By forcing themselves actually to visualize the structure, they can match their points to it. Thus, they can check not only that the points are in the right order, but also that all those that should be included are included.

In the particular example I gave, the structure was that of a Department responsible for building and maintaining a state highway system. Once you saw the match between its activities and the ideas in the grouping, the proper order became obvious.

The document from which the grouping was taken came from a consulting firm, and is known as a Letter of Proposal. Such letters spell out for a prospective client what his problem is and how the consulting firm proposes to go about solving it. If the proposal is accepted, the consulting firm will then carry out the analyses required to solve the problem and write a report embodying its findings, conclusions, and recommendations.

Coming up with those findings, conclusions, and recommendations requires the creation and use of a number of analytical structures. These structures, in turn, must be referred to in checking the order and completeness of the ideas generated by them.

Those of you who write documents that detail the results of problem solving, whether in consulting or in business, may find it useful to review the general problem-solving process and some of the analytical structures associated with it, as a basis for looking critically at what is said.

THE PROBLEM-SOLVING PROCESS

Ideally, problem solving begins with problem setting – i.e., identifying precisely what you mean by ‘the problem’ and how you will know when you have achieved a solution. When you identify a problem, essentially what you do is recognize that a particular situation yields a specific result.

The problem is either that you do not like the result (e.g., Sales are down 10 percent), or that you cannot explain the result (e.g., What determines what we think? Is it the structure of the brain? Is it our genetic makeup?) Changing the result in the first instance calls for the application of routine problem-solving skills. Finding the explanation in the second demands the somewhat more creative hypothesizing of scientists and inventors.

I am talking here about routine problem solving. (See the Appendix for a discussion of creative problem solving.) This process has been described in a number of different, sometimes conflicting, ways. The simplest, most practical description I have seen was set out by my friend B. Robert Holland in his manual, *Sequential Analysis*, published by McKinsey & Company in 1972. According to Holland, the process consists of answering a series of questions in logical sequence:

1. What is the problem?
2. Where does it lie?
3. Why does it exist?
4. What could we do about it?
5. What should we do about it?

The answer to each question must be structured visually before you can be said fully to understand what you have found. Let me take you through the sequence using a simple example, and then show you how creating the structures required at each stage can aid you in writing clearly about your results.

In doing so, let me point out that I recognize that you may in fact not go about problem solving in this clean, compelling manner. The problem situation you face can be very murky, and information can come at you in a random way, in a variety of misleading or overwhelming forms. And you always have the personalities of the people with whom you are working to consider. What I *am* advocating, however, is that when you sit down to put your thoughts in order prior to writing, you try to force an analytical structure on your findings and conclusions.

The example I will use is this: Suppose that you are a cigarette manufacturer and you discover that the productivity of the machines in Department A is lower than the productivity of the machines in all your other departments – i.e., Department A turns out fewer cigarettes per machine than the others.

What is the Problem?

The problem is that you do not like the result. But that is not a complete definition of the problem. To what precisely do you object? How will you know when the problem is solved? In effect, what question do you want your analysis to answer?

What you want to do here is to try to create a clear image of exactly what you mean. You may have to gather some data in order to answer the question, but it should be easily available. For example, this particular company measured its machines in terms of productive hours per day, and the figures were available for each machine. The useful image, then, would probably be some visualization between the good performers and the poor ones (p.124).

Now you can say to yourself, ‘We’re losing 2 hours of productivity a day. What I want to know is what is causing those lost hours? Or more specifically, how do I eliminate the causes of lost hours?’

Why Does the Problem Exist?

The overall structure of the situation will indicate a number of directions in which your analysis can proceed. In our cigarette example we know we can gather facts that let us judge whether the machines were without raw material, or without maintenance, etc. – a relatively simple exercise.

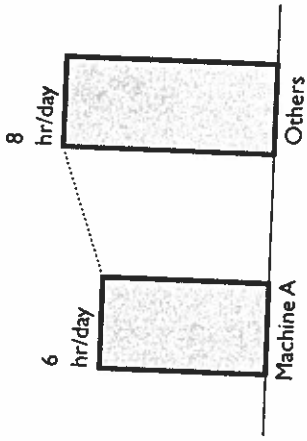
In more complex situations, however, you will have to probe more deeply into both the things and the processes that make up the structure. You will be trying to make clear the components of each, their importance to each other, and how they change over time. (A number of analytical structures have been developed that permit you to initiate this probing and display its results so that they can be thought about productively. I will talk about several of the most useful of these in the next section.)

Clearly, in these more complex situations you will also have to be selective. Not all possibilities are likely to prove equally important in solving the problem. Consequently, you will have to make a judgment early on about which areas deserve the greatest concentration of effort. Such judgments can only be based on experience in the industry or in solving similar problems, and are thus generally made by senior members of the consulting staff.

What Could We Do About It?

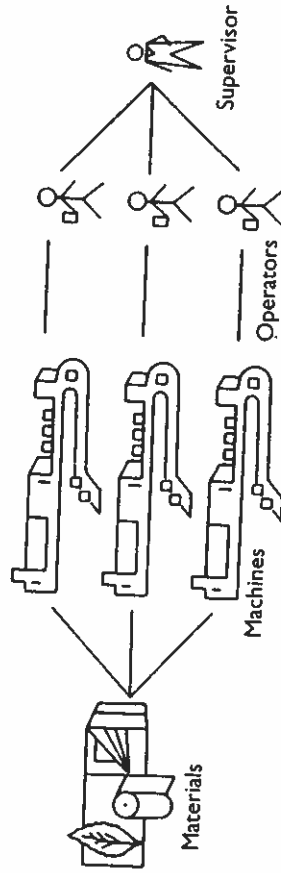
Once the situation has been visualized and analyzed, so that you know why the problem exists, you have a good idea of what needs to be changed. However, there may appear to be alternative ways to change, each of which derives logically from the structure of the activity under study. They must now be tested to determine which way most effectively creates the desired result.

In our cigarette company example, the problem turned out to be that the operators were not 'tuning up' their machines properly, which in turn was the result of inadequate training by their superiors. How could one go about improving the supervision, then? You could make the job of training new operators a specific objective in judging the supervisor's performance, you could transfer a supervisor from a more productive department to this one, or you could increase the number of supervisors. Which course



Where Does the Problem Lie?

Next you gather the data that will allow you to picture the situation within which the problem occurs – i.e., the set of activities that produce lost hours. This will enable you to isolate all the possible ways in which lost hours of production could be caused.



In this case five possible things could be going wrong: no materials at the machines, broken machines, no operator, poor operator, or poor supervisor. These are the possibilities that you must investigate.

In creating a useful structure of the situation, you are trying to show how the elements in the situation relate functionally and interact as a system to accomplish a specific purpose. Sometimes these relationships are not at all obvious, so that to diagram them you must first do a good deal of digging. Keep digging until (1) you are sure you have identified all the parts in the system, (2) you can arrange them in sequential order, and (3) you can clearly show inputs and outputs.

DEFINING THE PROBLEM

As I noted earlier, the likelihood is that you will not have done your problem solving in quite the neat and tidy way described, particularly where you face very complex problem situations. If you feel you have solved the problem, however, you will no doubt have generated sufficient data to be able to re-create the structures used to define the problem, showing:

- Where you are now
- Where you want to be
- The difference between the two.

The ease with which re-creating these structures can help you decide what to say in your introduction and how to set up your pyramid may amaze you. To demonstrate that ease, let's look at the introduction shown in Exhibit 34, *DDT: A System for Document Digitalization and Teletransmission*.

The DDT System

Here we have an extremely densely written text. What it says is approximately as follows:

S = We did a study in 1989 telling how documents could be stored and transmitted by computer. Research Institute also did a study on the problems of transmitting documents on Euronet/DIANE.

C = You recommended more technical studies. We have been looking at the technological, economic and managerial issues of converting documents to digital form and delivering them by teletransmission. This is because technology is rapidly developing that could permit electronic document delivery.

Q = It is technically possible to do at reasonable cost on a European scale

A =

- We conceived a system to build on DIANE called DDT
- Market forces will not bring such a system about, it demands a demonstration project

of action makes most sense depends on its feasibility and on its likelihood of success (on its benefits and risks, if you like), which must be thoroughly assessed before you choose.

What Should We Do About It?

In making the decision to choose one alternative over the next, you must be able to visualize the new situation with the change implemented. Creating this picture should suggest to you the additional changes that must be made to accommodate it, and once again highlight the points that need analysis and verification before you make a final recommendation.

With the numerical consequences clear, you next want to explore the risks involved in achieving them. Risks in this context would generally be of three kinds: you will have made a mistake in your assumptions, you might not achieve your objective, or you may inspire retaliation of some kind. Should it look as though the choice is very risky for any one of these reasons, you would want to stop considering it as an alternative.

What this section has been saying is that before you can legitimately advise someone on how to change an undesirable result, you must have defined clearly five things: (1) the gap between where he is and where he wants to be, (2) the structure of the situation that gave rise to the gap, (3) the structure of its underlying processes, (4) the alternative ways the structure could be changed, and (5) the changes required to accommodate the alternative you choose.

You can see that completion of Step 1 tells you not only how to direct your analysis of the problem, but also how to write your introduction. It identifies the question your report must be structured to answer. Steps 2 and 3 identify the major analyses that must be completed before you can formulate recommendations to answer the question.

Thus, in looking critically at the draft of a report, you will want to make sure first that the introduction reflects a clear definition of the problem, and then that the findings and conclusions derive from appropriate analytical structures. Chances are that you will find glaring omissions in both cases.

Exhibit 34 DDT: a system for document digitalization and teletransmission

Introduction The Reason for Our Study

In August 1989 we were commissioned by you to conduct a study of 'Document Digitalization and Teletransmission.' We were to identify and analyze mechanisms:

Enabling a transition to digital storage and transmission techniques
Required for the cost-effective transmission of documents.

The 'Problems of Document Delivery for the Euronet User' were discussed in a technical report prepared by the Research Institute last year. On-line search services for scientific and technical information (STI) enable the user to identify promising references in the literature quickly and easily. But the user's needs are not met until he has a full text copy of the relevant articles, so a speedy, comprehensive and economic document delivery service is needed. The planning study prepared by the Research consultants sheds light on the requirements, problems and possible solutions for document ordering and delivery on Euronet/DIANE

DIANE is operational today. The acronym stands for Direct Information Access Network for Europe. It represents the ensemble of information services available through the Euronet telecommunications network. Euronet itself is a data transmission facility, not an information service.

DIANE provides a framework for the services that major European hosts offer via Euronet. The hosts are typically computer service bureaus which store bibliographic data bases. By providing a medium for the introduction of common features, such as standard command language, referral service and user guidance, DIANE presents a clearer image to the user of the wide range of information services available through the network.

The EEC Committee for Information and Documentation in Science and Technology (CIDST) considered the Research Institute report, and the comments and recommendations of others who studied it, and recommended additional technical studies.

We have undertaken two of these, looking at the closely related technological, economic and managerial issues of converting documents to digital form and delivering them by teletransmission. The background to the study is the rapid development of computing and telecommunications technology that might already, or could be expected in the near future, to provide the means of electronic document delivery. This could eliminate, or cut down significantly, the movement of paper currently supplied by a document fulfillment center to a reader.

Conclusions

Our study confirmed that it is technically possible to convert a document into a digital form that can be stored in a computer data base and transmitted by digital telecommunications to printers located near to those who wish to read the documents.

The cost of digitalization and teletransmission continues to fall. However, expensive equipment is required, and large volumes of documents must be handled to achieve low unit costs. An operation planned on a European scale could deliver documents overnight at a marginal cost per page that is comparable with the charges made by fulfillment centers now meeting requests by copying and mailing documents.

We conceived a system, called DDT, which would use existing technology in a new way and looked at the organizational, managerial, legal and regulatory issues involved in establishing it as a Europe-wide operation. DDT would build on the experience gained with DIANE, and supplement it. It would be a speedy, comprehensive and economic document delivery service, accepting requests in the form of bibliographic references and fulfilling them by teletransmission from data bases of digitalized documents.

However, we believe that market forces will not bring such a system about. If the demand for quick access to full texts is to be satisfied, then a demonstration project is required.

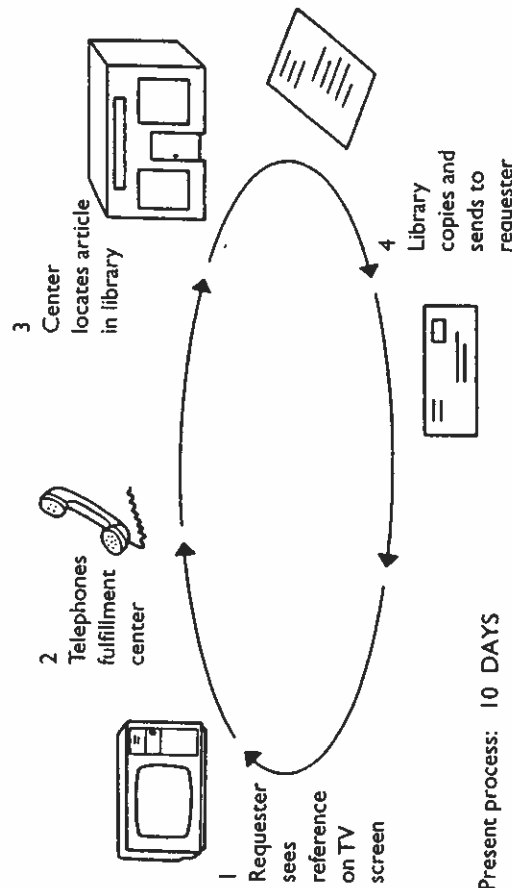
DDT must develop as an open system, through which any information provider can deliver documents to any user. It must therefore be based on international standards.

Further technical studies are needed to determine how to apply existing technology to DDT.

- DDT must be an open system, based on international standards
- Further technical studies are needed
- Important nontechnical issues must be resolved.

Ignoring the sheer ugliness of the title, the text permits very little sense of the problem it was dealing with to shine through. What in fact is the problem, and what is the question concerning it? 'Looking at the technological, economic and managerial issues of converting documents to digital form and delivering them by teletransmission' is not very specific. To make it more specific, you must ask yourself, what do they have now and how do they want to change it?

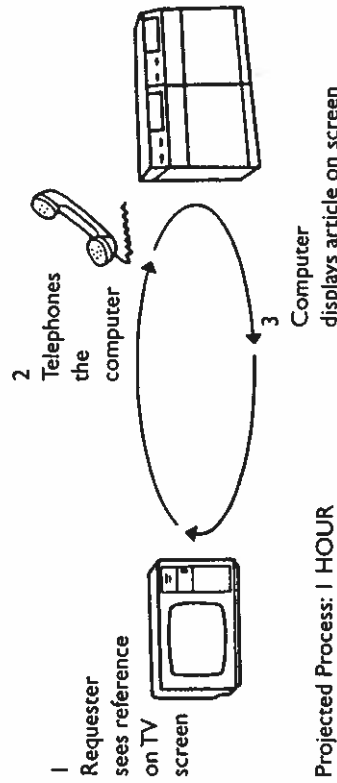
What they have now, apparently, if you read the text closely, is a situation in which someone scans a televised listing to locate a document, and telephones a library requesting it. The library locates the document, has it copied, and mails the copy to the requester. Total elapsed time, 7 to 10 days.



What they would like instead is a system in which someone scans a TV listing, telephones for the document, and receives it back on his screen within an hour.

Given this understanding of the problem, and a clear statement of how you will know when you have solved it, you can easily identify

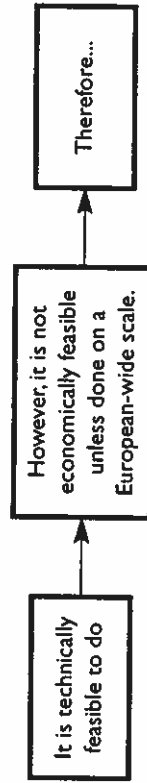
the question the analysis is meant to solve: Can we reduce the retrieval time from 10 days to 1 hour by transmitting the document electronically?



A glance at the initial picture lets you see what would have to change structurally to permit this to happen:

1. Can we convert the printed documents to digital form?
2. Can we store them centrally?
3. Can we transmit them direct at low cost?

It would seem, then, that the analysis should have been directed at answering those three questions directly. The answers (yes, yes, and no) would then probably direct you to a deductive structure for your pyramid:

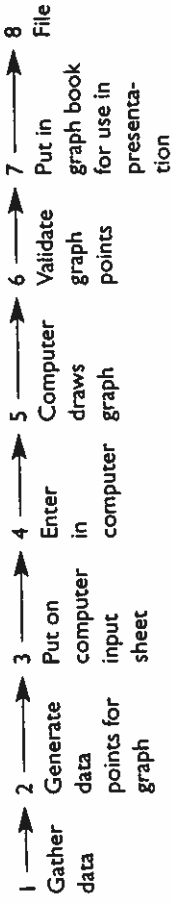


This was a situation in which the reader knew the problem, and the writer was writing simply to give a solution. Very often, however, you will write to give a solution when the reader does not know the problem, so it has to be explained in detail. That is the situation in Exhibit 35, *Period Graph Books*.

Period Graph Books

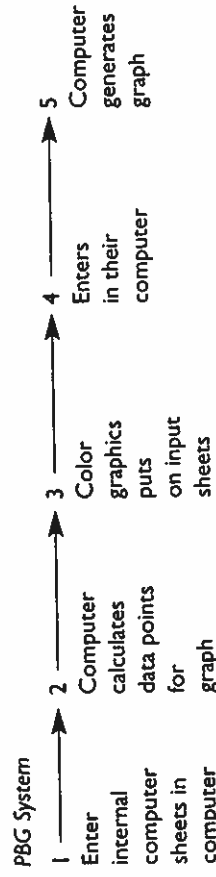
This memorandum was written for the signature of the head of the department that produces the period graph books. These are books of graphs that show company performance in sales, costs, profits, etc., for the previous period. They are made available by the staff group to managers who use them to prepare presentations to top management.

The situation within which the memorandum was written is this. The head of the department was unhappy because the graphs are full of errors. The errors are caused partly by the system used to produce them:



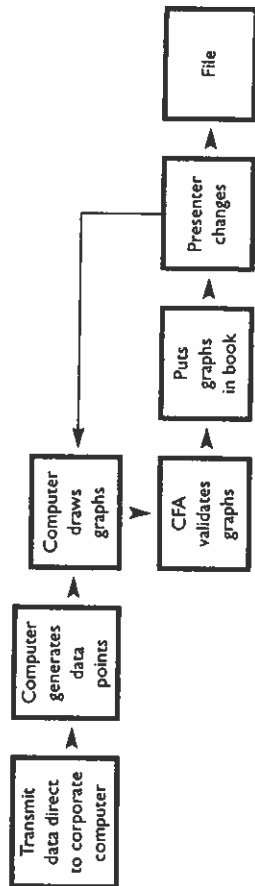
Mistakes are made in gathering and entering the data, the figures are often late or incomplete, and frequently the graph is returned by the computer too late to pick up errors in it. Even if the graphs are correct when put in the book, however, the presenter causes another problem. He may arbitrarily decide to change it to show a clearer (or more desirable) trend line. In such cases, he does not inform the staff group of the change.

The department is responsible for producing four of these books. Since the system for producing one of them utilizes the computer to gather data, the department head has reasoned that it could be used to gather data for the others.



Consequently, he has decided he wants a system like this:

Proposed system



He has asked his assistant to write a memorandum to their boss, who knows about the problem, to explain the changes needed to correct it. The result is the document shown in Exhibit 35. The document says roughly this:

S = We are now responsible for producing graph presentation books.
 C = Some issues/problems have surfaced as a result of this transition.
 Q =
 A = This is the current production process.
 This is the process for the PBG monitor book, and problems we have with it.
 The problems result from the inefficient nature of the process, which needs streamlining.
 At your convenience, can we discuss how best to proceed?



Exhibit 35

TO:
 FROM:
 SUBJECT: **Period Graph Books**

As you are aware, commencing in Period 5 the Corporate Financial Analysis Department assumed responsibility for the production phase of four graph presentation books from the Corporate Planning Department. The purpose of this memo is to outline some of the issues/problems that have surfaced as a result of this transition.

Production

In order to address these issues more clearly, I will briefly outline the production phase as it currently exists. Specific activities are as follows:

1. Data gathering—Base data sources consist of external reports (e.g. 'P' forms), internal division documents, and information relayed verbally from the division via telephone.
2. Specific data point generation — involves either manual or computerized (PBG only) calculations. For example, rolling 13 revenues, costs, and percentages (e.g. A&M as % of Net Sales).
3. Transcribe data points to input sheets — John Brennan's area supplies computer printouts of data points YTD and analysts update it for latest period's data. There is one computer page for each graph and generally each graph requires 2 new data points — actual and rolling 13. These input sheets, upon completion, are returned for updating the Color Graphics' data base.
4. Data validation — Check for reasonableness and ensure consistency of calculations.

Issues

The basic issue concerns the overall control from the point of obtaining divisional information to the actual generation of graphs. With respect to the four books transferred to the Corporate Analysis Group, this has made the control even more difficult, as it has injected one more individual into the process, and it has served to further fragment and abet an inefficient system.

In support of this, I will outline the process for the PBG monitor book and some of the related problems. The majority of PBG's monitor book calculations are computerized on a Corporate System designed solely for PBG due to the massive amount of calculations needed, since approximately 13 graphs are generated for each region.

The primary data source for input into this PBG Corporate System is the Division's internals, which are computer outputs from their systems. These results are re-input into the Corporate PBG System, which calculates rolling, YTD, per case, and percentage data points to be used for the graphs. This Corporate Computer printout is used to provide data points for Color Graphics Input sheets. The Color Graphics Department re-inputs these points into their data base and generates the graphs.

As described, the process involves divisional personnel and 3 Corporate departments — Planning, Financial Analysis, and Systems. The period data in one form or another is input into a computer system no less than three times. Thus, we have created a very inefficient system and have increased the potential for error due to the number of people involved and the related fragmentation.

Some of the problems that we've encountered during the 7 periods that we've been involved are:

- Inconsistency of data input between periods and between regions
- Incorrect calculation of Variable Costs due to the original computer program design

- Unexplained changes in data points that were previously correct
- Data base was not updated for prior period's information so that this information had to be posted again on the computer input sheets.

Overall Assessment

The majority of these problems have arisen due to the cumbersome inefficient nature of the process itself. The fragmentation of the production process has resulted in no one person having control of the data and has created 'gray areas' for which responsibility is unclear. The risk of potential errors has increased, as there is the chance that things will fall between the cracks.

The production process sorely needs streamlining, both in terms of the individual books, as well as in terms of a base computer system that would efficiently execute all of the divisions' common calculations, e.g., rolling data points. Given our current staffing, we cannot handle the production streamlining and control of the graph books.

At your convenience, can we discuss how to best proceed?

You can see that there are a number of things wrong with the document besides its poor introduction: the steps in the general system are not completely listed, the problems with the PBC system are not readily evident, and there is no mention of the changes that should be made to institute the new system.

Nevertheless, whenever you outline the problems in a system, you are by implication stating the actions that must be taken to correct the problems. Thus, as a rule of thumb you should always organize this kind of paper around the changes needed, supporting each suggested change with a discussion of the system and its weaknesses.

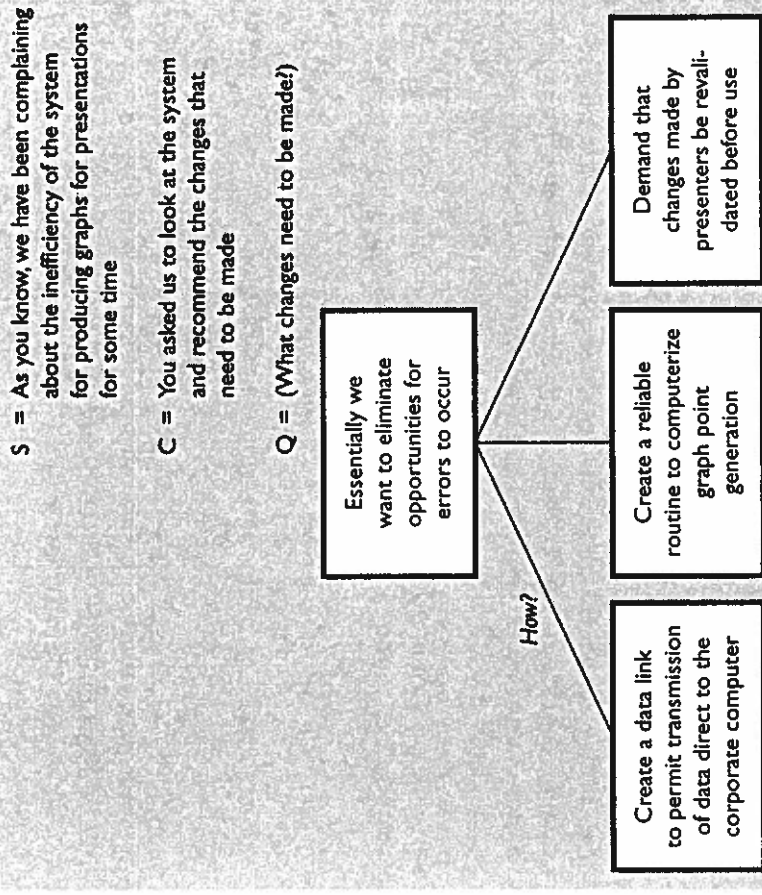
Visualizing the before, the after, and the differences between the two makes it easy to be specific about what the changes should be:

- Create a data link to permit transmission of data direct to the corporate computer.
- Create a reliable routine to computerize graph point generation.
- Demand that changes made by presenters be revalidated before use.

If these are the major points to be communicated, then they can form the key line of the pyramid (Exhibit 36). They serve to answer the question, 'What changes need to be made to eliminate errors?'

It is now a simple matter to work backward to determine what information has to be communicated in the introduction to induce the reader to ask that question. In this case, he need only be reminded that he knows about the problem, that he asked to have a suggested solution put in writing, and that now the document will tell him the solution.

Exhibit 36



In most cases, with a little effort, you will find it relatively easy to visualize both the situation within which the problem occurs and the way it will look when the problem is solved. You need these to guide the writing of your introduction and to give direction to your analysis.

In doing the analysis, however, you will be creating additional structures. I'd like to look at a few of the most common of these now, to show how you can use your awareness of them to find flaws in your groupings.

STRUCTURING THE ANALYSIS OF THE PROBLEM

When you reach the stage of determining specifically why the problem exists, you will frequently find that the relationships you need to analyze are not directly evident. In that case your strategy should be to visualize the logical structure that must have existed to produce the results that you observe.

An excellent method for doing so is to create what are known as logic trees, of which there are several varieties. I know of five, but there are no doubt more. Let me describe these, and then go on to show how you can use the logic-tree concept to find gaps and illogicalities in what you have written.

Five Typical Logic Trees

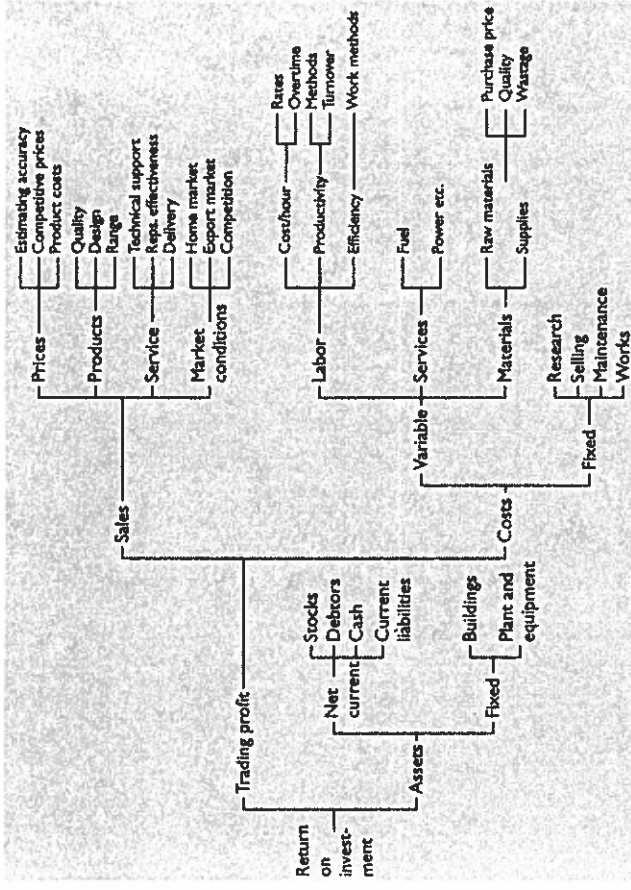
The great value of logic trees lies in the fact that they can often reveal where the problem is, why it exists, and what to do about it all in one picture. The trees differ slightly depending on the kind of structure being shown, but all begin at an end result and branch into causes.

1. *Financial structure.* Exhibit 37 shows an ROI tree that lays out part of the financial structure of a company, and then permits you to ask questions like 'What might cause sales to be off?' and 'What might cause that cause?' The trick is to create a mutually exclusive and collectively exhaustive group of causes at each branch.

2. *Task structure.* A deeper, more explicit approach is to make the tree show the important tasks of the business that it must organize itself to perform (Exhibit 38). To do so you begin with EPS and divide the tree in terms of the company's financial structure, stating each element as a discrete managerial task. Then you impose the Profit and Loss Account and the Balance Sheet on this structure, again stating each item as a task.

Contribution in a cigarette company, for example, is composed of Net Sales minus Specification Costs (leaf, packing materials, duty, direct labor), minus Advertising and Promotion. These categories then become tasks (Increase Net Sales, Reduce Leaf

Exhibit 37 Financial Structure



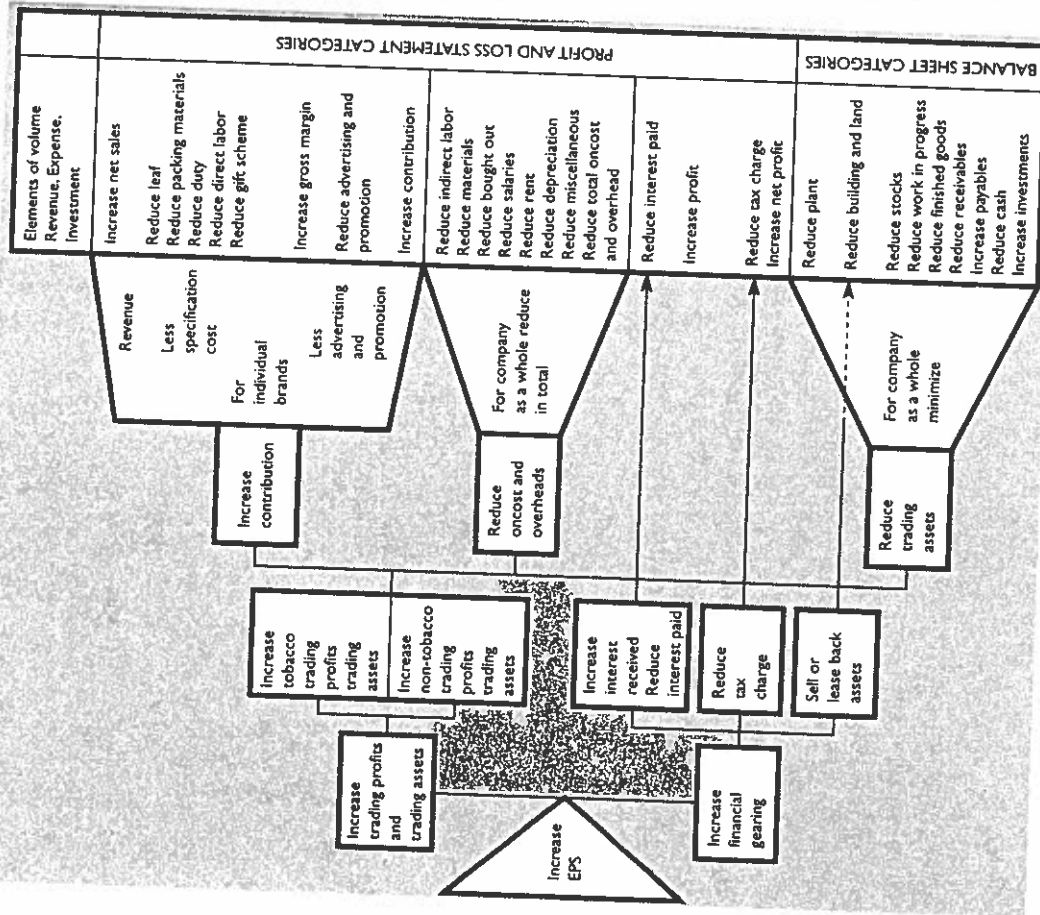
Costs, etc.). You now know the key tasks of the business, and can analyze the numbers in the tree (trends, sensitivities, comparisons to industry and competition) to determine the priorities for performing them to increase EPS.

3. *Activity structure.* Yet a third approach is to use a tree to trace the activities that have to be performed to produce an undesirable end objective – high costs, for example, or overlong installation times. The trick here is to visualize all the causes that could possibly bring about the effect, and relate them at their proper levels.

For example, installation of telephone switching equipment involves work partly done in the contractor's factory and partly done by his men on the site. Elements at the site are the men doing the building, the facilities available to them, the equipment being installed, the testers testing the equipment, and the customer approving the procedure at various intervals. How do these all relate?

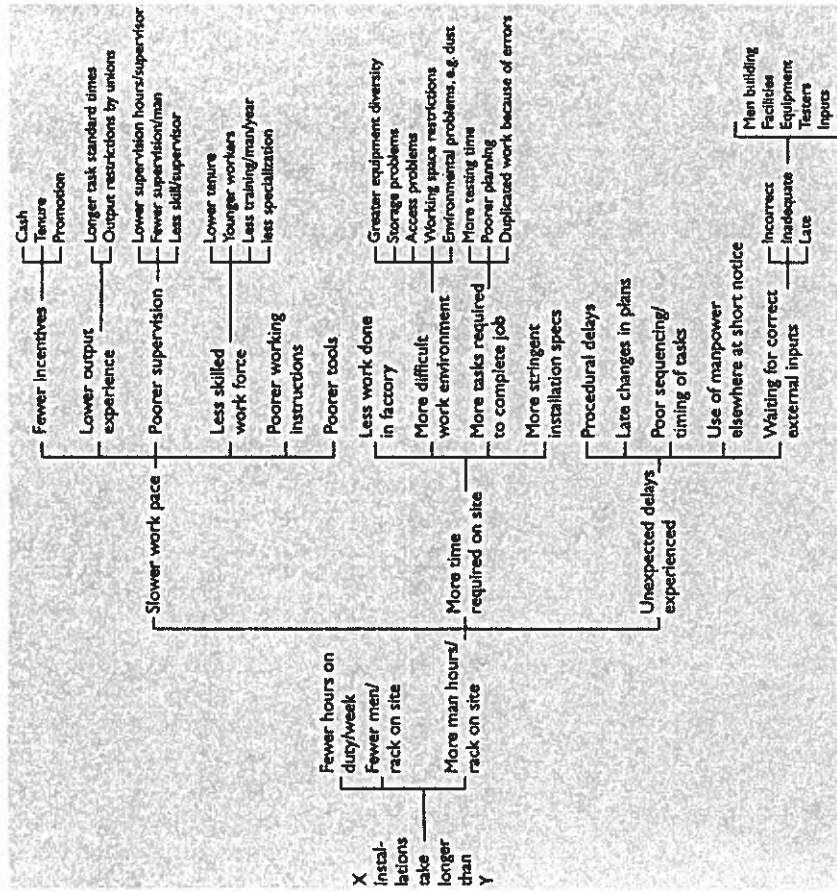
As you can see from Exhibit 39, you begin your tree with the effect you are trying to understand, that installations take longer

Exhibit 38 Task structure
(From *Task Analysis*, McKinsey & Company, 1972.)



than expected. At the next level you hypothesize the mutually exclusive and collective exhaustive reasons that this could occur: fewer men on each rack, more hours per man on each rack, fewer hours on duty per week. You then take each possible reason and break it down further. What could cause more hours per man on each rack? Either the men are working more slowly, or the job demands more time, or there are unexpected delays. Again, you

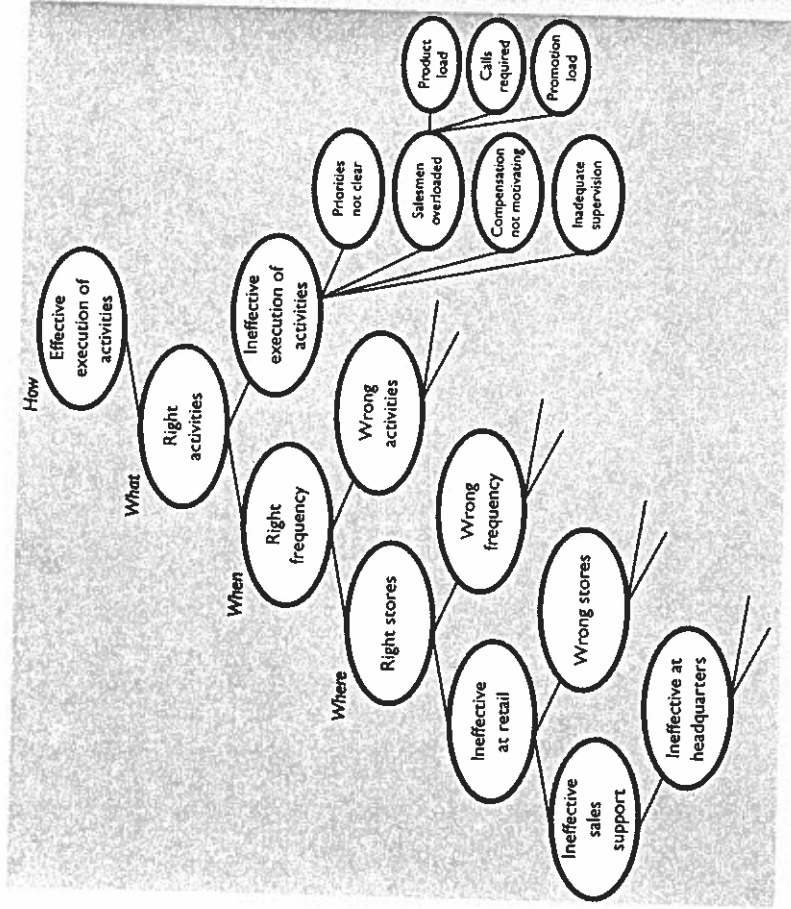
Exhibit 39 Activity Structure



take each possibility and ask, why would this happen? The result is a list of the areas where facts must be gathered and analyzed.

4. *Choice structure.* This kind of tree is related to the activity structure, in that it attempts to find the causes of an undesirable effect. This time, however, you simply display bifurcate choices until you reach a level where you have more precise knowledge of the likely causes. In Exhibit 40, for example, if your sales support is ineffective, it can be ineffective at retail or at headquarters. If ineffective at retail, you can be either in the right stores or in the wrong ones; if in the wrong ones, then that is the problem. If in the right ones, then either you sell with the right frequency or the wrong frequency; if the right frequency, then either the activities are the right ones or the wrong ones, etc.

Exhibit 40 Choice Structure



The secret to this choice diagram is to visualize the sequential process involved in selling, and reflect it in your bifurcations. First you pick the store, then you call on it, then you do the right things in it, either well or poorly. The result again is a list of the analyses that must be performed, and that will tell you how to solve the problem.

5. *Sequential structure.* A more sophisticated version of the choice structure is what I call a sequential structure (Exhibit 41), and again I am indebted to B. Robert Holland for the example. The value of this structure lies both in its completeness and in the order in which analyses of each element are meant to be performed.

For example, your analysis might identify several indicators that your marketing program is less than adequate. Let's say the packaging is wrong, the advertising is wrongly directed, the promotion is sloppy,

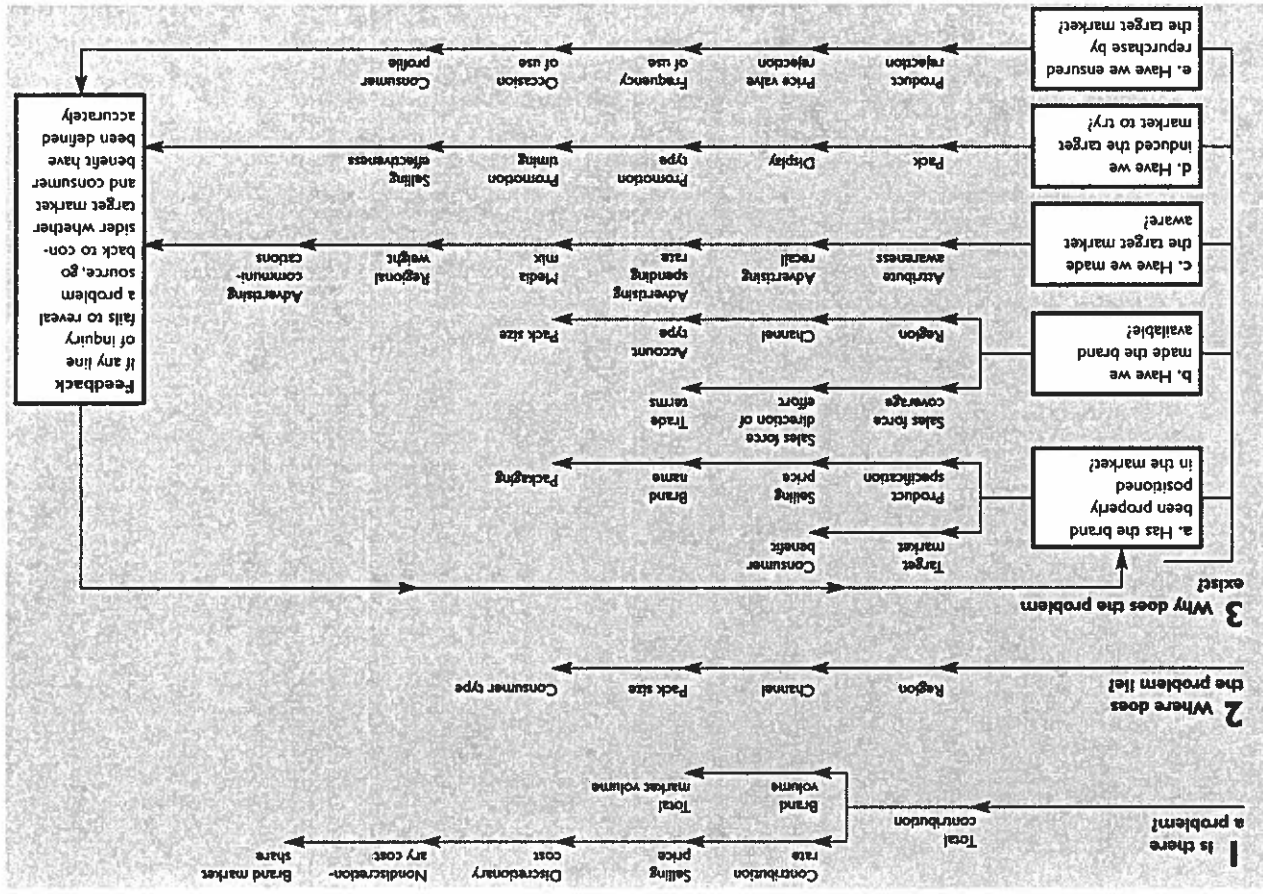


Exhibit 41 Sequential Structure (From Sequential Analysis, McKinsey & Company, 1972.)

and those people who do buy the product don't use it frequently enough. Weaknesses identified at the top must be corrected before those at the bottom. Thus, there is no point in trying to coax people to use the product more frequently before you get your promotional house in order, and no point in spending money on promotion if you will continue to advertise to the wrong people.

Use of the Logic-Tree Concept

Once you understand the technique for displaying the logical relationships between groups of activities, to show their cause-effect nature, you can use the concept to question the logic of what you've written. A good example of how to do so can be seen in analyzing the *Key Issues* shown in Exhibit 42.

Here again we have a very wordy, ugly, mediocre expression of a business message. And again its impenetrability results from the lack of a clear image in the writer's mind that he wanted to communicate, itself the result of a confused approach to the problem solving.

The text was written to a company that supplies various kinds of pipes and fittings to construction sites. It purchases them from suppliers, and stocks them in a central warehouse; this warehouse in turn supplies a dozen or so smaller warehouses in regions throughout the state. The company has just been taken over, and the new owners think that an inventory cost of \$27 million for the central warehouse is too high. In addition, because the central warehouse is frequently out of stock of some items, the outlying warehouses also order direct from suppliers, further increasing inventory cost.

In this situation, does Exhibit 42 properly list the so-called 'key issues'? An issue, by the way, is a question so phrased as to require a yes-or-no answer. Phrasing it in this form permits you to direct your analysis to a specific end product needed to prove or disprove your understanding of the cause of a problem.

Such questions as number two, 'What level of inventory investment is necessary?' are accordingly not issues. Stated as an issue, the question would be 'Is the present level of inventory too high?' or 'Do we need as much inventory as we now have?'

Exhibit 42

Key Issues

Based on our discussion several issues emerged that should be addressed since the answers will affect improvement opportunities, and possibly, future business strategy. These issues are preliminary only, and we would expect others to emerge.

- 1. Is the present inventory management system suitable for all elements of the business?** We understand that a computerized 'IMPACT' type system is in use. We are familiar with systems of this type, and find them quite useful in non-manufacturing, stocking businesses in which thousands of relatively stable stock-keeping units are processed. However, it may not be as effective a method as others of determining stock levels and placing orders both centrally and in the regions.
- 2. With present systems, procedures, and organizational relationships, what is the level of inventory investment necessary to meet customer service objectives?** A determination should be made of the investment required to serve present markets with the current products offered under existing procedures. This will provide the proper base from which to determine opportunities for improvements through change as opposed to those that could be realized through more control or discipline in the use of present systems and techniques.
- 3. Are centralized inventories cost effective for you?** In the Piping Group, two centralized inventory pools are maintained for tube products, and valves and fittings. These pools were established when the business was small and working capital extremely limited. The central pool was intended to achieve lower inventories, lower cost, and better service, particularly for large construction projects; management is questioning this policy.
- 4. What are present levels of obsolete and slow-moving inventories?** Excessive inventories are frequently a result of problems in this area. A key part of the analysis should concentrate on determining current inventory excesses. More importantly, we will determine the root causes so that recommendations to prevent reoccurrences can be developed.
- 5. With changes in inventory policies, organization structures, and systems, how much improvement can be made in inventory turn?** This is the key issue, and could affect long-term business strategy. Management is willing to consider changes in long-established operating procedures if such changes can reduce the working capital intensity of the business.

Given your understanding of the problem-solving process from section one, you will be able to recognize the question as originally stated as an attempt to define how we will know when we have solved

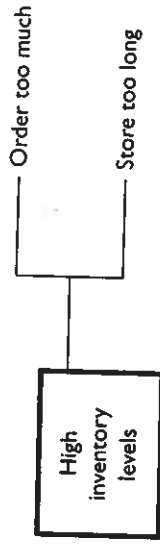
In general, I don't believe there ever is a need for a section called 'Issues' in a Letter of Proposal. The issues, if any, will always derive from the analytical process to be used to solve the problem. So the issues, the process, and the end products of the study all turn out to be the same thing. (See Chapter 9 for a discussion of end products.) 'Issues' is apparently the popular buzzword in business circles these days. Exhibit 43 shows another set of issues, more confused if possible than the previous group. Here they are meant to identify the alternative ways available to reduce the cost of energy consumed in a factory.

Exhibit 43 Major Issues

1. How much can we reduce energy costs by improving operating practices and implementing simple, low capital engineering projects in each of the primary mills?
2. Given that we can significantly reduce energy costs by improving mill operating procedures, what is the magnitude of our cost advantage/disadvantage compared to our competition? Is it sustainable?
3. How much of a competitive lead in lower energy costs could a sharply focused capital spending program provide?
4. What are the right energy development programs (i.e., research, engineering) to significantly improve our competitive position?
5. What is the best mix of fuels and sourcing arrangements to control costs and ensure supply — both short and long term?
6. Does our capital project evaluation and approval process quickly surface and implement the best energy projects to provide maximum benefits in all appropriate mills?
7. What programs are needed to most effectively influence government funding, taxation, and regulatory action?
8. What human resources are needed to effectively manage the necessary energy tasks — i.e., organization, responsibilities, skills, resources?
9. To what extent are product/mill assignments creating a competitive penalty because of energy?
10. What is our corporate energy strategy and the business plan for pursuing it?

the problem. The problem now is that the cost of the inventory is \$27 million, and it should be instead some other number. The first thing to establish is what that other number should be, which will prove that in fact the present levels are too high.

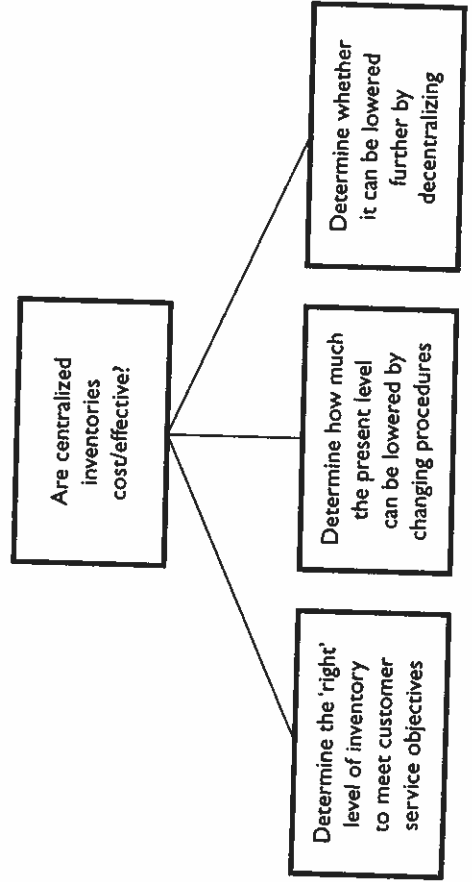
Assuming that the figure is too high, we can use a tree diagram to identify the possible causes of its being too high. What does one do to create inventory at high levels? Perhaps this:



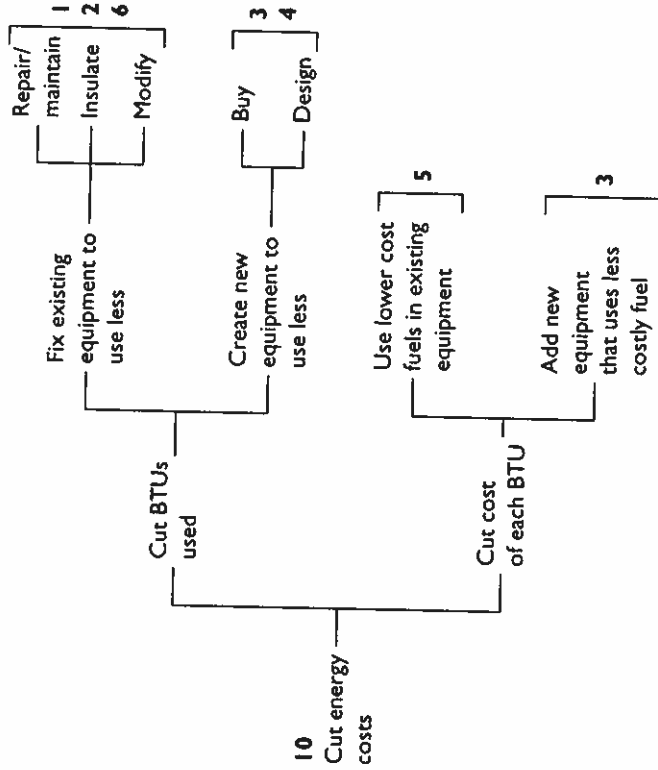
Now we can frame proper issues, which turn out to relate to points 1 and 4 in Exhibit 42:

- Is the management system placing orders properly?
- Are they holding too much obsolete and slow-moving inventory?

What does all this tell us? First, that talking about issues here is misleading. Instead, what is being discussed is the process the consultant will follow to solve the client's problem. What is that problem? That his centralized system may not be cost/effective. He should probably be saying something like this:



If you tried to diagram the alternative ways to reduce the cost of energy, you would get a choice diagram like this.



And once you have the diagram, you can see that Issues 7, 8, and 9 simply don't relate to the subject. Issues 1, 2, and 6 are related to fixing the existing equipment to use less, Issues 3 and 4 are related to creating new equipment to use less, Issue 5 speaks to using lower cost fuels in existing equipment, and adding new equipment that uses less costly fuel is touched on in Issue 3. Issue 10 refers to cutting energy costs altogether.

Remember, all groupings of ideas must have had their origin in an analytical activity of the mind. In situations where you are trying to solve a problem, the likelihood is that your groupings derived from one or another of the structures you created to guide your analysis. Matching your ideas to these structures can help you to verify their logical validity.

(The entire process of problem solving, incidentally, is called Abduction, to distinguish it from Induction or Deduction. For a detailed discussion of Abduction, particularly as it applies to scientific problem solving, see the Appendix.)

9

QUESTIONING THE SUMMARY STATEMENT

We come at last to consider the first rule of the pyramid: ideas at any level must be summaries of the ideas grouped below them, because they were in fact derived from them.

When a grouping of ideas conveys a deductive argument, the idea above is easy to derive because it is a simple summary that leans heavily on the final conclusion. But when the grouping is an *inductive* one, made up of a set of statements that you see as closely related in some way, the idea above must state what the relationship below implies.

Most writers don't state the implications of their groupings. As we have seen, their tendency is to tie together ideas that have a general rather than a specific relationship, so that nothing is directly implied. Consequently, they are forced to cap them with what I call intellectually blank assertions:

- The company should have three objectives.
- There are two problems in the organization.
- We recommend five changes.

I call these statements intellectually blank because they do not in fact summarize the essence of the ideas grouped below them. They simply state the *kind* of idea that will be discussed. As such they cannot serve as nuggets on which to focus future thinking.

This is, of course, the major purpose of summarizing a grouping – to glean an insight about which you can then think further. You will take that summary point and either find others like it (induction) or comment further on it (deduction). But you must have a true summary before the process can begin.

For example, I once worked with someone who wrote, ‘The company has two organization problems’ and then listed the two problems. When pressed to state how they were alike so that he could make a proper summary statement, he discovered that in fact he wasn’t talking generally about ‘organization problems.’ He was talking specifically about ‘areas of the organization where greater delegation is needed.’

Once he saw that, he realized that there were not two of these so-called problem areas, but four, only one of which he had properly identified. He further realized that his insight was that the major organization problem the company faced was its inability to delegate authority. Now having clearly stated the problem he was free to focus his thinking on finding solutions to it.

A second reason you want clear summary statements is that it makes life easier for the reader. A document studded with intellectually blank assertions is boring beyond belief to read because it does so little to anchor the reader’s perceptions. In addition, there is a real danger that he could misunderstand you.

To illustrate, here is an exchange I heard on the radio several years ago:

First speaker: John Wain says he believes he is well placed to write this biography of Samuel Johnson for three reasons:
 The same poor Staffordshire background
 The same education at Oxford
 The same literary preferences.

Second speaker: I don’t agree. There are no real truths in Staffordshire.

This is a superb example of the second speaker’s not grasping what the first meant, because the first speaker did not in fact say what he meant. The second speaker sits poised, with his mind open, waiting for the first speaker to give him his point. But he doesn’t state the point, he states ‘for three reasons.’

Thus, apparently, what the second speaker heard as the major point was, ‘The same poor Staffordshire background,’ and his mind ignored the other two reasons. So that when he came to reply, he replied to the point he heard. The speakers were speaking directly past each other.

Now if instead the first speaker had said, ‘John Wain says he is well placed to write this biography of Samuel Johnson because he and Johnson are essentially the same kind of people,’ then while the second speaker would have had to listen to the three support points, he would have had to reply to the point that tied them together.

What do you have to do to make a proper summary? First, as the previous two chapters have shown, you have to check the origin of the grouping to make sure it is MECE (i.e., that its order reflects a process, a structure, or a classification). Then you look at the *kind of statement* you are making. Regardless of the origin of the idea, its expression will be either as an action statement, telling the reader *to do* something, or as a situation statement, telling the reader *about* something.

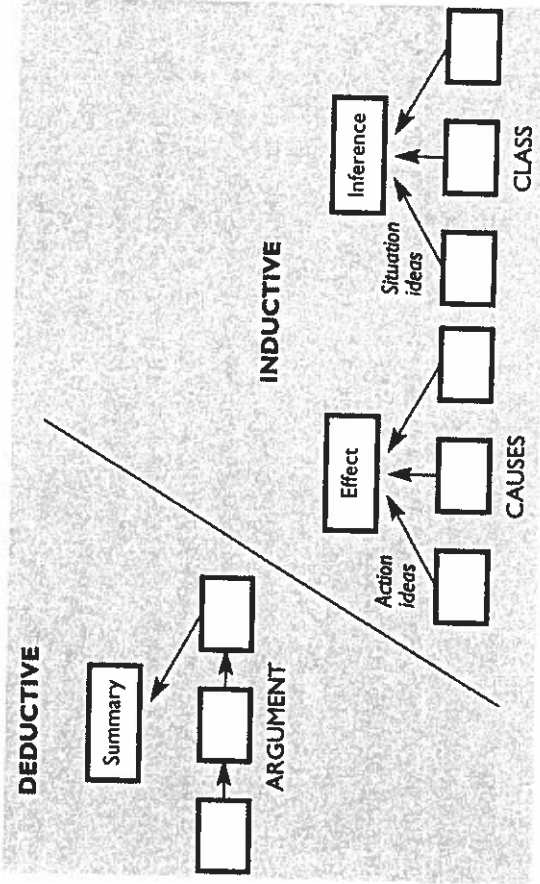
- Summarize the action ideas by stating the effect of carrying out the actions.
- Summarize the situation ideas by stating what is implied by their similarity to each other.

Thus, as Exhibit 44 illustrates, summarizing inductive groupings means either determining the effect of actions or drawing an inference from conclusions.

STATING THE EFFECT OF ACTIONS

The great majority of ideas in business writing are statements of actions – i.e., statements described by such plural nouns as steps, recommendations, objectives, or changes. You use

Exhibit 44 The Form of the Argument Dictates the Process of Summarizing

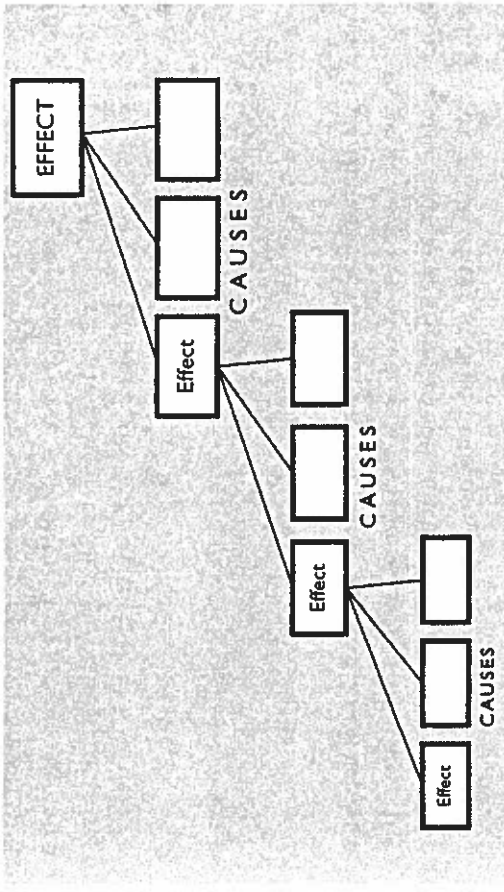


them when writing manuals, stating action plans, describing systems, or spelling out how to go about solving a problem.

Since actions are always taken to achieve some purpose, you place these ideas in a causal structure that groups them under the effect they are meant to achieve, approximately as displayed in Exhibit 45. As you can see, if you have a large number of steps to carry out in getting to the end result, the hierarchical structure makes it easy for the reader to grasp how they all relate and the order in which they must be carried out.

Sorting actions by their effect is an alien kind of activity for most people, while separating various causes from various effects at a number of levels of abstraction leaves them in chaos, logically speaking. There are many reasons for this, chief among them the fact that writers habitually state actions so vaguely that it is difficult for them to determine their precise effects. In addition, very often a writer doesn't understand the difference between a cause and an effect, and in any case his tendency is to want to group by similarity, since that's his most common thinking activity. Let me suggest ways to deal with these difficulties.

Exhibit 45 Action statements should be grouped in a causal structure



Make the Wording Specific

If you build a causal structure properly, you will be able to say about each grouping of ideas, starting at the bottom, 'I do these three things to achieve the above effect, I do the next higher three things to achieve the next above effect,' etc. Each of the points must be mutually exclusive from the next - i.e., no overlaps - and each grouping of points must be collectively exhaustive in terms of the point at the top.

To judge whether the grouping is collectively exhaustive, the effect must be so specifically stated that it implies an end product you can hold in your hand. In other words, you can't say, 'I do these three things so that I can improve profits,' because a 10 percent improvement in profits and a 2 percent improvement in profits are both an improvement in profits, but the steps you would need to take to achieve each would differ greatly.

To be both clear to the reader and useful to yourself in checking your thinking, the point should say something like, 'I do these three things so that I can improve profits by 10 percent by January 15.' This kind of statement permits you to judge whether the steps you have grouped together underneath would in fact bring about this end result.

You will not always, of course, have a clear numerical goal as your end product. But there will always be some tangible way to judge that the step has been completed. A useful technique is to visualize a real person actually taking the action, so that you can judge how he will know when he is finished. By that criterion, this sentence is almost pure gibberish:

A world consciousness must be developed through which every individual realizes his role as a member of the world community.

What does that mean you should do? How will you know when you have done it? Can you visualize someone 'realizing his role'? If you cannot, you do not know what the author actually means. Here is another example where you do not know:

To reduce the chance that conflict will turn to confrontation rather than healthy debate and consideration of issues on their merits, the Task Force must be able to:

- Handle a variety of personal attitudes
- Build favorable rapport with company personnel
- Develop good interviewing skills
- Plan and conduct interviews effectively
- Learn to gain agreement on suggestions while maintaining an objective posture.

What can the writer have had in mind? What is it actually the Task Force must do? And to what end? If they do it, what will they accomplish? As you can see, without knowing what the final objective is meant to be, you cannot judge that the steps below will in fact achieve it.

Remember that the technique is to look for an end product or cutoff point that will let you know when the step is completed. To illustrate, opposite are some examples of typically vague statements made in business writing, each translated into exactly what was meant.

You can see that each translation is easier to comprehend because it brings an image into the mind. This of course makes the document much more interesting to read. More important, perhaps, without this end-product orientation you cannot tell with confidence what the next step should be.

What was said	What was meant
1. Strengthen regional effectiveness	1. Assign planning responsibility to the regions
2. Reduce accounts receivable	2. Establish a system for following up overdue accounts
3. Review management processes	3. Determine whether management processes need to be revised
4. Improve financial reporting	4. Install a system that gives early notice of change
5. Tackle strategic issues	5. Define a clear long-term strategy
6. Redeploy manpower resources	6. Place people in positions of comparable responsibility.

In number one above, for example, once I visualize the planning responsibility assigned to the regions, I am stimulated to think whether anything else must be done in conjunction with this to accomplish some higher goal, if there is one. Thus, in addition to assigning responsibility, I may need to establish a planning review system to direct their activities.

By contrast, if I visualize 'strengthen regional effectiveness', what do I see? Nothing that would identify the obvious need for another step.

You will have noted that an idea can serve as both a cause and an effect in a structure. Consequently, *all* steps should be written so that they imply an end product. When your language does not obey this rule, you confuse your assessment of the proper cause-and-effect relationships. To illustrate an extreme case, take the following set of steps of what a project staff should do:

Identify high-potential profit-improvement projects

1. Review background data
 - a. Define your key task
 - b. Collect data for the key task
 - c. Review events and trends affecting the key task

2. Identify possible projects

- a. Measure profit impact of improved performance
- b. Assess possible level of improvement and profit impact
- c. Prepare a draft Profit-Improvement Project Plan.

The first step, 'Review background data,' states an essentially meaningless guideline for action. How does one know when he's finished reviewing the data? Is the end product of the review a judgment? A plan of action? Does 'review' mean read? Assess? And if you look at the substeps for guidance on the meaning of 'review,' you find that this cannot in fact be what the person is meant to do.

The purpose of the substeps (define the key task, collect the data, etc.) must be to bring about the major step stated above them. Accordingly, you must be able to ask, 'I do these three things so that what will happen?' Here the 'what' cannot logically be 'so that you can review background data.' A similar complaint can be made about the three substeps under Step 2, 'Identify possible projects.'

A good part of the writer's problem here lies in the imprecision of the language he has used to state the steps. Exhibit 46 shows, in the right-hand column, what in fact the author meant to convey by his choice of words in the left-hand column, and given that intention, what a better listing of the steps might have been.

This analysis demonstrates some common errors to look for as you group steps to form a system. Ask yourself the following questions about any grouping:

1. *Does the same step appear in more than one place?* In the original listing here, for example, the overall step and Step 2 (Identify high-potential profit improvement projects and Identify possible projects) are essentially the same point.
2. *Can I visualize someone taking the action?* If you can't, it means you have not stated the end product clearly, which makes it difficult to determine precisely what the reader needs to be told next. Try to think of the end product as being in the reader's hand at the end of the step, and then make your next statement convey an action that builds logically from this situation.

Exhibit 46

ORIGINAL STATEMENT	CLARIFICATION
<p>1. REVIEW BACKGROUND DATA</p> <ol style="list-style-type: none"> a. Define your key task b. Collect data for the key task c. Review events and trends 	<ol style="list-style-type: none"> a. Select an operating activity where cost and investment are high b. Look for evidence of poor performance c. List likely future changes in operating conditions that would make correcting performance of no value
<p>2. IDENTIFY POSSIBLE PROJECTS</p> <ol style="list-style-type: none"> a. Measure profit impact of improved performance b. Assess possible level of improvement and profit c. Prepare draft PIP plan 	<ol style="list-style-type: none"> a. Measure profit impact of correcting poor performance b. Assess the level of profit improvement actually likely to be obtained c. Estimate the analyses required and people needed to follow up the project d. Work out a timetable for their activities

The 'Review events and trends' step, '1c on page 153, for example, is a step that disobeys this rule. The disposal to which the information about events and trends is to be put is unclear, since it does not attach logically to that gathered during the previous two steps. Visualizing someone using the end product can help you avoid this kind of vagueness.

3. *Will the substeps bring about the step above them?* Again referring to 1c, it is difficult to see how reviewing events and trends contributes directly either to identifying a possible project or to justifying its pursuit, the two major points in the revised listing on Exhibit 46. It probably belongs as a substep under 2a in the new listing, as something to be taken into consideration in assessing the level of profit improvement actually likely to be obtained.
4. *Have I kept the subject the same?* As I mentioned earlier, an action statement always implies that someone specific is taking the

Better statement of steps

HOW TO PREPARE A DRAFT PROFIT-IMPROVEMENT PLAN

I. IDENTIFY A POSSIBLE PROJECT

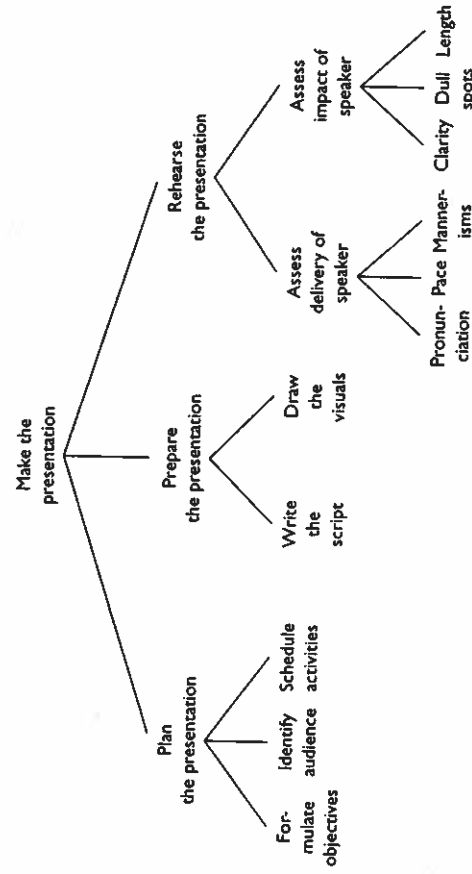
- a. Select an operating activity where cost and investment are high
- b. Look for evidence of poor performance
- c. Measure profit impact of correcting poor performance.

2. STATE THE IMPLICATIONS OF PURSUING THE PROJECT

- a. Determine the level of profit improvement actually likely to be obtained
- b. Estimate the analyses required and people needed to follow up on the project
- c. Work out a timetable for their activities

action. Whoever the specific someone is must stay as the same person throughout the system, or you will find yourself saying something other than what you precisely mean. Look critically at the steps given in Exhibit 47, for example.

Exhibit 47



The unstated phrase in front of each point is 'you should.' You can visualize what 'you should' do both to plan and to prepare the presentation by carrying out the steps listed below these points. But can you visualize your actions in rehearsing the presentation? Does the author mean 'you should' address the delivery of the speaker and the impact of the speaker, when in fact you *are* the speaker? Of course not. More likely, he means something like:

- Run through the presentation in the presence of a colleague.
- Ask him to assess your delivery and its impact.
- Incorporate his suggestions in a second run-through.

To summarize, statements about actions are sometimes so numerous that they need to be grouped. To be valid, the groupings must be arranged hierarchically as causes leading to the same effect. The wording of each cause or effect should be such as to imply a clear end product resulting from the accomplishment of the step. When it does not do so, you do not in fact say exactly what you mean. At best, that makes your writing dull; at worst, it makes it useless.

Distinguish the Levels of Action

Even if you get the language right, telling cause from effect can be tricky. How do you know which is which? In a causal hierarchy like Exhibit 45, an idea is an effect if you expect the reader to take the action *before* he takes the next action on the same line. It is a cause if you expect him to take it *so that* an end product can be created. This sounds more confusing than it is. For example, here is a set of steps an author is recommending that committee chairmen take before they hold committee meetings:

1. Determine the objective of the meeting
2. Prepare the agenda
3. Decide the items to be discussed
4. Decide which people can contribute to the discussion
5. Specify the end result desired of the discussion
6. Distribute the information needed to carry out the discussion
7. Arrange the seating.

Are these seven separate steps in a row, each one to be carried out before the next, or does carrying out some of them create others? Take the first one, determining the objective. Do I do that before I prepare the agenda, or do I do it as part of the preparation of the agenda? The only way I know how to answer that question is literally to visualize the way the agenda would look when finished, and decide what steps someone would have to take, starting from scratch, to produce it.

I would have thought the agenda the author is talking about contains three things:

- A statement of the objective
- A list of the items to be discussed in order to achieve the objective, which would naturally have been drawn from the statement of the objective
- A statement of the end result desired from the discussion of each item.

If my visualization is correct, then points 1, 3, and 5 are causes of point 2. Point 2 is on the same line with point 4, however, because it would seem that I must have the agenda in my hand, completed, before I can make a decision on which people to invite. Similarly, I must have the list of people complete before I can decide what information to send them in advance. And I would need to know what each is going to say before I can decide where is the best place for them to sit. So in fact the major points are 2, 4, 6, and 7.

That was a relatively simple example, in which it was obvious at once that you were dealing with action ideas. Sometimes, however, you will in fact be dealing with actions that you have worded as if they were conclusions.

In most cases a conclusion about the cause of a problem implies the action required to correct it. Since positive recommendations for action are more interesting to read than negative conclusions about problems, it makes sense to turn them into an action structure. For example, suppose you had drawn the following 'major conclusions':

1. Although the company's sales force has significant strengths to build upon, substantial efforts will be required near term to ensure future competitive viability.

2. Increases in sales force manpower are required to increase sales call capacity and meet intensified competition.
3. Specialized attention is necessary to improve your competitive position with chain headquarters buying offices.
4. Field representatives may not be allocating their time optimally to achieve maximum sales potential.
5. Increased merchandising requirements and the need for additional selling capacity dictate the necessity for specialized merchandising resources.
6. Significant manpower increases will require the formation of additional districts and additional management levels.
7. A formal field sales strategy is needed to provide direction to field personnel.
8. Standardized quantitative measures are needed to guide and evaluate sales resources.

The first step would be to restate those that imply actions as actions. That would mean restating all but the first one, as follows:

2. Add salesmen
3. Assign specialized salesmen to HQ accounts
4. Tighten account scheduling process
5. Hire part-time merchandisers
6. Add more districts and management levels
7. Create sales strategy
8. Standardize quantitative measures of work.

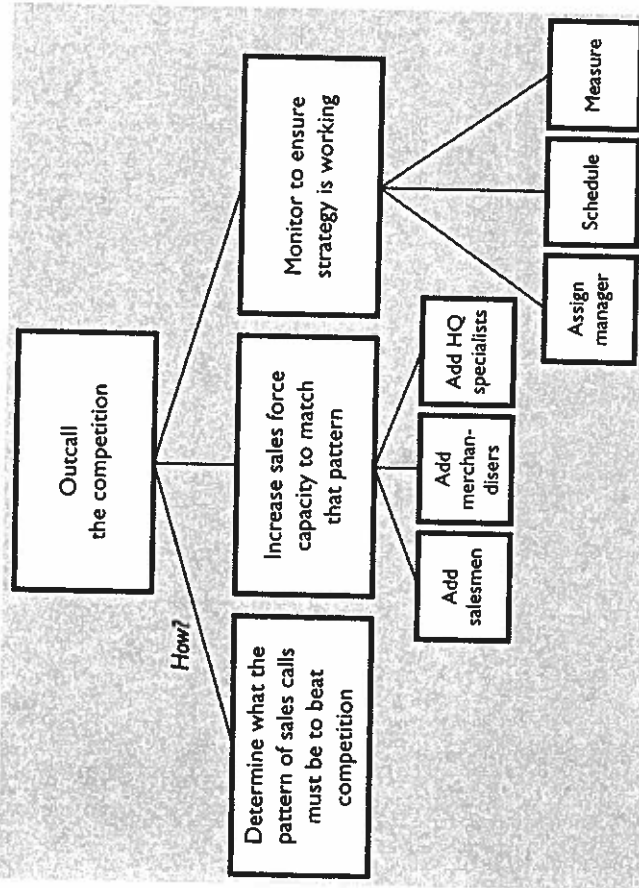
Clearly these are not quite in end-product terms, but that is not necessary at this stage when you are sorting out your thinking. The technique is to decide roughly what goes with what in terms of cause and effect, and then restate the points to be totally clear.

Thus, you would note that 2, 3, and 5 are all adding people, so that their effect would be to increase the size of the sales force. Numbers 4, 6, and 8 have to do with managing the sales force. Number 7 stands alone, so that roughly this is being said:

- Create a sales strategy
- Increase the size of the sales force
- Manage the sales force.

Why are we doing these things? Apparently to keep our competitive lead. And if we do them all, what in effect will happen? Essentially, it seems we will outcall our competition. So that you might have a structure such as that shown in Exhibit 48.

Exhibit 48



In closing this section, let me just point out that you cannot group action ideas by similarity rather than by effect. If you try to do so, you will find that you no longer have mutually exclusive groupings, nor will you be able to judge whether you have been collectively exhaustive in listing your actions.

For example, in the article on conducting committee meetings already referred to, the author said:

- The Chairman's job can be divided into two corresponding tasks:
Dealing with the subject
Dealing with the people.

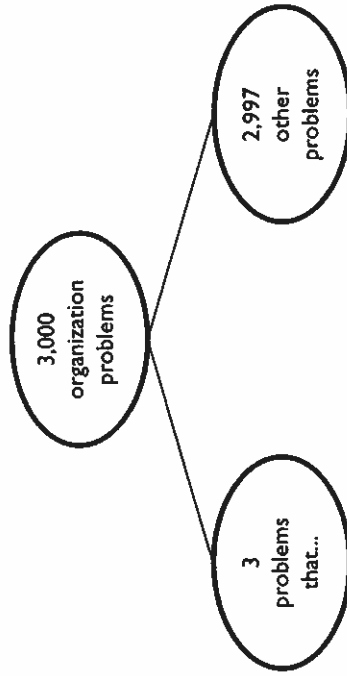
What this arrangement of points implies is that during the meeting the Chairman must first deal with the subject, and then when he has

finished, deal with the people (whatever 'deal with' means). Obviously, you can't separate his job that way and still reflect the actual steps he has to take in the order in which he has to take them, because he sometimes has to do both kinds of things at once. The points as stated are not the effects of carrying out a coherent set of actions, and thus could not have been arrived at analytically.

DRAWING AN INFERENCE FROM CONCLUSIONS

What you *can* group together by similarity are situation ideas – statements that can be described by such plural nouns as reasons, or problems, or conclusions. You would have classified the ideas in this manner because you believed each of them to possess a characteristic in common.

To review what you read in Chapter 7, when you say something like 'The company has three organization problems,' you have in effect taken the entire universe of possible organization problems that the company could have and made a bifurcate division of them:



You then ask yourself, 'Why these three and no others? How do I know that the division is mutually exclusive – that nothing in the right-hand oval should be included in the left?'

The only way you can know is to define the objects permitted in the left-hand oval so specifically that only the ones you have

included will fit the description. In this case, perhaps 'because they are the only organization problems that result from not delegating authority properly.' What you are doing is stating precisely how these particular organization problems differ from all other organization problems in the company. You want to be as specific as possible, since the clearer your definition, the easier it is to make a general statement that applies to them all.

It is not always easy to state specifically what a particular set of ideas has in common, since it requires some creative insight. However, there is a technique you can use, which you may already have noted my using in the discussions of earlier examples. That is first to find the structural similarities in the sentences in which the points appear, and then to visualize the relationships implied between the parts that are similar.

Find the Structural Similarity

Ideas are always written in sentences that have a subject/predicate structure. Thus, the common property linking the ideas will usually show up because the sentences all:

- Discuss the same kind of subject
- Express the same kind of action or object.

If the subjects are all exactly the same, you look for a similarity by which to group among the actions or objects. If the actions or objects are all exactly the same, you look for a similarity by which to group among the subjects. For example, the following statements are all complaints about the figures in an information system. They can thus be related in terms of their verbs.

1. Productivity figures for accounting, estimating, and surveying should be updated.
2. Regular personnel turnover figures are now necessary for all types of employees.
3. Competition information from tenders should be gathered so that the strength of competition in different markets can be monitored.
4. The present information about market rates for salaries is not adequate.
5. Division and project capital lockup figures are needed.

I will show you how to visualize these relationships in the next section. For the moment, let's look at the structure of another list. Here are the major points of a presentation given by a consultant to a client who wanted to know whether he should enter the automotive aftermarket – spark plugs, tires, etc.

1. Market is large and growing at an attractive rate.
2. Aftermarket is profitable.
3. Key market characteristics indicate high barriers to entry.
4. Overall trends are favorable, but uncertainties obscure some market segments' outlooks
5. Overall, the market appears attractive, but is highly fragmented.

As you can see, since the subject is the same in each case (aftermarket), the points relate to each other by predicate. But they go together only if the predicates can be found to fall into the same category or categories. You can instantly see that there are both positive and negative points being made, so that there does appear to be some relationship. Again, I will show you how to work it out in the next section. Here I just want to show the process of matching.

Sometimes you will go through this matching exercise and *not* find any relationship at all between the points. That is always an indication that there is something wrong with your grouping and that further thinking is required before you can say precisely what you mean. Take this listing of the 'Characteristics of the Planning and Control System' being installed in a publishing company:

1. The planning cycle and its attendant control mechanism should be on an annual basis.
2. The plans should be built up via an integrated system.
3. The plans should be compiled in the context of a strong directional lead from the top of the division.
4. The planning system will distinguish between the current practice and the planned change.

These points say that the things to note about the planning system are that it is annual, integrated, begins at the top, and distinguishes between present and future. So what? That's like your telling me that your wife is five feet eight inches tall, has honey blond hair, likes

green dresses, and drives a Buick. I can't put those four points together into an overall statement that will tell me anything interesting about your wife.

On the other hand, if you tell me your wife is five feet eight inches tall, has honey blond hair, wizard legs, and her measurements are 36-24-36, then I can say, 'Wow, she must be a knockout lady.' In the first case, you have made four separate comments about your wife. In the second, you have made four related comments from which I can draw a larger idea, and then continue to think about that idea.

This impetus to think further is, as I have said before, the major reason for drawing inferences in the first place. A grouping of ideas like the planning and control system characteristics above does not push your thinking upward, and therefore cannot guide it forward on this particular subject.

Visualize the Relationships

How you actually draw an inference from a proper grouping is a bit difficult to explain with precision. You have assembled in your grouping a collectively exhaustive class of observations about a subject, and you now want to make a statement about the class as a whole.

Essentially the statement should give an insight into the implications of their being similar in the way they are. Achieving that insight requires a so-called inductive leap. The springboard for that leap is likely to be a visualization of the source of the relationships reflected in the grouping.

Let's look again at the first two examples in the previous section. The first group said that the information:

1. Should be updated
2. Is now necessary
3. Should be gathered
4. Is not adequate
5. Is needed.

They clearly fall into two distinct groups: those complaining that the information does not exist (2, 3, and 5), and those complaining that the information exists but is not adequate (1 and 4). So we see that the list implies that there are two problems with the information system.

Now, why these two problems and no others? What is the same about them that made the author instantly recognize them as problems that should be grouped together? Possibly because these defects indicate a uselessness for planning purposes. In that case, the point the author would state at the top would be: 'The planning system as presently set up produces information that is useless for planning purposes.' Why? Because either the information needed doesn't exist, or it exists but it's not adequate.

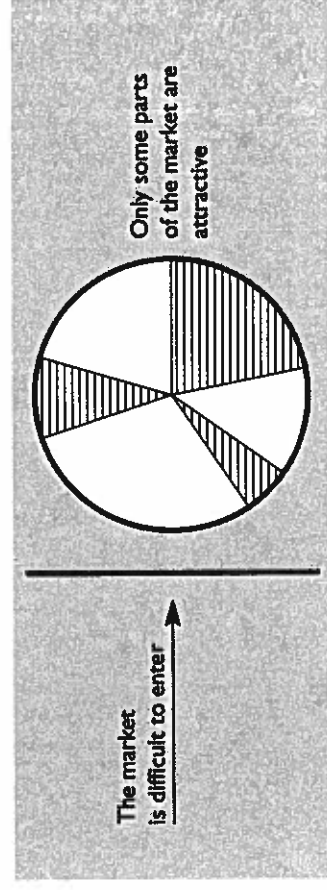
The next one, on the automotive aftermarket, is a bit harder. Again, the ideas fell into two groupings:

- Positive points: large, growing, attractive, profitable, favorable trends, attractive
- Negative points: barriers to entry, uncertainties, fragmented.

Clearly if the market is large, growing, and profitable, it is attractive. And favorable trends also means it's attractive. Let's visualize this attractive market with a circle, as shown in Exhibit 49.

The negative points don't group so easily. Fragmented means that the circle must have some segments in it, but uncertainties obscure some segments' outlooks. This means some of the segments must look different from the others. Finally, he says there are barriers to getting in, so let's show that with a line stopping entry.

Exhibit 49



Now what conclusions can we come to from the visualization?

- Only some parts of the market are attractive.
- These are going to be difficult to get into.

That sounds like the beginning of a deductive argument. The author has left off the 'therefore' point, which means he never bothered to complete his thinking. No wonder he found it difficult to write a clear summary statement of the points.

Sometimes you will be presented with groupings that look like situation ideas, but are really action ideas in disguise. Begin by treating them as if they were classed together because of their similarity, and then switch the form if you can visualize the effect that together they would achieve.

For example, suppose you read:

There are four variables to be managed in the resource allocation process:
 Sequence and timing of activities
 Definition of specific people's tasks
 Definition of information needs (content and form)
 Decision-making process.

Why these four variables and no others? What is the same about them that made him group them together? If you try to state them more specifically, so as to find an order, you will see that the author is probably saying this:

The four variables are:
 Spelling out the sequence and timing of project planning activities
 Specifying where decisions are needed
 Identifying who will participate in making them
 Defining the information they need to do so.

These have now become a clear series of actions. Why would I want to take these four actions? What would be the effect? I suppose it would be to fix it so that everybody who should participate does so, and does so properly. The summarizing point then might be:

The major management task in the resource allocation process is to ensure early and substantial participation of the proper people.

Similarly, suppose you went on to say:

Definition of content and form of information is often critical:
 Determines what information is generated – and used
 Broadens perspective of participants
 Focuses attention on key issues
 Facilitates collaboration across functional and divisional lines.

Again you question. Why these four reasons and no others? What is the same about them that makes the author bring them together? You would then note that the last three have to do with the behavior of the participants, while the first one is in a way saying the same thing as the point at the top. Then why the three and no others? Perhaps he means to be saying this:

Defining what information is needed and how it should be presented can be critical to gaining agreement and understanding:
 Focuses the participants' attention on key issues
 Broadens their perspective
 Facilitates their collaboration across functional and divisional lines.

Before you start objecting to the difficulty of forcing your thinking upward every time, let me admit that you're not going to be enforcing this discipline absolutely rigidly throughout all your writing – not because it's not a useful thing to do, but because you don't always need that degree of precision.

How do you judge whether you've been sufficiently precise? In general, if you can think of as many points outside the group as in the group to which the overall statement could apply, you will know that it is not sufficiently precise to serve as a valid inference about the grouping. The example below from Chapter 3 falls in this category:

- Composing room costs may represent a profit-improvement opportunity:
 Low productivity
 High overtime
 Uncompetitive prices for simple jobs.

If I see a company that has low productivity, high overtime, and uncompetitive prices, I can infer that here is a profit-improvement opportunity. However, I can substitute three other points (e.g., high scrap yield, poor timekeeping, undisciplined systems) and still infer that there is a profit-improvement opportunity. The point at the top is too broad to make a statement about these three points and no others.

Here's another imprecise example, this time properly inductive in form:

- Japanese films are now escalating their drive for the Chinese market.
The Toyota Motor Company sent official representatives to the Canton trade fair.
Japan Air Lines is negotiating to fly into China.

What about Mitsubishi, or Hitachi, or half a dozen others that come to mind? Two examples do not justify a generalization about *all* Japanese firms. By contrast:

- The doctrinal dispute between China and Russia is still very much alive.
Hostile rhetoric is flying between Peking and Moscow.
Both countries are deploying troops along the border.

Here the class term is 'indications of a dispute,' and it is difficult to think of anything other than outright war that would rightfully belong in the class. Thus, the question raised in the reader's mind by the general statement will be sufficiently answered by the two points below.

The message to take away from this discussion is that you cannot simply group together a set of ideas and assume your reader will understand their significance. Every grouping implies an overall point that reflects the nature of the relationship between the ideas in the grouping. You should first define that relationship for yourself, and then state it for the reader.

Always ask yourself of any group, 'Why have I brought together these particular ideas and no others?' The answer will be either that they all fall into the same narrowly defined category, and are the

only ideas that do fall into that category, in which case your summary point will be a statement about their sameness. Or that they are all the actions that must be taken together to achieve a desired effect, so that the summary point states what that effect is.

You should force yourself to justify each grouping of ideas in this way, so that you are sure that your thinking is dead clear and that your writing reflects it.

10

PUTTING IT INTO READABLE WORDS

- A primary area of potential improvement is improving cost-effectiveness of field sales-force deployment (and organization) to reflect the need for redefined selling missions at store and indirect levels dictated by changes in the trade environment.
- Preplanned adjustments may be developed from the alternative preliminary plans submitted by the Group and be in the form of outlines of contingency plans and prioritized guides to adjustments in special programs and other discretionary expenditures.
- Current needs for accurate cash flow analyses are particularly demanding upon the existing system; it is not prepared to meet the stringent accuracy requirements. Improvements are available through incorporating information not adequately considered in making projections.

These passages were produced by bright, articulate people with excellent problem-solving skills. Any one of them can explain his ideas orally and be completely comprehensible. But they appear to believe that, in writing, the more dehydrated the style and the more technical the jargon, the more respect it will command.

This is nonsense. Good ideas ought not to be dressed up in bad prose. Works on technical subjects can at the same time be works of literary art, as the William Jameses, the Freuds, the Whiteheads, the Russells, and the Bronowskis of the world have proved. Of course technical communications addressed to specialists must employ technical language. But overloading it with jargon and employing a tortuous and cramped style is largely a matter of fashion, not of necessity.

Your objective should be to dress your ideas in a prose that will not only communicate them clearly, but also give people pleasure in the process of absorbing them. This, of course, is advice that every book on writing gives, and if it were easy to do, everyone would be doing it. It is not easy to do, but there is a technique that can help. What it primarily requires is that you consciously visualize the images you used in thinking up your ideas originally.

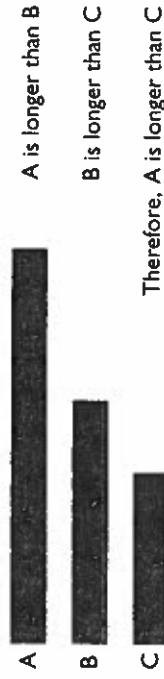
As must be obvious by now, you do all your conceptual thinking in images rather than in words. It is more efficient to do so. An image can take a great mass of facts and synthesize them into a single

You will recall I said at the very beginning of this book that writing anything clearly consists of two steps: first decide the point you want to make, then put it into words. Once you have worked out your pyramid structure and rechecked the thinking in your groupings, you know exactly the points you want to make. You also know the order in which you want to make them. All that remains is for you to put them into words.

In theory this should be a relatively easy task. One ought to be able to expect the normal business writer to translate his pyramided points into a series of concise, graceful sentences and paragraphs that clearly convey a lively message and capture the reader's interest. Alas, it does not always happen. The average sentence, far from being concise and graceful, is long-winded and heavy with jargon. This makes the paragraphs seem impenetrable and the subject endlessly boring. Let me give you a sampling:

abstract configuration. Given the inability to think about more than seven or eight items at one time, it is a great convenience to be able to compress the world in this way. Without it you would always be limited to taking decisions on the basis of a few low-level facts.

But bring together instead seven or eight of these abstract concepts, and you have in front of you an enormous amount of complex detail that you can easily manipulate mentally. Look, for example, at how much more quickly you can grasp the relationships of these three lines to each other from the image than you can from the words:



To compose clear sentences, then, you must begin by 'seeing' what you are talking about. Once you have the image, you simply copy it into words. The reader, in turn, will re-create this image from your words, thereby not only grasping your thinking but also enjoying the exercise.

Let me demonstrate this process, first by showing how easily images appear when you are reading well-written prose, and then by giving you some hints on how to find the images lurking in bad prose so that you can rewrite it.

CREATE THE IMAGE

Here is a passage from Thoreau's *Walden*. As you read it, try to keep track of what's going on in your mind.

Near the end of March 1845 I borrowed an axe and went down to the woods by Walden Pond, nearest to where I intended to build my house, and began to cut down some tall, arrowy white pines, still in their youth, for timber. . . . It was a pleasant hillside where I worked, covered with pine woods, through which I looked out on the pond, and a small open field in the woods where pines and hickories were

springing up. The ice in the pond was not yet dissolved, though there were some open spaces, and it was all dark-colored and saturated with water.

As you took in the words, did you not build up a sort of mental picture in your mind, to which you added details as you took in successive phrases and sentences? What you were building was an image, but not a photographic image. Rather it is what George Miller, to whom I am indebted for this example,* calls a 'memory image,' and it grows piecemeal as you go along.

If you read it as I did, first you see that it's March 1845, so that perhaps you have a feeling of a gray day in the past. Then you see one person borrow an axe from a second person, both indistinct, and you see him walking toward the woods, axe in hand. The trees turn into white pines, and you see Thoreau chopping at them. The next sentence introduced a hillside, so that suddenly the trees are on a hill. Then you see Thoreau stand up straight and look across at the pond, the open field, and the ice.

Your experience may or may not have been exactly like that. The point is, however, that you were *constructing the passage* as you read. The result of this constructive activity is a memory image that summarizes the information presented. You construct the image as part of the process of understanding, and the image then helps you to remember what you have read.

If you put the book down and try to remember what you read, you will probably find that you can't repeat it verbatim. But if you recall the image you can read off from it what you see, and it will be roughly equivalent to the original.

That images help to increase recall has been proven in memory studies, although these studies also show that people forget some details and embellish others, depending on their emotional predilections. Nevertheless, the memory image does provide a record of the passage and of the information extracted from it – a record that the reader constructs as he reads, phrase by phrase.

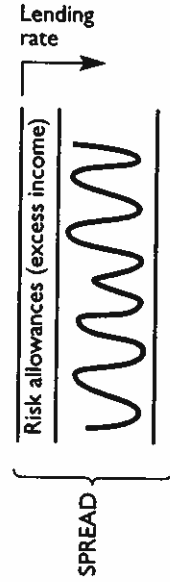
* From 'Images and Models, Similes and Metaphors,' in *Metaphor and Thought*. Andrew Ortony, editor. Cambridge University Press, 1979.

This is the kind of thing that must happen every time you read anything if you are to comprehend and remember it. Some passages are more difficult to visualize than others, and if the ideas being presented are particularly abstract, it may be that you will represent them with skeletal structures rather than with images. But unless the passage can be visualized in some form, unless the reader can actually 'see' what is being said, he cannot be considered to have understood it.

To demonstrate, here is a passage from a document that debated whether the International Bank for Reconstruction and Development should change from a fixed lending rate to a floating one.

If the risk allowances provided in the lending rate spread turn out to be too high, the Bank's income will be returned to borrowers as a group through a reduction in the lending rate in subsequent periods. Thus, fixed rate lending would involve extra costs for borrowers as a group only if the Bank were systematically to overestimate risks and thereby earn 'excess' income more or less permanently. This possibility seems remote.

Although the concepts discussed are fairly abstract, words like 'spread,' 'excess,' and 'reduction' permit you to visualize a clear set of relationships. If asked to draw them, you could do so with no more than four lines and two arrows, perhaps like this. (I have added the words, but you would not need do so for yourself.)



This skeletal nature of the image is important to note. One does not want a complete, detailed photographic reproduction, but only a sense of the structure of the relationships being discussed. These will generally consist of one or more geometric forms (e.g., circle, straight line, oval, rectangle), arranged in a schematized or sketchy fashion, plus something like an arrow to indicate direction and interaction.

It may seem almost childish as you look at it. But all the great 'visual thinkers' of the past who have talked about it, from Einstein on down, have emphasized this vague, hazy, abstract nature of their conscious visual imagery.

COPY THE IMAGE IN WORDS

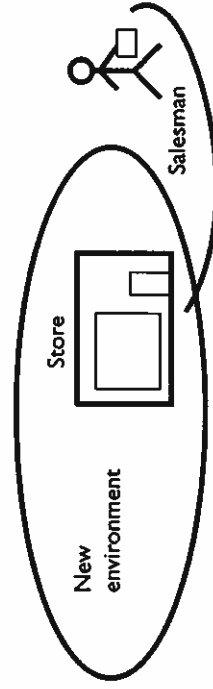
Using just these basics to create images can make a very great difference to rewriting bad prose. Let me demonstrate this using the first example on page 171. Because the words as laid out fail to call to mind an image as you read, your mind gropes in vain for something solid to hang onto. Look at the beginning of that first sentence again.

- A primary area of potential improvement is improving cost-effectiveness of field sales-force deployment (and organization)

By the time the field sales force arrives, the rest has disappeared from your mind. But the sentence goes on:

- to reflect the need for redefined selling missions at store and indirect levels dictated by changes in the trade environment.

Now, what *nouns* do we have to hang onto here that are relatively concrete? The sales force, store, and changed trade environment, perhaps. How might they be pictured in relationship to each other?



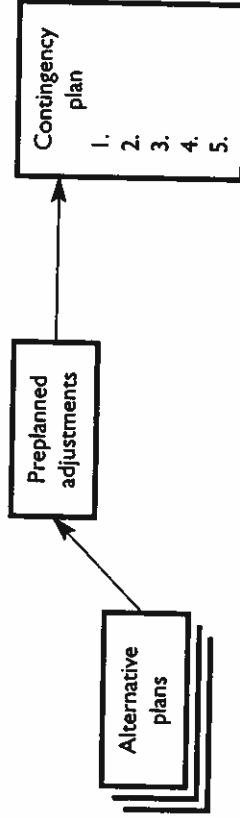
This seems to indicate that the main relationship being talked about is that of the salesman to the store. Perhaps he meant to say:

- We must redeploy the sales force to match the new trading environment.

As you can see, the trick is to find the nouns and look for the relationships between them, seeing them as a visual image. Let's apply the technique to the other two examples on page 171.

- Preplanned adjustments may be developed from the alternative preliminary plans submitted by the Group and be in the form of outlines of contingency plans and prioritized guides to adjustments in special programs and other discretionary expenditures.

Again, the nouns seem to be 'preplanned adjustments,' 'alternative preliminary plans,' and 'outlines of contingency plans and prioritized guides' (whatever that means). How might the author mean them to relate to each other?



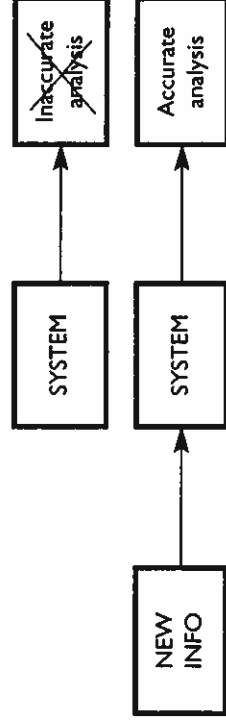
Apparently what the author wants out of the reader is some sort of contingency plan. In which case he might want to express his message like this:

- Outline the order in which activities will be curtailed should the plan need adjusting.

One more example:

- Current needs for accurate cash flow analyses are particularly demanding upon the existing system; it is not prepared to meet the stringent accuracy requirements. Improvements are available through incorporating information not adequately considered in making projections.

Right off, of course, we can object that it is not the system that is not prepared to meet the stringent accuracy requirements. However, to apply our process, the nouns appear to be 'inaccurate cash flow analyses,' 'system,' 'improvements' and 'information.' Might they go together in this way?



The key insight to be gained from the image is apparently that insertion of the proper information will yield accurate analyses, giving us perhaps:

- The system can produce accurate cash flow analyses if we feed X kind of information into it.

(Without access to the author, we cannot judge what he means by 'Information not adequately considered in making projections.')

To summarize, then, a useful way to help yourself write lucid prose is to force yourself to visualize the relationships inherent in your ideas. Once you have a clear mental image, you can straightaway translate it into a clear English sentence, which your reader can just as straightforwardly interpret and absorb. And he has the additional advantage of being able to store this knowledge in his memory in image form.

Storing knowledge in image form is, of course, essential given the word-by-word process of reading and our limited ability to hold many words in our minds. By rescuing the image from the words, the reader is able not only to transfer the knowledge in large chunks, which are more efficient for his mind to process, but also to transfer it as a vivid impression, which makes it easier to recall.

To quote a kinsman of mine, Professor William Minto, who lived in a more leisured era: 'In writing you are as a commander filing out his battalion through a narrow gap that allows only one man at a time to pass; and your reader, as he receives the troops, has to reform and reconstruct them. No matter how large or how involved the subject, it can be communicated only in that way. You see, then, what an obligation we owe to him of order and arrangement – and why, apart from felicities and curiosities of diction, the old rhetorician laid such stress upon order and arrangement as duties we owe to those who honor us with their attention.'

Go thou and do likewise.

PROBLEM SOLVING IN STRUCTURELESS SITUATIONS

Chapter 8 characterizes problem solving as a relentlessly logical process for discovering and displaying the underlying structures that give rise to events we consider undesirable. Our theory has been that the solution of the problem will always lie in tinkering with the structure as indeed it will if the problem is that we do not like the result the structure is yielding.

However as I mentioned, there is another kind of problem situation where the problem is not that you don't like the result but rather that you can't explain it. You can't explain it for one of three reasons:

- Because the structure does not yet exist – as when you are trying to invent something new (e.g., the telephone, underwater tunnelling)
- Because the structure is invisible – as in the brain or DNA, so that you have only the results of the structure to analyze
- Because the structure fails to explain the result – as when Aristotle's definition of force did not explain the momentum of a cannonball, or when tools rust mysteriously no matter what you do to guard against it.

It is possible that you may confront one of these structureless situations in the course of an ordinary problem-solving assignment. Although such situations require a higher level of visual thinking than we have been discussing, you will be pleased to know that the reasoning process employed is very similar.

What is required is simply another form of Abduction – a name coined by Charles Sanders Peirce in 1890 to describe the process of problem solving. In calling it Abduction he hoped to emphasize the affinity of problem-solving thinking with Deduction and Induction. Let me explain the difference between the two forms of Abduction, and show you how to use the second.

Analytical Abduction

C. S. Peirce's insight was that in any reasoning process you always deal with three distinct entities:

- A Rule (a belief about the way the world is structured)
- A Case (an observed fact that exists in the world)
- A Result (an expected occurrence, given the application of the Rule in this Case).

The way in which you can consider yourself to be reasoning at any one time is determined by where you start in the process and what additional fact you know. To illustrate the differences:

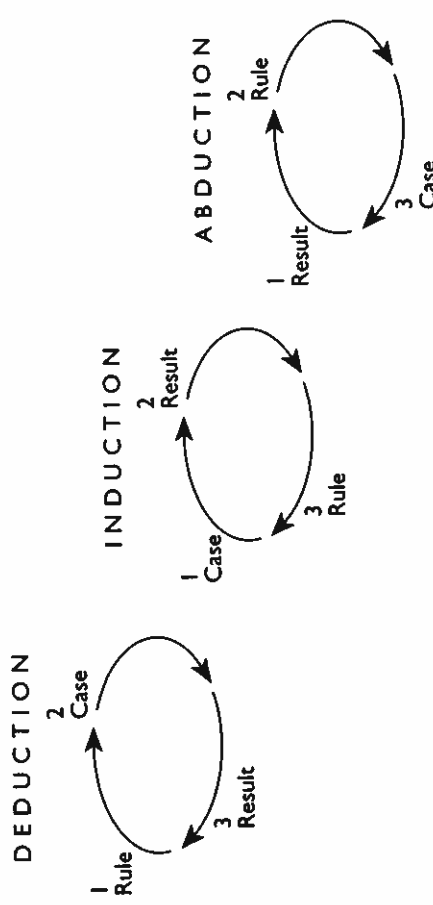
Deduction	If we put the price too high, sales will go down. We have put the price too high. Therefore, sales will go down.	If A then B A Necessarily B
Induction	We have put the price up. Sales have gone down. The reason sales have gone down is probably that the price was too high.	A B If A then probably

Abduction	Sales have gone down. One reason sales go down is that the price is too high. Let me check whether in fact the price is too high.	B If A then B Possibly A
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We have been saying throughout that analytical problem solving consists of noticing an undesirable Result, looking for its cause in our knowledge of the structure of the situation (Rule) and testing whether we have found it (Case). You can see that this exactly matches the Abductive reasoning process shown above.

Even though Abduction is different from Induction and Deduction – and it is important to note the difference – they are also closely related. Thus, in any complex problem-solving situation you are likely to be using all three forms of reasoning in rotation. As I said earlier, the form you are using, and the results you can expect from it, depend on where you start in the process.

Where you start determines the form of thinking you will use.



Scientific Abduction

The major difference between the analytical problem solving discussed in Chapter 8 and the so-called creative or

scientific problem solving discussed here is that we know the structure that creates our result and the scientist doesn't. That is, we have two of the essential elements and can reason our way to the third. He must invent the second before he can reason to the third.

In reasoning to the third, the scientist follows the classical scientific method:

- Hypothesize a structure that could explain the result.
- Devise an experiment that will confirm or exclude the hypothesis.
- Carry out the experiment to get a clear yes-or-no answer.
- Recycle the procedure, making subhypotheses or sequential hypotheses to define the possibilities that remain, and so on.

The hallmarks of the scientific method are generating hypotheses and devising experiments. Both activities demand high levels of visual thinking.

I. Generating hypotheses. The hypotheses are drawn out of the air, but are directly suggested by examining the structural elements of the situation that produced the problem. For example, if your problem is that you want to find a way to permit people to communicate over long distances without shouting, then you will be thinking specifically about ways to magnify the voice or amplify the ear, and your hypotheses will reflect the possibilities you envision.

Exactly *how* you go about envisioning productive possibilities is, unfortunately, not something one can spell out in a recipe. It frequently requires a kind of genius that permits you to see analogies between what you know of the problem and what you know of the world. And indeed this is what Alexander Graham Bell apparently did in inventing the telephone:

'It struck me that the bones of the human ear were very massive, indeed, as compared with the delicate thin membrane that operated them, and the thought occurred that if a membrane so delicate could move bones relatively so massive, why should not a thicker and stouter piece of membrane move my piece of steel.'

Clearly, we touch the tip of a very big iceberg here. No one knows what makes an apt analogy occur to one person and not to another.

Certainly having total knowledge of the problem situation helps, as does spelling out and re-examining all your assumptions about it. What we do know from those who have written about the process, however, is that their insight when arrived at is always a visual image.

2. *Devising experiments.* Once the hypothesis is formulated, the next step is to use it to suggest experiments that will confirm or deny it. Again, visual thinking is required to say, 'If this structure were valid, what would follow as a matter of course? Let me set up an experiment to prove conclusively that in fact it does follow.' To put it in terms of the Abductive process:

Result: I observe the unexpected fact A.

Rule: A may be so because B is the case.

Case: If B were the case, then C would follow as a matter of course. Let me check whether C does in fact follow.

We can see the process very easily in the story of Galileo and the cannonball.

Result: Aristotle says that force is that which produces velocity. From this it follows that when a force ceases to act on a body, the body should cease to move. Yet if I shoot a ball from a cannon, the ball continues to move even though the force has stopped. Aristotle must be wrong in his conception of force as it relates to motion.

Rule: I can observe the relationship between motion and force simply by dropping a ball from my hand. When I do so I notice that the situation contains three structural elements:

The weight of the ball

The distance through which it falls

The time through which it falls.

This suggests three different hypotheses:

Force is proportional to the weight of the body on which the force acts.

Force is proportional to the distance through which the body moves when the force acts.

Force is proportional to the time through which the force acts.

Case: If hypothesis 3 is true, then the distance covered would be proportional to the square of the time. This means that if a body covers one unit of distance in one unit of time, it must cover four units of distance in two units of time, nine units of distance in three units of time, etc.

Let me roll a ball down the side of an inclined plane. This will slow up its fall sufficiently for me to measure the distances covered in different units of time, and thus determine whether the relation between distance and time is the one prescribed by my hypothesis.

New Rule: It is the same. Therefore force is that which produces *change* of velocity.

The trick in structuring an experiment is to make sure that it will yield a clear-cut, yes-or-no answer. It is not enough 'to see what happens' if you change one or another of the conditions in the situation. The result of the experiment must allow you to state unequivocally whether you will keep or discard the hypothesis.

It is in the sciences that have most rigorously applied this particular requirement that the greatest advances in our knowledge have occurred over the last 50 years. To quote Charles Darwin, 'How odd it is that anyone should not see that all observations must be for or against some view, if they are to be of any service.'

To bring this discussion to a close, I have set out both forms of Abduction on the next page. As you can see, they follow a common pattern. It is a pattern that can be of enormous value in guiding you to produce rapid breakthroughs in thinking about and resolving problems. Its value lies in the fact that it forces your thinking forward in a rigorous way, in the minimum sequence of steps, without dawdling or getting tied up in irrelevancies.

Each step demands a clear end product that you can literally see; each image indicates the direction in which the subsequent analyses should lead. When the problem has been solved, the images serve as anchors to guide the course of your discussion and the choice of your words.

Herb Simon says that solving a problem simply means representing it so as to make the solution transparent. I have striven to give you an understanding of the process by which such

representations can most efficiently be created and utilized. We are all probably capable of thinking far more creatively and efficiently than we attempt. Clearer knowledge of the process involved might influence us to try.

Techniques of Problem Solving

Basic Process	Analytical Problem Solving	Scientific Problem Solving
1. What is the problem?	Visualize the difference between the result you get now and the result you want	Define the discrepancy between the result you get and the result you should expect to get given the prevailing theory
2. Where does it lie?	Visualize the structure elements in the present situation that could be causing the result	State the traditional assumptions of the theory that might give rise to the discrepancy
3. Why does it exist?	Analyze each element to determine whether it is doing so, and why	Hypothesize alternative structures that would eliminate the discrepancy and explain the result
4. What could we do about it?	Formulate the logical alternative changes that could produce the desired result	Devise experiments that will exclude one or more of the hypothesis
5. What should we do about it?	Create a new structure incorporating those changes that will produce the result most satisfactorily	Reformulate the theory on the basis of the experimental results

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