1.5.2. Performance and Tool Performance

1.5.3. Tool List with Module References

1.5.4. SIMPLICITY AND SKILL—PAUL GAUGUIN

1. Background

1.5. Tools and Skills Categories

1.5.5. Skills

1.5.5.1. SORTING OUT SKILLS TO BUILD AND USE MANAGEMENT TOOLS.

We need a range of skills to manage our domain of responsibility and to build the management tools we need and use the tools well.

Webster defines skill as "the ability to use one's knowledge effectively and readily in execution or performance." (*Webster's Ninth New Collegiate Dictionary*) I won't distinguish carefully among the concepts of knowledge, skill, and ability at this time. Clearly, from the definition, knowledge, skill, and ability work together to help us reach a goal. There must be intellectual skills for performing mental and conceptual tasks and operational skills for performing physical tasks. In the intellectual category, I'll include concepts I've discussed like holistic thinking and being a generalist. In the operational category, I'll include tasks like diagramming organization charts and designing a calendar.

Some skills must be subordinate to others, such as the skill of constructing a Gantt chart being part of the skill of project management. Project management may be more than a skill; it may be a discipline. But, for now, I'll treat project management like a skill. Also, there's probably human-relations skills for performing emotional tasks. How about putting people at ease or promoting a sense of confidence in others as examples of human relations skills?

I'm interested in management tools. Many management tools are implemented using an associated operations tool. For example, we implement the data-to-information chain as a conceptual management tool usually with an associated computer, file cabinet, notebook, or other operations tool acting as a container.

A management tool or operations tool has potential. We exercise the potential (like converting potential energy into kinetic energy) through the guide for the tool, our skill in using the tool and the guide for the skill (in itself a management tool), and the fit of the tool to the situation. For a management tool, we often need an associated operations tool to live up to the management tool's potential. I use the word mechanism for the combination of a tool with its associated guide, the necessary user and operator skills; the fit of the tool to the application; and, if appropriate, the associated operations tool.

A mechanism by itself doesn't guarantee the desired result. We have to consider the systems approach and rules for integrating the mechanism into the system we're working on. In short, using a tool well includes not only the science behind the tool and its use; using a tool well includes art. If we didn't need art, we could consider the illustrative model in Figure 1.1.29.1. to be a map, develop a spreadsheet or procedure for walking through the illustrative model, put the whole thing into a computer, and let the computer automatically manage the domain of responsibility.

We have to fold in art through the skills. As I discuss skills, we'll work on folding in the art of management. Conversely, we can't manage well using art alone. We need to understand the science behind management and the tools we need to manage with. I assume that if we learn, practice, and develop skill for using a management tool, we'll develop technique.

I've discussed a few of the skills we need in management systems engineering in earlier modules. Recall skills like system, holistic, and generalist thinking (skill in the systems approach); personality typing; design; delimiting a domain of responsibility; analysis and

synthesis; and writing, reading, speaking, and listening (skill in communicating). In the next module, I'll develop six categories for skills. We can use the categories to sort out the many skills we can think of into generic groups to help us use and understand the skills and watch out for skills we can't think of. When considering management tools, we can think of hundreds of specific tools, like time management tools. We're better off understanding categories of tools and using the specific tools as examples of the categories. The same approach helps us with the many specific skills we can think of.

After developing skills categories, I'll concentrate on systems analysis skills for building management tools. Later, I'll discuss skills for using management tools, especially in regard to the rules that help gain skill in using the management tools synergistically together. Figure 1.5.5.1. lists a number of the skills I'll discuss in this book. I've neither distinguished importance nor signified emphasis in the book among the skills.

EXAMPLE SKILLS ILLUSTRATE THE BREADTH OF ABILITY MANAGEMENT SYSTEMS ENGINEERS NEED.

- Systems approach
  - System perspective
  - Holistic perspective
  - Generalist perspective
- Systems integration
- Capturing the work process and charting
- Understanding life cycles
  - Framework for the engineering process
  - System development life cycle
  - Project management life cycle
- Information gathering
- Analytical thinking
- Analyzing information flow
- Evaluating systems
- Consensus and group dynamics
- Communication
- Information sharing
- Modeling systems
- Diagnosing problems and solutions
- Relationship building
  - Typing personality
  - Diagnosing interpersonal cycles
  - Resolving conflict
  - Coaching
- Information portrayal (Output design)
- Distinguishing data and information
- Imaging
- Input design
- Storing data
- Measuring performance
- Control for quality
- Dealing with change
- Leadership
- Project management
- Crisis management
- Iteration and recursion
- Hierarchical decomposition
- Using charts and graphs
- Using models
- Balancing analysis and synthesis
- Problem solving
- Facilitation
  - Building consensus
  - Building effective teams
  - Supporting empowerment

Figure 1.5.5.1. *I'll discuss skills for building and using management tools in upcoming modules.*

1.5.5.2. MANAGEMENT SYSTEMS ENGINEERING SKILLS CATEGORIES—SHOWING INTERRELATIONSHIPS.

You need a synergistic set of skills to help you play various roles for management, for leadership, and for management systems engineering.

We know we need to develop skills to be successful in managing our domain of responsibility. During a work day, the number of different skills we use is huge. Some of the skills are simple motor skills, like penmanship. (I mean the fundamental motor skill of making letters on a page.) Others are complex intellectual skills, like writing for thinking (writing things down) and writing for communication (writing things up). Editing is another complex skill we tend to overlook but is extremely important in our work. Typing is a skill all of us will need more and more as we deal with computers. I'm now composing at a keyboard. I can think faster than I can type. The better I am at typing, the less I forget as I think through this module. Spelling and punctuation are skills we can get help with from new office automation tools. My word processing package has a speller.

As we consider one important skill in applying both the engineering and the management processes—communication—we realize we're dealing with hundreds of associated skills. I just listed a number of simple and complex skills for writing. What about skills for reading, speaking, listening, interpreting body language, and so on?

To help get a grip on the many skills we can apply to improve our work, I'll develop a set of categories, like I did for management tools. I show these categories in Figure 1.5.5.2. For each category, I've included representative skills. I've included six categories, one for skills that cross-cut the other five categories. As we can see from the description of skills I just made, many of the skills work together. Typing helps me write things down. Spelling and punctuation help me write things up in that if people are distracted as they read through my spelling errors, they won't receive what I send very well. I won't communicate well. Since communication is but one of the important skills for engineering and management, we can see that we need a huge number of skills to work together synergistically to be a good management systems engineer.

In Figure 1.5.5.2., I took the first three categories of skills from Mintzberg's categories for things managers do. Mintzberg says "The classical view says that the manager organizes, coordinates, plans, and controls; the facts suggest otherwise." To Mintzberg, the facts suggest that "....formal authority gives rise to the three interpersonal roles, which in turn give rise to the three informational roles; these two sets of roles enable the manager to play the four decisional roles." (Henry Mintzberg, *The Manager's Job: Folklore and Fact*, Harvard Business Review, 53:4, 1975, pp. 45-61.) I described these roles in Module 1.3.1. You need skills to perform these roles. I've shown three categories of skills to include interpersonal, informational, and decisional skills.

Since the idea of a process is so fundamental to what we do as management systems engineers, I believe we have to develop skills attuned to the understanding, construction, and operation of a process. The management system, or organization, includes a number of processes, including the work process and the

management process. I therefore include a category for organizational, or process, skills. Some skills are very conceptual and require a way of thinking or a way of looking at the world. I call those attitudinal skills. Ultimately, attitudinal skills may include the attitudes for human relations skills we act out through our interpersonal skills.

Just as you need to know what tool fits what situation in management, you need to know what skills apply to the situation. The classification in Figure 1.5.5.2. gives you a structure to think about and sort out the skills you need. If your skills are strong in one category and weak in another, you run the risk of not having a balanced approach to your work. For example, if you're strong at interpersonal skills, but weak at decisional skills, your people will want to work with you but will be frustrated because you have trouble closing the loop in the management process.

I believe you can learn all skills mentioned in this book. Simon speaks directly to learning management skills. He says, "...the important skills of [a manager] are decision-making skills. It is generally believed that good decision makers, like good athletes, are born, not made. The belief is about as true in the one case as it is in the other...A good [manager] is born when a [person] with some natural endowment (intelligence and some capacity for interacting with his fellow men) by dint of proactive, learning, and experience develops his endowment into a mature skill. The skills involved in intelligence, design, and choosing activities are as learnable and trainable as the skills involved in driving, recovering, and putting a golf ball." (Herbert A. Simon, *The New Science of Management Decision*, p. 4.)

Likewise, Flesch contrasts a special talent with an acquired skill. When talking about how hard people find imagining an audience when sitting down to write, Flesch says, "But it isn't a special talent you're born with—it's an acquired skill. You can learn it—just as thousands and thousands of ordinary tongue-tied people have learned to stand up before an audience and talk to them for five or ten minutes without making a complete mess of it." (Rudolf Flesch, *On Business Communications*, Barnes and Noble Books, 1974, p. 4.) I have yet to figure out something we truly have a special talent we're born with. However, I do notice some people tend to acquire some skills faster than other people. I think this acquisition is easier for people with a predisposition for certain abilities. Perhaps if you are tall and have a strong voice, you'll acquire a public speaking skill easier. However, I believe you can work to strengthen your voice—but not grow taller, yet.

You can't be perfect at everything you do. But you need to know your strengths and weaknesses and work for balance in applying skills to the workplace. You have two options for covering your weaknesses. One option is to learn new skills and improve old ones. You can, in fact, make a weakness a strength by learning new skills. I believe you can improve your skills at anything, including holistic thinking, leadership, and communication. These skills take time and effort to improve, but the result is worth the effort. An interesting aside is that for skills like these, you can improve in many different ways. You can improve leadership skills by independent study of leadership and of recognized leaders, by taking a course, or by gaining experience through volunteer efforts in the community.

Your second option is to recognize and then cover your weakness by working with someone skilled in areas you aren't. I've found I have to balance my options at covering weaknesses. I've decided to learn how to write better and I've decided not to learn how to deal with bureaucrats better. I study and practice writing skills. I hire people into my organiza-

tion who are good at dealing with the bureaucracy.

The bottom line is that you should continually assess your skills. You need to determine your skill levels as accurately as possible. Then you can figure out where you want to improve. Every day you're not improving one or more of your skills is a day you slip behind in being an effective engineer or manager. Do you know which skills you're improving today? Are they the skills you need for balance?

CATEGORIES HELP SCRUTINIZE OUR SKILLS TO DETERMINE HOW TO IMPROVE.

Interpersonal
Leadership, consensus/NGT, communication, MBTI

Informational
Information gathering (monitor), information dissemination/information sharing, data dictionary, information portrayal, distinguishing data and information, images, modeling the system, input design, file design, storing data

Decisional
Evaluating systems (cost/benefit), measuring performance, control for quality, crisis management

Organizational/Process
Understanding life cycles, information flow (DFD), records management, process definition and scope, integrator role, project management

Attitudinal
Holistic thinking, generalist thinking, analytic thinking, dealing with change, integrating

General skills—cross-cut the others
Iteration and recursion; hierarchical decomposition; use of charts, graphs, and diagrams; use of models; balancing analysis and synthesis; creative skills; problem solving

Figure 1.5.5.2. *For effective management, you need a closed set of skills, working together synergistically to support your decision making process.*

1.5.5.3. SKILLS FOR UNDERSTANDING AND BUILDING A MANAGEMENT TOOL

You need specific skills to carry you through the system life cycle for building a management tool.

I'll overlay skills for building management tools on the system life cycle discussed in Module 1.1.20.1. I call these skills analysis skills because we're analyzing what we're doing. I call the skills *system* analysis skills because that's what management information system (MIS) developers call them and what they're analyzing is a system. I'm as interested in describing system analysis skills as I am in describing the details of the functions of the management-tool-building process. The data-to-information chain is very analyzable. The functions of the MIS and the steps for its development are relatively easy to describe and to evaluate. I believe the skills we need for MIS development are also the skills we need for developing any management tool. Therefore, I'll have MIS development in mind as I continue through this module.

We must look at the life cycle of the project, product, or process we're building. Assume we're building an MIS. We must consider MIS development starting with recognizing the need and continuing through to the MIS's obsolescence, retirement, and disposal. We must think about the resources, like cost and people, the MIS will require. We also must think about the contribution (positive and negative) the MIS will make for its entire life. Most of our consideration for the MIS life cycle will focus on the system life cycle. My discussion of the system life cycle constitutes something perhaps larger than a skill—at least a group of skills. However, I'll consider understanding the life cycle to be a skill. You can apply this life cycle analysis skill to more than just MIS development. You can apply it to any service or product you're responsible for.

We'll start with understanding the life cycle for system development. How do other system analysis skills relate to the framework for the engineering process shown in Figure 1.1.11.7. Start with the five categories of functions: analysis, design, implementation, follow-up, and follow-through. Realize the skills can't be neatly directed to only one of the categories shown in Figure 1.1.11.7. I identify fifteen of the most important skills and overlay them where they best fit in the five MIS development categories of functions. You can expect to use the skills I've shown in relation to functions of one category when you're doing functions of the other categories. Here are the fifteen skills I discuss as system analysis skills:

1. Communicating to get information about and to give information to stakeholders of the management tool and recognizing the importance of documentation for traceability, maintainability, and accountability;

2. Interacting in groups for participation, consensus, and ownership;

3. Understanding the engineering process framework, or the system life cycle, for developing the management tool;

4. Understanding the work process (what is managed) to be reflected in the management tool;

5. Understanding the decision maker (who

manages) who'll be using the information produced by the management tool;

6. Gathering information or collecting data about the work process or the decision maker;

7. Analyzing the information flow overlaying the work process and modeling the operation, or manipulating and analyzing data about the layout of the work process;

8. Modeling the management system;

9. Getting data into the management tool, (or what is used to manage), or input design;

10. Storing, verifying, and updating data within the management tool, or logical data analysis;

11. Organizing and accessing data within the management tool, or file design;

12. Portraying information from the management tool, or output design;

13. Controlling for quality, including reliability design;

14. Evaluating the system, including cost/benefit analysis; and

15. Managing a project.

In the next modules, I'll review the role of people who practice system analysis skills and the general skills they use for sequencing and integrating the system analysis skills I've listed here. I'll re-emphasize the systems approach as a cross-cutting skill for building management tools. Then, I'll focus on the first and most important of all the skills—communication. I'll expand upon sending information by discussing the writing skill in some detail and showing parallels with speaking. Then I'll discuss listening as the crucial skill for communication. After straightforward communication, I'll address the second skill of interacting in groups. After the first two skills, the following skills become more tangible.

1. Background

1.5. Tools and Skills Categories

1.5.5. Skills

1.5.5.4. System Analysis

1.5.5.4.1. Role of System Analysis

The role of the system analyst is to use systems understanding and problem solving skills to build management tools to meet the needs of the decision maker in his or her domain of responsibility.

Why am I discussing the role of a system analyst in the middle of outlining skills we need to build and use management tools? We play roles to meet responsibilities. We use skills to carry out our roles. Roles are vehicles your skills ride on as you journey toward accomplishing your responsibilities. (See Figure 1.5.5.4.1.)

The who manages component in the MSM uses decision making, problem solving, and other skills as they play leadership, administrative, liaison, and other roles. I discuss the system analyst role in regard to building management tools; but the role and the associated skills are applicable to making good decisions.

The who manages and the information specialist coordinate efforts at the information portrayal/information perception interface and the measurement/data interface. In participating in this coordination, the information specialist needs to play the role of system analysis. And, so does the manager. The role of system analysis is traditionally discussed in reference to developing computer systems. I expand the role to building any management tool and to managing any domain of responsibility.

The system analyst is a problem solver. The idea of a system analyst and the role of system analysis comes from developing computer systems. Computer system analysts focus on building computer systems more so than using computer systems. Therefore, the role of system analysis is more an analysis role than an holistic or a synthesis role. In computer systems, we leave the integration or synthesis to the user. To build any management tool, you'll need to apply system analysis skills.

Often discussed in books on developing computer systems, skills for system analysis work together to solve the problem of getting the right information to the right people in the right place at the right time. These system analysis skills apply to developing any management tool. We can extrapolate the use of these skills even further. If you're going to analyze any system, you need system analysis skills. As management systems engineers, we must have skills both in analysis and in synthesis. I'll discuss the role of system analysis here. I'll discuss the problem solving process in Module 1.5.5.6.

In their handbook of systems analysis, Miser and Quade rightfully describe the nature of system analysis as being quite complicated. They first list a number of difficulties in carrying out the role of system analysis. Their list includes: 1) inadequate knowledge and data, 2) the involvement of many different disciplines, 3) unclear goals and shifting objectives, 4) pluralistic responsibilities, 5) resistance to change in social systems, and 6) complexity. (Hugh J. Miser and Edwards S. Quade, *Handbook of Systems Analysis: Overview of Uses, Procedures, Applications, and Practice*, Elsevier Science Publishing Co, New York, 1985, pp. 14 - 15.) The system analyst then must be a quick learn, have vision, be an integrator, be adaptable to change, and be skilled at human interaction.

Miser and Quade approach system analysis generically, not only as a computer development role. They argue that a system analyst approaches a problem in terms of these elements: 1) Setting the framework for systems analysis (defining objectives and generating and ranking alternatives for reaching objectives by involving iteration and feedback); 2) Formulating the problem (stating the objectives and constraints); 3) Generating and selecting alternatives; 4) Forecasting future states for the system; 5) Identifying the consequences, or outcomes, including the use of models; 6) Comparing and ranking alternatives, using criteria and including value and utility; and 7) Documenting the analysis and results. (pp. 119 - 145.) The value to you in seeing their approach is to compare their approach to the engineering method I'll describe in the next module and to the steps of problem solving I'll describe in Module 1.5.5.6. You'll notice that the process and skills of system analysis are essentially the process and skills of solving system problems.

The system analyst must combine both technical skill for developing the components and the relationships of the components into a working management tool and interpersonal skill for working with the user of the management tool, or the decision maker. The system analyst must have imagination, flexibility, and adaptability to develop the management tool to meet the needs of an unique domain of responsibility, regardless of the resource available to him or her. For building management tools, the system analyst must be able to identify the needs of the user and to have the knowledge and experience to overcome barriers and create pathways to meet those needs.

To begin developing a management tool, the system analyst must be able to delimit, learn, and diagnose the domain of responsibility and understand the user of the management tool. Our previous discussions on delimiting domains of responsibility, the information portrayal to information perception interface of the MSM, and the frameworks for diagnosing a domain of responsibility provide a starting point for developing the management tool. Now, we must figure out more about the work process and the aim of the domain of responsibility for which we're developing the tool.

In the next module, I'll describe the role of the system analyst through an example. I'll use the example of a small country inn because I've owned and operated a country inn and am familiar with the management needs.

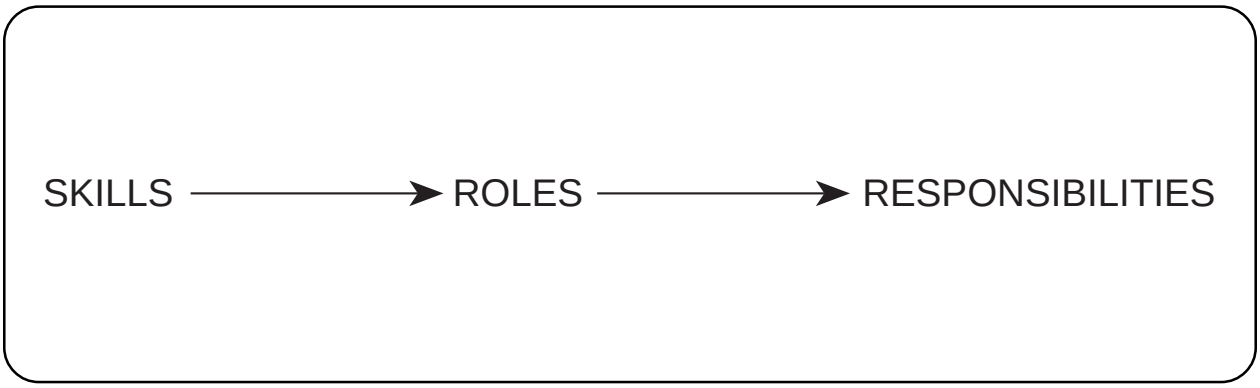

Figure 1.5.5.4.1. *Roles are vehicles your skills ride on as you journey toward accomplishing your responsibilities.*

1.5.5.4.2. An Example System Analysis Effort

By considering how a system analyst can help the business of a small country inn, we can see the use of the steps Where We Are, Where We Want To Be, and How To Get There—a form of the engineering method.

I'll describe the need for system analysis to build a detailed understanding of the work process and the aim of the organization through an example. The example I choose is one of a family-owned country inn. As I describe tasks of system analysis, note that these considerations don't contain any definition of computer processing.

First, as a system analyst, you must delimit, learn, and diagnose the domain of responsibility. You must find out how the innkeeper and the owner of the inn are getting information now and learn what's working well. Make sure what you do preserves the characteristics of the successful parts of the existing system for getting information. In this role, you're figuring out the situation in the domain. I say you're looking at Where We Are. You must know Where We Are (WWA) and Where We Want To Be (WWWTB) before you can begin to know How To Get There (HTGT).

Many system analysts focus on what's wrong with the existing system for converting data to information. A good system analyst focuses on what's right with the existing system. To understand what's right, the system analyst should walk through the work process and the information overlay to the work process. In the country inn, experience the work process from the point of view of the traveler. Experience the work process from the point of view of a worker. Experience the work process from the point of view of the innkeeper. Learn the reservation process. Learn the other parts of the work process.

How are data gathered and recorded? If data gathered last week must be retrieved to change a reservation, how well can the innkeeper find and use the data? What's happening is that the system analyst is experiencing the physical reality of the innkeeping system. Then, the system analyst must translate the physical reality into a logical model of the inn and its process. The model should emphasize the handling of data and the conversion of those data into information that will be perceived by the decision maker for making decisions and taking action.

As part of WWA, you must understand the needs and forces that both the innkeeper and the owner have for the management tool being developed. They won't express these needs and forces in terms of tool characteristics. Rather, they'll have needs in terms of occupancy rate, cash flow, and absenteeism of workers.

As part of WWWTB, you must understand the expectations and vision of the innkeeper and owner. Can you translate those expectations into functions a management tool can serve? Determine what the expectations of the innkeeper and of the owner of the inn (different people) are for what the management tools will provide in the way of information to support decision making.

One of the bigger skills a system analyst must have is to translate physical issues of the workplace into logical counterparts for management tool design. In the country inn, where

will the management tool be housed? Is the tool easily accessible? Can those who need to use the tool understand what the tool can do? Then, can they use the tool? Can you build the management tool for a cost a small country inn can afford? When you add in a computer to house the data to information conversion process, the cost can become prohibitive. Do you know inexpensive ways to house the tool, such as a rolodex, notebook, or marker board? In addition to being able to function in terms of data, information, and mechanisms for converting data to information, the system analyst must understand business issues and how to translate those issues into tool characteristics. The system analyst must be able to judge quickly to what extent the mechanization of the needed data to information conversion needs to be.

After the system analyst knows what's right with the existing system and what's needed in the future system, then the system analyst can look for ways to improve the system. Now we're looking at HTGT. The system analyst will find opportunities for improvement at two levels: physical and logical. Consider an example of translating a physical issue into a logical one for a computer-based management tool as described by Powers, Adams, and Mills. "...suppose a hotel does a considerable part of its business with tours. Under the existing reservation system, tours are booked as a unit. When reservations are reported to the local hotel, however, cards are broken out in the names of individual guests. The fact that these guests are tied to a single tour is lost, creating a gap in information that might be useful to management. For example, suppose a hotel in southern Florida learns that a snowstorm has caused cancellation of all flights from Pittsburgh. Suppose further that the hotel had 20 guests in a single tour scheduled to arrive from Pittsburgh. If the card had already been broken out by guest name, it would be difficult to locate the unavoidable cancellations. However, a computer system could quickly search for and report the names of all guests who would not be arriving. The added dimension of information made available to management represents a system improvement achieved at a logical level. Timely information about business problems makes it possible to understand, anticipate, and react to situations that would not come to light under present methods. The ability to get information into a computer immediately represents a substantial improvement at the physical level. Rooms status is more current, by hours, than was possible under the manual system." (Powers, Adams, and Mills, *Computer Information Systems Development: Analysis and Design*, South-Western Publishing Co., 1984, p. 36.) My recent experience with a hotel and its computer-based management tool runs in the opposite direction. The desk clerk enters information from the registration card into the computer when the rush slows down. In the meantime, those people trying to call me on the phone are told I'm not at that hotel. The system analyst can never lose the translation between the physical and the logical.

Opportunities for improvement in management tools come from closing gaps. When we look at WWA, we want to close performance gaps. Are we doing what we know we should be doing? If not, we have a performance gap. When we look at WWWTB, we want to close expectation gaps. Are we doing what we want to do to improve. If not, we have an expectation gap.

When we introduce a new management tool into the country inn, we'll affect their work process at a physical level. The innkeeper will adjust how he or she takes reservations to reflect the abilities of the management tool. When we introduce the new tool, we'll affect the information flow at a logical level. The management tool can link information not easily done before.

Before any management tool can be designed and implemented by a system analyst, the innkeeper and the owner must be able to see what the resulting effect will be on their business. If they don't see a worthwhile return on their investment in time, money, and frustration of changing their work rituals to fit the new management tool, they'll not agree to developing the tool. We can always find hardware (tool container) and software (data to information conversion procedure) that exceed the ability of the innkeeper and the owner. Can we find the operations, the work procedure, and the information portrayal to come close to the ability of the innkeeper and the owner? If we can, we'll probably succeed as system analysts.

As we consider the role of computers in management tools, consider two needed considerations. One is to figure out how soon and how well the computer (the associated operations tool) fits into the solution of the country inn needs. Computers certainly don't fit into figuring out the problem. The other consideration is to figure out the solution not based on computers—then fit computers into the solution, if appropriate.

1.5.5.5. General Skills of System Analysis

You need certain general skills to do the system analysis to build a management tool.

In Figure 1.5.5.2., I identified a category of general skills for cross-cutting the other categories of skills. These general skills are extremely important for supporting the role of system analysis. Those who discuss building management tools and especially those who discuss building computer-based management information systems (MIS) promote the process of system analysis. Some people prefer the structured system analysis process of Edward Yourdon. (I'll show you some of Yourdon's ideas later.)

I've discussed the importance of balancing synthesis with analysis and of balancing holistic thinking with analytic thinking. I accept the need for balance, but will focus on general skills for system analysis here. You can imagine that a structured system analysis would be the height of analytical thinking.

I've also discussed the parts of the Management System Model (MSM) the manager (tool user) and the information specialist (tool builder) know best and the interfaces at which their expertise overlaps. I'll emphasize the view of the information specialist, or system analyst, here. (We have to be careful to recognize that information specialists aren't the only people who analyze systems. However, as a job title, system analyst often designates the analyzing of information systems.) Don't forget that the general skills are valuable for much more than system analysis. However, if we're going to focus on building management tools, system analysis for building an MIS is a good place to focus. The MIS tends to be the more structured of the management tools and makes a tangible example for considering the general skills.

Information specialists, or system analysts, should consider all management tools and how they together convert data into information to support the decision maker. However, I'll emphasize the analysis of the data-to-information chain here because that type of tool is both structured and representative. The MIS is exercised as a tool more frequently than a plan, for example, even though the data from the plan (what you intend to do) and from the MIS (what you did do) should be compared frequently (to see how well you did what you intended to do).

The skills of system analysis go beyond building management tools. Analysis of a system goes hand in hand with synthesis of a system. There's no sense in doing synthesis if there's no analysis. For example, can you use a management tool if you don't build one? As I described in Module 1.5.5.2., one of the categories of skills we need in management system engineering is the general skills that cross-cut the other categories. These general skills include iteration and recursion; hierarchical decomposition; use of charts, graphs, and diagrams; use of models; balancing analysis and synthesis; creative skills; and problem solving.

The system analyst provides a service function to support a user. A system analyst is a professional. Service professionals serve clients. Clients depend on those services. The system analyst role is an important one.

As we apply these general skills to help provide the decision maker with the information he or she needs, we can thoughtfully ask: Why the decision maker doesn't use these skills to

provide his or her own information? Why doesn't the decision maker use their knowledge of their own decision making style and their operation to develop the best tools to meet their needs? The answer is that the management tool builder has several advantages over the decision maker. First, the tool builder deals with many different domains of responsibility. If the tool builder is a generalist, he or she can transfer many lessons learned from one domain to another. The tool builder is better able to understand the frameworks for diagnosing the domain based on using the frameworks for a large number of domains. Second, the decision maker often can't see the forest for the trees. He or she is so involved with the details of the domain and the decisions, he or she lacks the objectivity of seeing the total system and seeing that system from a fresh perspective. Third, the tool builder has developed experience in effectively and efficiently developing management tools. However, the tool builder, and anyone practicing system analysis, needs a set of general skills to apply to any situation.

Iteration and Recursion

In analysis, we decompose the whole into its component parts. We'll learn a number of skills and techniques for looking at the details of a system. We can repeatedly apply the techniques to look deeper and deeper into the system. We repeat the techniques iteratively or recursively. When we use iteration, we recycle through a closed-loop process. In the case of skills, we reapply the skill in the same way over and over to the increasingly detailed understanding of the system. For example, we can look at information flows across the boundaries of a domain of responsibility like we did in developing context diagrams. We can reapply the technique of developing information flows by treating the partitions of the domain as individual context diagrams. When we use recursion, we go back or forward in a closed-loop process by skipping steps in the process. We can repeat all of the steps or only the last few. We can skip ahead to future steps of the process. We saw this recursion when we looked at conducting management system analysis and management system synthesis together.

Later I'll describe a partitioning process you can use to determine the subdomains in your domain of responsibility. You'll repeat the partitioning activity again and again until you can distinguish the fundamental information flows within your domain. You took the first step in this iteration when you scoped a domain of responsibility in Module 1.1.18.8. Clearly the idea of partitioning is hierarchical decomposition and is analytic, not holistic.

Hierarchical Decomposition

In hierarchical decomposition, we decompose the whole into its component parts and those components into their component parts. We are dividing, or partitioning, each system or process into its subsystems or subprocesses repeatedly until we reach what we believe are manageable pieces. We'll use hierarchical decomposition when we look at information flows inside the domain of responsibility. If we partition the context diagram, or the management system, into its subdomains or subsystems, we can look at the information flows between these subdomains. Then, we can partition the subdomain further and further until we have no need to decompose any more. At that point, we believe we have all the information flows in the organization and can then identify the data set that makes up all the information used in the organization. We abandon the decomposition when we clearly understand the fundamental parts of the system.

Use of Graphs, Charts, and Diagrams

We'll use diagrams to help us iterate through hierarchical decomposition to find the fundamental information flows. Graphs and charts

help us see the entire system. Since to touch a system anywhere is to touch the system everywhere, we need to see the entire system to decide where to touch it. We need to diagram, or chart, the work flow to see where we want to measure. We need to diagram the entire organization to see the individual information flows to determine the set of data from which we make all the information. We need to graph the total effect of an impact on a system to see the effect of an individual force, as in the example of a force field analysis or a cause and effect diagram.

Graphs and charts are very effective as communication tools. System analysts use graphs, charts, and diagrams to describe the organization for the user to confirm. I've shown a relatively simple data flow diagram, describing the processing involved in a student registration system, in Figure 1.5.5.5. We can use Figure 1.5.5.5. to communicate with people responsible for registration or for students who register to make sure we've captured what really goes on in the system.

Charting is an important tool for both the manager and the information specialist. The manager does a work flow chart to understand and improve his or her operation, or work flow. I'll discuss work flow charts in detail when I talk about using management tools. The system analyst does a data flow diagram (DFD) to understand and improve the data and information provided to the manager. I believe a DFD is really an information flow diagram, in that the DFD captures the information flows in the organization. Another tool, the data dictionary, identifies what data are carried along with the information flows.

Recall the diagram for the framework of the engineering process in Figures 1.1.20.1.1.a., and 1.1.20.1.1.b. Those figures are much like a data flow diagram, in that the arrows symbolize information flows between functions of the engineering process. You should see some similarity between the DFD in Figure 1.5.5.5. and Figures 1.1.20.1.1.a. and 1.1.20.1.1.b. Figure 1.5.5.5. shows three sided boxes for data stores. Data stores are where you store data for later access, like a computer data base or a file cabinet. (Figure 1.1.20.1.3. is much like a work flow diagram in that the figure includes both decisions and actions.)

Use of Models

We've seen how we use models for showing the organization and for showing performance criteria in the illustrative model. We've discussed the types of models. Here, we're interested in modelling as a general skill and the use of models to help build management tools. We can use equations or diagrams as a model. An organization diagram models how people interact in an organization. A data flow diagram models how information moves in an organization. A work flow diagram models how the activities of the operation fit together. We use models as graphic, written, or visual representations of the system we're analyzing.

Balancing Analysis and Synthesis

I discussed the meaning and importance of analysis and synthesis in a general definition module. The issue here is that we can't do one effectively without the other. Just as we combined management system analysis and management system synthesis, we get more out of doing one of these skills when we're able to do the other.

Consider an analogy from Powers, Adams, and Mills. "When an architect develops a home for a client, a process takes place that begins with a description of the life-style to be supported and special features desired. From this description, the architect visualizes a way to meet the client's needs. Before breaking ground to construct a building, however, some modeling must take place. This is done with blueprints, detailed drawings, and, in cases,

actual miniature models of the buildings. In the same way, data flow diagrams and the supporting data dictionary model a system conceived in the mind of a systems analyst for a user. Models, then, are tools for communication and understanding." (Powers, Adams, and Mills, *Computer Information Systems Development: Analysis and Design*, South-Western Publishing Co., 1984, pp. 53-54.)

Creative Skills

The system analyst must strive for ultimate understanding of the workings, needs, and issues in the existing system (WWA) and for creative, visionary thinking for the workings in the future system (WWWTB). Using creative skills, the system analyst can figure out the best way to transform the existing system into the future system. This transformation is partly content and structure of management tools and partly communication with and support of the people who will be affected by the transformation and will be threatened by the change.

One of the biggest problems facing a system analyst is sorting out what's right with a system and what needs to be changed. This problem requires the builder to put aside his or her desire to be creative and make sure he or she doesn't propose change for change sake. Once the system analyst knows a change is clearly needed, then he or she can use creative skills to make the change without undoing what's working well. He or she must know when the change is necessary and have the imagination to develop the process and content of the change without being inhibited by what's now in place. The system analyst faces an interesting paradox: Respect the value in what exists and improve the system.

To illustrate the level of creative thinking required in deciding the types of changes needed, consider the situation in many government oversight agencies. A government oversight agency is one that's close to the legislative body they serve. The government oversight agency is usually called the headquarters for the many local government implementation agencies located where the work is being done.

I'll use a state department of transportation as an example of a government oversight agency. The government oversight agency is the state department of transportation (headquarters) which is located in the state capitol where the legislative body is. The local government implementation agency is the county highway department that maintains the roads and clears the snow during winter storms. I've found that many government oversight agencies design their organization structure as a management tool to reflect the work that's being done locally. That is, headquarters has divisions for each of the functions implemented at the local level; in the case of the state department of transportation, a division for maintenance, a division for bridges, a division for snow removal, a division for construction projects, and so on. However, nobody at the state level ever maintains anything, constructs anything, or removes any snow. What the government oversight agency does do is broker information. They interpret the desires of the state legislature regarding transportation and make adjustments to the resources allocated to the local agencies to support their interpretation. They interpret the needs and problems of the local highway departments and make adjustments to their proposals and issue statements (usually in the form of budgets) to the legislature to reflect those needs and problems. The government oversight agency brokers information in two directions. But, they are organized as bridge builders and highway construction people, not as information brokers.

Here's where the creativity comes in. How does the system analyst ensure that he or she puts aside his or her view of what's needed to ferret out what's working well in the government oversight agency's organization struc-

ture that moves information up and down the state hierarchy? How do you get the agency's decision makers to see the advantages of changing their tried and true organization structure so they can be more effective in their work? Once the decision makers agree to a new organization, how fast and in what way do you transform the organization from its existing structure to its new structure? As the organization goes through the throes of change, how do you encourage, support, and resolve real concerns over the problems caused by the change? To work out the answers to these questions, the system analyst needs incredible understanding of the work process, the management process, and the people being affected. The system analyst must be visionary in seeing and holding onto the vision of what should be and how that future state will work. The system analyst must be creative in not only suggesting how to make the change but in working with the people and resources during the change to support the fear that accompanies any change in job description and in interagency relationships.

Problem Solving

I described problem solving as a general concept in Module 1.1.14.1. and highlighted problem solving as a fundamental of the engineering process in Module 1.1.11.6.4. I'll describe problem solving as a general skill in Module 1.5.5.6.

The system analysis process supports the needs of the system analyst for creativity and for problem solving. The use of models begins with diagramming the physical existing and future system. The system analyst uses the physical model to gather information from those who know the system and communicate the future to those who will be affected by the change in the system. The system analyst must be able to translate the physical model into a logical model needed by those who will build the management tool based on the logical relationship between data and information, not on the physical operation in the workplace. As the transformation takes place, the physical and logical models continue to play important roles for the system analyst.

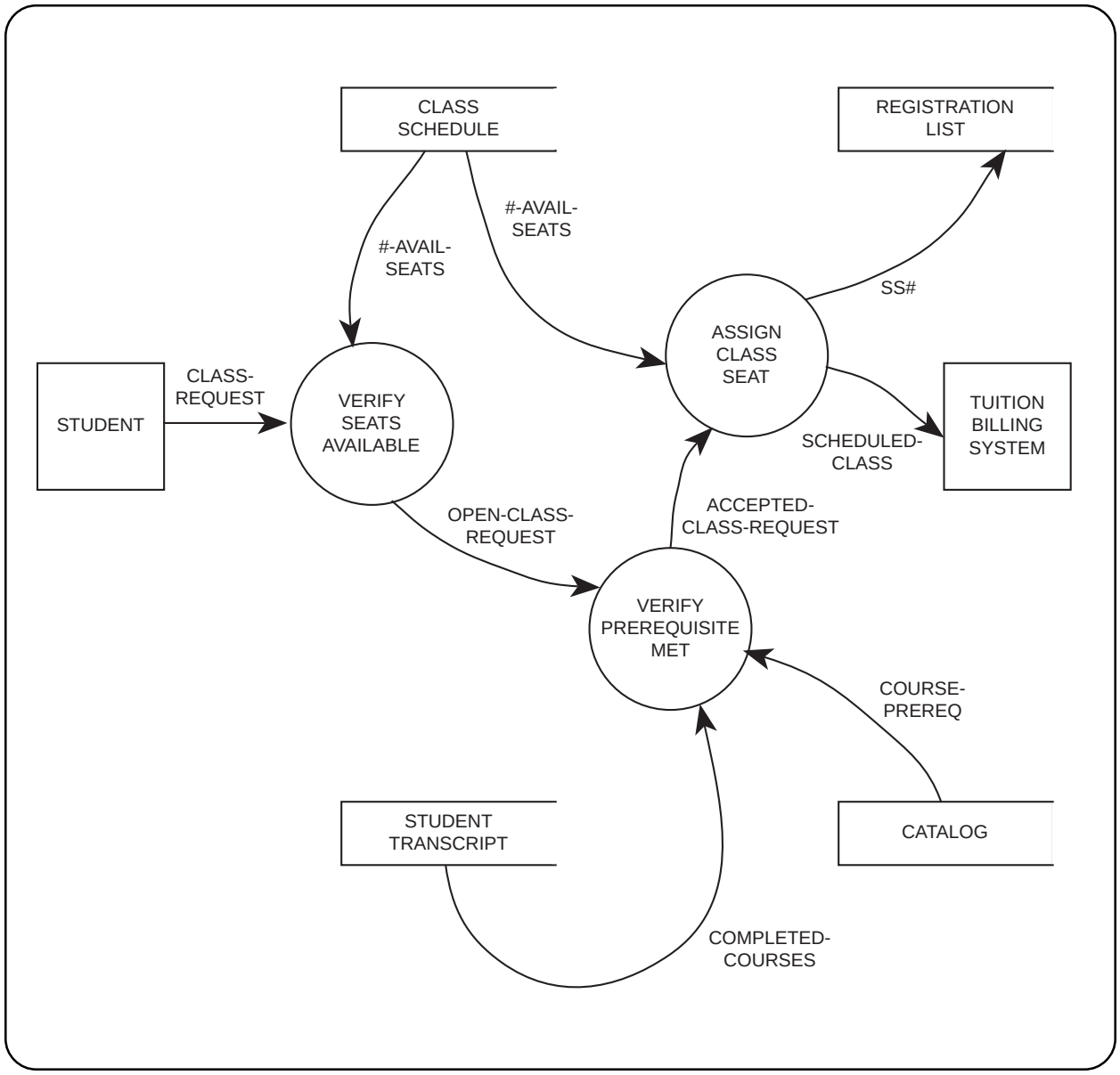

Figure 1.5.5.5. *The data flow diagram for a simplified student registration system illustrates how system analysts model information flows. (taken from Powers, Adams, and Mills, p. 54)*

1.5.5.6. SKILLS FOR PROBLEM SOLVING

As a fundamental for the engineering process, problem solving is a skill that involves a large number of interpersonal, informational, decisional, process, and attitudinal skills. The steps for problem solving show where the skills fit together.

Problem solving involves making a number of connected decisions, often in a group setting, all aimed at a specific objective. Recall that the decision making process includes the steps of investigation (get the facts), design (develop alternatives), and choice (pick an alternative). The problem solving process involving skills, as well as tools, will follow a similar path to the one for decision making. I've shown ten steps for problem solving in Figure 1.5.5.6.

The first step has to be to figure out what the problem is. This step requires an open mind, a quick learn, and an understanding or experience with other problems and their characteristics. From here on out in the process, be sure not to lose sight of what you decided the problem was. If you made a mistake, redefine the problem. All diagnosing skills are important here.

The second step is to determine the goals (qualitative) and objectives (quantitative) for what a solution means for that problem. Make sure everyone preparing and implementing the solution understands the same goals and objectives. Holistic skills are important here.

The third step is to study the problem. Where did the problem come from? What's its root cause? What are the characteristics of the problem relative to the goals and objectives you determined? What assumptions do you have to make to consider the problem? Analyze the problem. Can the problem be divided into subproblems such that solving all the subproblems solves the problem and achieves your goals and objectives? This question involves the general skill of hierarchical decomposition. What are the consequences of not solving all the subproblems or partially solving some or all of them? Recall that the do-nothing alternative is an alternative. Therefore, you must know the consequences (both good and bad) of solving the problem as well as not solving it. Analysis skills are important here.

The first three steps parallel Simon's intelligence phase of decision making. In the case of problem solving, we're cycling through any number of decisions and the early phases of the decision making process for a number of decisions.

The fourth step is to develop alternatives for solving the problem. For each alternative, consider a strategy for how you'll implement the solution. Many of your alternatives will be part of the solution as opposed to the complete solution. By that I mean one alternative for solving the problem may have a clear beginning but then have a number of alternatives for what to do next. The idea of strategy carries with it the ideas of priorities and contingencies. Which is the highest priority goal? Which alternative has the most or best fall-back position. This step is almost as important as the first step for identifying the right problem to solve. If you overlook a good alternative, you only have sub-par alternatives to choose from. All creative skills are most important here.

The fifth step is to evaluate the alternatives. Develop a consistent set of criteria to measure the alternatives against. Apply your understanding of priorities and contingencies to the

alternatives. Identify the resources you'll need for each alternative. Consider the method and its difficulty for applying the resources to the problem. Consider the risks and threats to the organization and its people for each alternative. Procedural and appraisal skills are important here.

The fourth and fifth steps parallel Simon's design phase of decision making. You need to design not one but many good alternatives to choose from. You need enough of a plan for implementation for each alternative that you haven't overlooked a risk or a barrier that will set you back when it rears up after you've chosen a particular alternative.

The sixth step is to choose one of the alternatives. By considering the advantages and disadvantages of each alternative in terms of the method, priorities, contingencies, and consequences of implementing the alternative, you must select the alternative to carry forward as the solution to the problem. Group choice requires an understanding of information sharing and consensus gathering. I discuss those concepts shortly. Decisional skills are important here.

The sixth step parallels Simon's choice phase of decision making. Now you must continue on from your choice and make sure the choice is implemented. In essence, you're following the choice phase with an action phase.

The seventh step is to formalize the action plan for implementing the solution. Through the action plan, you assign responsibilities, dedicate resources, and lay out the method and contingencies for implementation. Part of your action plan must include points to test the choice and the progress of the implementation. You must ensure all those affected by the method for solution have bought in to the need (There is a real problem.) and the solution (The method will work.). Interpersonal and informational skills are important for this step and the next few steps.

The eighth step is to implement the solution. We learned from the Management System Model that every decision requires an attendant action. Now is the time to act. And you must monitor the progress of the solution. Evaluate the solution to determine if you chose the right alternative.

The ninth step is to follow up on the solution. You want to formalize the solution, especially if the problem is recurring. If possible, you want to go to the root cause of the problem and make sure the problem doesn't come up again. If not, you want to ensure you identify the next occurrence of the problem early and apply what you learned from solving the problem before. You don't want to go to all the trouble to figure out how to solve a problem and not have your solution formalized and at the ready to solve the problem again.

The tenth step is to iterate on the solution for continuous improvement. Your skills for iteration and recursion help you know when to apply what you learned in earlier steps to improve the steps next time through. The resemblance to the Plan-Do-Study-Act (PDSA) Cycle occurs because both the PDSA Cycle and problem solving stem from the scientific method.

Clearly, problem solving is an opportunity to integrate your skills. As an integrator, problem solving cross-cuts all the categories of skills.

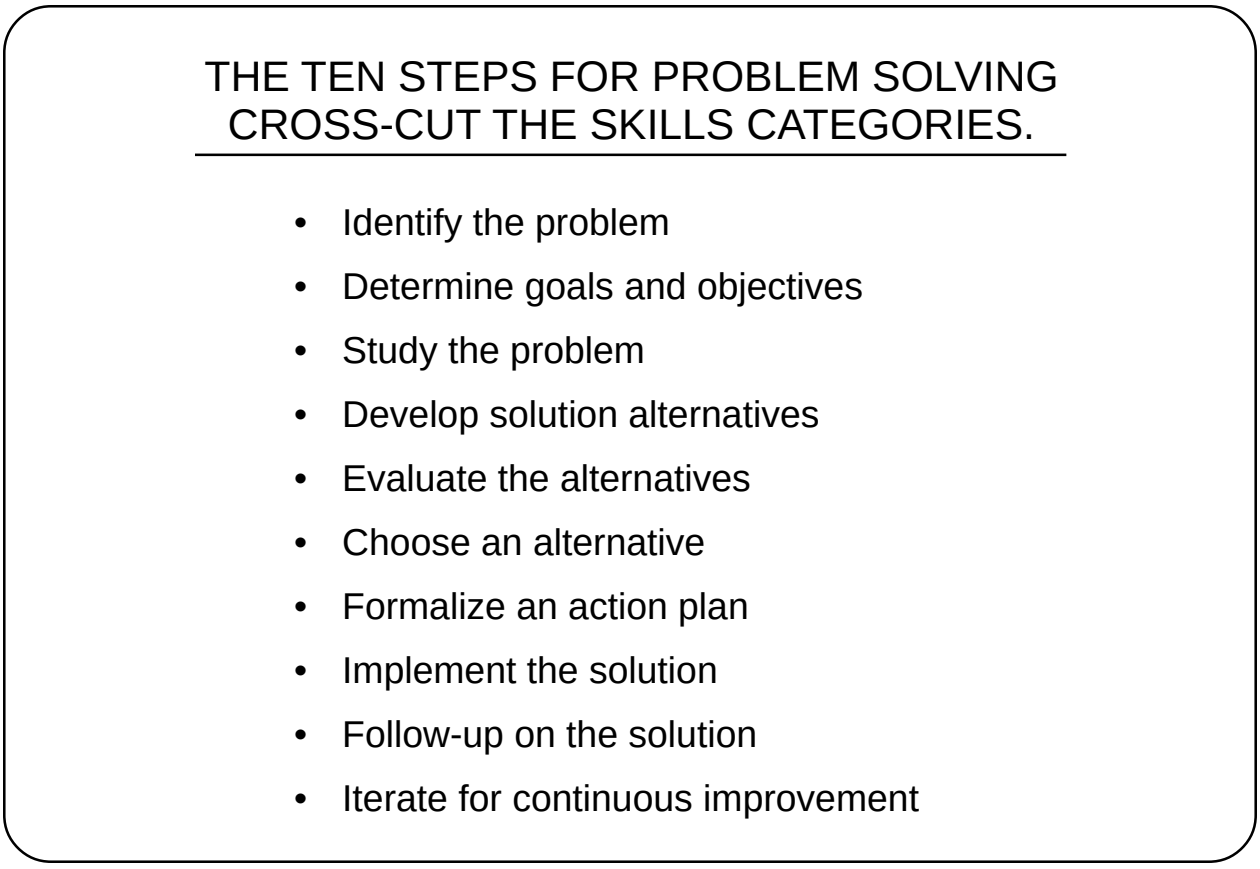

Figure 1.5.5.6. *The ten problem solving steps reflect the scientific method leading to a resemblance with the PDSA Cycle.*

1.5.5.7. The Skill of Understanding the System Life Cycle.

Understanding the system life cycle puts the other skills of the management system engineer into context.

The system life cycle is the framework for the engineering process, the process by which we improve organizations and build, select, or change management tools. As such the functions of the life cycle discussed in Module 1.1.20.1. tell us where each of the skills highlighted in Module 1.5.5.2. fit into the engineering process. Even though the skills described can be effectively used in the management process, I've highlighted them here to indicate their importance in carrying out the engineering process. I'm not surprised by the effectiveness of these skills in both the management and the engineering processes because both processes have the same root: the scientific method.

The understanding and use of the system life cycle, either for the engineering process or for the organization life, is a skill in and of itself. I might call the role needed for exercising this skill that of a system synthesist. Of course, I believe the management system engineer must be able to play both roles and to find the right balance between the roles. The skills may be the same or similar for playing both analyst and synthesist roles, but each role dictates how the skills will be used. Even the ability to make such a balance indicates an associated skill.

Developing a management tool isn't a simple process. We recognized that problem when we saw the complexity in the system life cycle in Figure 1.1.20.1. To develop a management tool, the management system engineer must be able to 1) identify the information requirements of the decision maker (Recall management system analysis.), 2) design the management tool to convert the needed data into the information to meet the requirements, 3) build the management tool to carry out the design, 4) make sure the designing and building of the management are conducive to the dismantling and replacement of the tool when the tool becomes obsolete, and 5) prepare the needed documentation, training, and project management to support the design, building, and use of the tool. Recall that these five activities are the analysis, design, implementation, follow-up, and follow-through groups of functions of the framework of the engineering process.

The way in which the framework of the engineering process is applied differs from situation to situation. The skills required to carry out the framework are broadly transferable. The skills for identifying needs and solving problems transcend any methodology or any discipline. These skills are needed for addressing any problem and building any solution.

1.5.5.8. An Information System Needs the Systems Approach.

Systems analysts can do more good than harm, if they and you practice the systems approach.

Everyone has some form of information system. Some information systems are primitive, but they are indeed information systems. The information system may be misunderstood or poorly suited to the organization. Such failings put managers and their system at cross purposes.

The way you manage can result from the state-of-the-art in establishing an information system. For example, in the Roman Empire, it took weeks or months to transfer information to and from the outposts. Therefore, the territories were given a great deal of autonomy to set policy and make decisions. With better information systems, authority can be focused better.

The existence of an information system does not imply the existence of the systems approach. You are familiar with your information system and it has worked to some degree. It reflects history and the real world. As suggested in Figure 1.5.5.6., don't abandon or abuse your existing information system. There are reasons why you have the information system you do—they probably are good reasons. You must know these reasons before turning to a new information system. Your existing information system is the first iteration in the process to develop your new information system.

Know Your Domain and Your Role Within It.

Microcomputer or no microcomputer, mainframe or no mainframe, you should analyze what it is you manage. The reason you must do that for computers is that they only do automatically what we tell them to do—we have to tell them things to do that will be helpful to us and work toward our mission. Otherwise they will do something, and a random selection will result in much harm.

I remember a day when I needed to assemble a number of notebooks for a prototype workshop on office automation. The 500 pages were to be divided by tabs; but, because of the last minute rush, the decision had been made not to number the pages. I knew very well where each page belonged; but, to get ready to leave for the workshop, I wanted my own workers, who are intelligent, logical, and know my idiosyncrasies, to assemble the books for me. If I led the process and the workers through the assembly we could assemble the books, otherwise for that one afternoon the job couldn't be done.

The bottom line is that even though I knew very well what I was doing and could do it myself, I could not in that short time tell my workers well enough how to do the job by themselves. (Later we numbered the pages and had the time for the workers to learn how to assemble the books.) Most importantly, if I didn't know the process well enough to tell my people how to do the job, surely I didn't know the process well enough to tell the computer how to do it.

For this reason, most of us have experience with automation specialists who repeatedly fail us. If we don't know what we manage well enough, surely the automation specialist doesn't. To deal with computer systems analysis you must balance a thorough understanding of your information needs and the availability and characteristics of automation.

Systems Analysts Will Help, If You Know Your Stuff.

Computer and information or automation organizations are service organizations. I learned a rule from being such a service organization. That is, "Never mess with the guy's operation." Do not ask him to change "what is managed" or "who manages" to make it easier to develop tools for him. Otherwise, you'll throw the management system out of balance or cause it to fail to meet its' objectives. You must insist that the service organization leave your operation alone. I have seen automation drive companies to bankruptcy—these were not hardware or software problems; they always were a fit problem.

Both you and the information specialist should recognize each other's responsibilities. The information specialist provides a service or support function to you. Without knowledge of your information needs, the information specialist can do nothing more than tell you the wonderful things automation is capable of accomplishing.

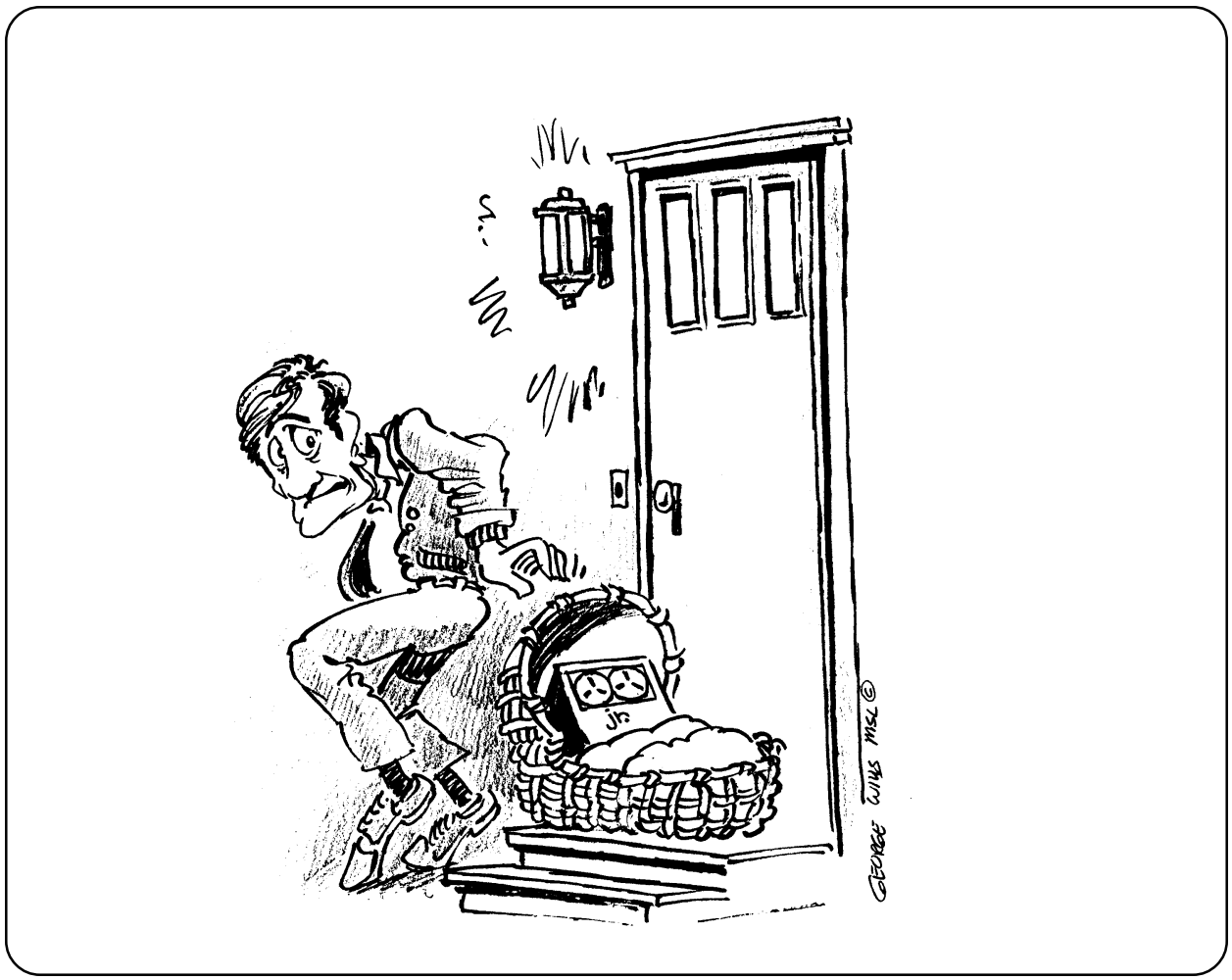

Figure 1.5.5.8. *"Good-by, Junior. We're tired of you."*

1.5.6. Skill List with Module References

1.5.7. EXERCISE ON SKILLS

If you know which of your skills are transferable and what they're transferrable to, you can determine your perceived value by a person who needs someone with skill to contribute to their organization.

Explanation
You've been developing skills since you were born. Some skills you learned at home and in the community and others you learned at school and in the workplace. Many of your skills seem personal but are applicable to your work responsibilities. Learning to cross stitch well teaches you paying attention to detail. Skill at putting together large jigsaw puzzles implies you are good at seeing a long, tedious effort through to its end. Skill derived in high school geometry indicates you can develop a logical solution to a problem.

You can transfer some of your skills to a large number of different situations. The skill of cross stitching is limited to situations where you want to do decorative needle work. The skill of paying attention to detail is broadly applicable to figuring out and solving a host of different problems and to doing a complete and thorough job in any line of work. What you learned from your life's experiences and how you understand the range of applicability of what you learned affect your skills and their transferability.

Exercise
Make a list of skills you believe you've developed. After each skill, briefly identify (with a phrase, if possible) a situation where you've displayed that skill. You want a situation that would convince a stranger that you indeed have that skill. Don't be limited by my lists of skills in earlier modules.

Group the skills into three groups: high, medium, and low transferability. As you think of transferability, think of using your skills in different work situations. Make sure you have at least a few skills in each group.

Which of your skills do you think are most valuable to a prospective employer? How do you show those skills to a prospective employer? Where did you get the skills most valuable to a prospective employer?

1. Background

1.5. Tools and Skills Categories

1.5.8. The Communication Skill

1.5.8.1. THE MESSAGE ISN'T IN THE WORDS—FRANCOIS BOUCHER

1.5.8.2. COMMUNICATION SKILLS FOR SYSTEM ANALYSTS

Communication is probably one of the two most important skills you can develop for your professional advancement. The other important skill is information gathering.

Often total strangers will need to coordinate and integrate their efforts to produce a responsive management tool to support a manager in his or her domain of responsibility. For example, a project for developing a management tool requires the participation of people with many different interests and backgrounds and from different disciplines. To coordinate these diverse people, this project needs effective communication programs directed to the specific information requirements of all the people involved. Some of these people are users, computer professionals, and top-level managers. The project leader must create a communication structure for delivering the information people need to do their jobs. A good system analyst should be at the center of this communication network. A system analyst must be able to speak the language of most, if not all, of the people working on or interested in the tool.

Who's Your Audience?

A primary responsibility of the system analyst in any project is to identify the audiences of their communications and the needs of those audiences. Rudolf Flesch says you should imagine yourself talking about *this* subject to *this* person at lunch. In other words, think about your audience before you begin writing. The needs of the audience must determine the context and purpose of the message. A simple approach to effective communication in any systems development project implies you must know your audience, understand their interests or motivation, and their information needs. Three formal communication activities of management tool development projects include: problem solving work sessions, technical reviews, and reports (written and oral presentations). These activities represent situations in building management tools where you'll need to exercise your communication skills.

Problem Solving Work Sessions

Let's begin with problem solving work sessions as an example of a setting a system analyst would find where he or she would need to practice communication skills. System analysis is problem solving. The overall problem being solved is made up of hundreds of smaller subproblems. Members of the project team will address one or more of these subproblems each day. According to Powers, Adams, and Mills, the best problem solving model involves *objectivity* when looking at a problem. They define five simple and direct steps to objectivity in problem solving. (Powers, Adams, and Mills, *Computer Information Systems Development: Analysis and Design*, South-Western Publishing Co., 1984, p. 218.)

Step 1: State the problem clearly, separating large problems into individual smaller ones.

Step 2: Analyze the problem for its probable cause.

Step 3: Identify alternatives for eliminating the cause.

Step 4: Consider the consequences of these alternatives.

Step 5: Choose the best alternative.

Compare these problem solving steps with the steps in Module 1.5.5.6. Any problem solving process emulates the scientific method. Effective problem solving is done using groups of people, some of whom know the problem and some of whom have expertise in solution alternatives. The key to bringing the right solution together with the right problem is our communication skills.

Technical Reviews

The second category of communication activities is technical reviews. You can participate in formal or informal technical reviews. Engineers tend to think of anything technical as having to be based on physical science. However, technical review is the review of the content of a system or its associated processes (WWA or WWWTB) or projects (HTGT) as opposed to the review of the management or progress of changes in the process or project. Therefore, you can conduct a technical review of any process, including those based on life science or social science as well as physical science.

A formal review includes the preparation of, transfer of, and interpretation of technical documents and reports and oral briefings and briefing charts. An informal review includes walkthroughs, table tops, and observations of the process or project. The communication issues in formal technical reviews are similar to those issues in reports, which I'll discuss shortly.

To illustrate the communication issues in informal reviews, I'll discuss what happens in a walk-through. In emergency management, we formalize a walk through a bit and conduct a table top exercise. In a table top, the participants in a potential emergency response gather and review and test an emergency plan or a emergency operating center, both of which are management tools. They review and test the management tools by using the tools in an hypothetical emergency situation. They also review their roles and skills in following the procedures laid out in the plan and using the resources available in the room that makes up the emergency operating center.

People who do a walk-through simply identify the strengths and weaknesses in the intermediate products in the development of a management tool. Some example development products are data flow diagrams, program structure charts, collections of input or output documents, and test plans. These walk-through people aren't expected to act on what they find; they just find strengths and weaknesses.

A walk-through is just what it sounds like. People who'll use or develop the management tool and others who want the tool to work walk through the tool, its features, and its use. They pretend they're exercising the tool. They put the tool through its paces.

Walk-through is a term coined in the MIS business for testing and improving computer-based information systems. In planning (primarily emergency planning), this activity is called a table-top exercise. Those people with responsibilities defined in the plan sit around the table and pretend they're carrying out their responsibilities. As they play out their roles, they find problems in the plan. They fix the problems. Then, when the plan is needed "to do its thing," the glitches are out of it.

In developing a computer-based management tool, usually three to five people will be involved in reviewing any particular intermediate product. The author, or developer, of the product provides most of the information during the walk-through. For large projects, one or more experienced system analysts will be appointed as administrator of walk-throughs. The administrator resolves any conflicts or disputes and has authority to cut off any unproductive discussion. Each walk-through administrator should also appoint a secretary

who has a thorough understanding of the product being examined. In table tops, we include people who observe the exercise and critique not only the management tool but those people participating in the table top.

A walk-through should be conducted in a businesslike way with all parties participating equally. Each member of the review team should receive an advance copy of the product they're reviewing. Additional walk-throughs may be scheduled if they find rework requirements during an earlier walk-through.

There are two end-product documents to a walk-through. One is a walk-through report, which is a brief, factual document identifying the product, author, date, names of participants, and outcomes. Another end-product document of a walk-through is the management report. This report summarizes the walk-through report but doesn't give a detailed list of errors found during the walk-through. If the participants accept the product, in full or in part, they sign the management report. The participants who sign this document share responsibility for the quality of the product.

Walk-throughs have some problems no matter how expertly and professionally they're conducted. One potential problem is when the product to be reviewed is too large, which results in a session taking too long. Another problem occurs if participants aren't given enough time to review the document and prepare themselves. Often in walk-throughs, we rush to give the participants review documents at the last minute and the participants don't have time to prepare properly for the walk-through.

Reports (Written and Oral Presentations)

The third category of communication activities is reporting (written reports or oral presentations). Reports deliver messages to identified audiences. Powers, Adams, and Mills (pp. 225-226) list five steps to be used in organizing a message. The five steps are:

Step 1: Identify audience needs and set priorities.

Step 2: Collect all relevant information.

Step 3: Start the presentation (message) with the most important item, then support this initial statement.

Step 4: Analyze and critique the content of the message.

Step 5: Use only enough time or words to deliver a message that meets the information needs of the audience.

This approach works equally well with written reports and oral presentations. I'll discuss the skills needed for both written reports and oral presentations shortly. Now, I'll highlight the communication activities management tool developers participate in.

Examples of written reports include management summaries, progress reports, procedures manuals, training manuals, and many others. We use graphic information portrayal, such as data flow diagrams and structure charts, in written reports. Management summaries are used as a basis for decision making and therefore should include recommendations for solutions and for actions. The management summary should be limited to a one-page to two-page typewritten presentation. Often the management summary is written in "bullet" form. We'll practice doing management summaries when we discuss the management process function, organizing and presenting information.

Procedures manuals should do for people what programs do for computers. The guiding principle in developing a manual should be that

people are in the system because they're able to apply judgment. Procedures manuals should emphasize the importance of the results and contain items to help build human understanding and interest.

Training manuals should be designed as easy-to-use references. No trainer can teach everything needed for smooth, continuous operation of a computer information system or any other management tool. This kind of skill and experience can only be built on the job. Effective training programs teach operators to learn.

Another type of report is an oral presentation, which may fall into at least three categories: project management reviews, status reviews, and acceptance reviews. Project management reviews include reports of progress during the current week, completion of tasks, time remaining for tasks in process, reviews of particular problems encountered, or tasks about to begin. I'll outline a set of ten simple tools for project management shortly. You'll use these tools to prepare the content of the project management review.

We give status reviews to keep user management current on the progress of the project. They are information sessions, not sales meetings.

Acceptance reviews consist of formal documents prepared in advance and provided to the decision makers. The purpose of an acceptance review is to get approval for recommendations made.

Most guidelines for preparing written reports apply equally to oral presentations. However, several special considerations also apply to oral presentations. An oral presentation should be supported by visual aids that focus the attention of the participants on the topics being discussed. Members of the audience should be encouraged to ask questions and participate actively in the discussion.

1. Background

1.5. Tools and Skills Categories

1.5.8. The Communication Skill

1.5.8.3. Written Communication I

1.5.8.3.1. AUDIENCE PLUS PURPOSE EQUALS DESIGN.

When you communicate you must match the purpose of the information sender to the purpose of the information receiver.

How do we design an information portrayal so we can effectively work the information portrayal to information perception interface in the Management System Model? Lou Middleman has the most valuable answer to that question in his simple equation: Audience plus purpose equals design. Whether you're planning what to say or what to write, always consider: Audience plus purpose equals design. You design the oral or written portrayal by considering in similar measure both the purpose of your communication and the audience to whom you're aiming the information.

When discussing the skill of communication, I choose first to look at written communication, because the written form is more tangible, is easier to look at again, and is useful for discussing both written communication and communication in general. The two best pieces to read to learn how to communicate in writing effectively are Lou Middleman's *In Short* (Louis I. Middleman, *In Short: A Concise Guide to Good Writing*, St. Martin's Press, Inc, New York, 1981) and Rudolf Flesch's *On Business Communications* (Rudolf Flesch, *On business Communications: How to Say What You Mean in Plain English*, Barnes and Noble Books, New York, 1972).

Both books speak to the way to write effectively and what to consider in writing so you'll hold your audience's attention. Neither spends much time on grammer, punctuation, or sentence structure. What we want in writing is to effectively transfer the information we want to get from us to some audience. Lou Middleman puts it well when he indicates that the issue in spelling or grammer is that if we do it wrong, we distract the reader. The reader can usually figure out what word we mean or what the grammer should be. But, why ask the reader to do that much work? The reader won't. If the reader has too much (really not much at all) trouble in finding out what he or she might want from what we've written, the reader will abandon what we've written.

When we set aside the issues of punctuation and spelling and so on, what's left? How do we communicate so the audience will stick with our communication long enough to get our message? How do we communicate so the audience will get the message we intend? Middleman and Flesch get into the specifics of issues like writing like you speak, spilling the beans, getting to the point, writing for thinking versus writing for communicating, using short sentences, and more. Middleman tends to be more intuitive and Flesch tends to be more sensing. Probably, your personality type will dictate which you like best.

One of Middleman's issues is knowing the audience of what you write. Later, I'll talk about matching the reader's and writer's purpose. Now, let's think about how important or urgent what you write will be to the audience. Stephen Covey urges us to focus on what's both urgent and important rather than just what's urgent. He also argues that the important should come before the urgent. Consider importance and urgency when you decide to write. In business writing, we often write memos. Do you expect the reader to read everything you write? Of course, you do. Otherwise, you wouldn't write it. Do you read every word of what people write to you? Of

course, you don't. You don't have time. The age of information has gotten out of hand. We can't read everything every writer has labored so hard to put in front of us. So, we choose.

When I look at my in-box material I stand over the trash can. Most of what I get I never open. I use the return address on the envelope or the subject heading on the memo to decide whether to trash the document. Sometimes I lose time because I throw away something I should have read at least the first sentence of. Then, I have to use some of the time I saved by throwing most of my in-box away. What do you want me to do with what you write? Consider how important or urgent I'll feel your document is based on at most the first sentence. Figure 1.5.8.3.1. is a scale for the importance and urgency of memoranda. What I consider 1 through 7 on the scale, I never get to. You want me to consider what you write a 10. In Figure 1.5.8.3.1., Middleman indicates that a 10 on the scale requires a reason (because) for reading a memorandum immediately. You must know the because before you write the document to have any chance for me to have a because to compel me to read what you wrote.

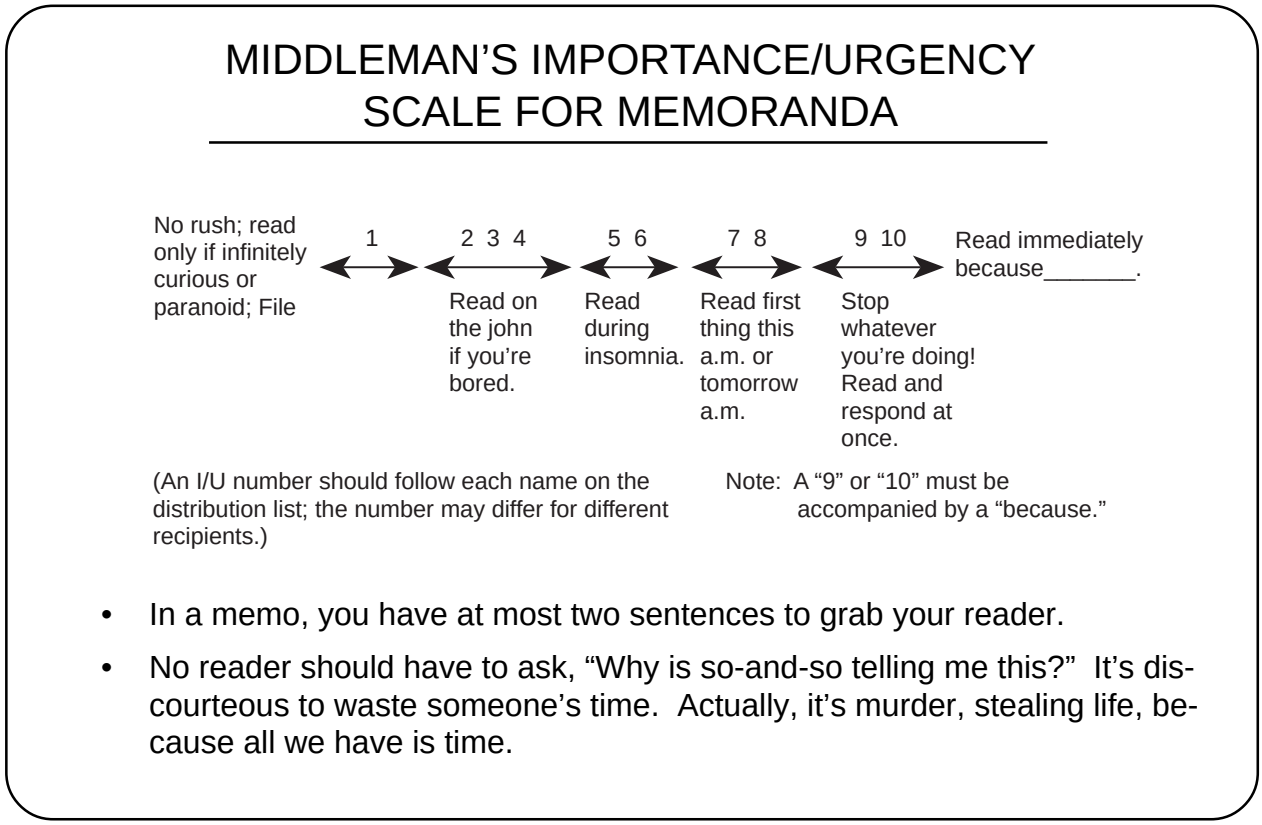

Figure 1.5.8.3.1. *What is the reason (because) for me to read your document immediately?*

1.5.8.3.2. SCOPING YOUR AUDIENCE

If you expect your audience to read what you write, you must know your audience well before you write.

How do you figure out your audience when you write a memorandum? The first hard question is: Who's the audience? Often, you don't know exactly who's going to read what you write. Often, more than one person will read your writing, and the people are quite different one from the other. When you write a love letter, it's easier. You're writing to one person that you've spent some time trying to figure out what's important to him or her, why he or she should hear what you have to say, what he or she wants to hear, and how he or she wants to hear it.

It's almost impossible to write a document that's equally effective for two or more people. I don't suggest using the same letter for two or more lovers. Tailor each letter to each lover. Likewise, don't send the same memo to two or more bosses. Consider the following issues when you scope out the reader of your memorandum. I'll include issues for a primary reader and a secondary reader. If you're writing to a bunch of people, I suggest you pick out one person to focus on and try to make that person the one who is most important to you in the bunch. Then try to group all the rest as the secondary reader.

1. When did you determine that you need to write the document?

2. When does the document have to be delivered?

3. What is the subject of the document?

4. If you need a title, what title reflects what you want the reader to conclude from reading the document?

5. Consider the following issues first for the primary reader and then for the secondary reader.

   a. What is his or her communication level (education, understanding of terms, experience, knowledge of the topic or field, etc.)?

   b. What is his or her position relative to acting on what you propose or discuss in your document (position, relationship to you, responsibility, etc.)?

   c. What is his or her attitude toward the subject (interest, history, motivation, concern, issues, etc.) before reading your document?

   d. Why would he or she want to read your document (need, importance, urgency, etc.)?

   e. What do you want him or her to do after he or she reads your document (action, response, etc.)?

   f. What do you need to say to get him or her to do that?

   g. What attitude do you want him or her to have toward the subject after reading your document?

   h. What attitude do you want him or her to have toward you after reading your document?

   i. What do you need to say to get him or her to feel that way?

6. Why (motivation, purpose, outcome, etc.) are you writing your document?

7. What do you want to accomplish in your career or financial position as a result of writing your document?

8. What resources (library, people, documents, etc.) do you need to prepare your document?

9. What information (facts, data, information) do you need to prepare your document?

10. What visuals (graphs, photographs, drawings, etc.) do you need to include in your document?

11. What constraints do you have on the document (style, length, etc.)?

12. What form (letterhead, binding, color, etc.) do you want to put the document in?

13. How many copies will you need to make of the document and where will they go?

I suggest that before you write a document you carefully answer these questions. Based on the answers, you can write down what you're thinking. Middleman says that we use writing to help us think through what we want to communicate. When we write to think, we're writing things down. He says that we use writing to help us transfer information. When we write to communicate, we're writing things up.

What we write down is good for thinking and lousy for communication. When we think, we make wrong turns, say the same thing in different ways, put extraneous information in to remind us of something else, and so many other cumbersome and messy techniques. This extra structure, or scaffolding, gets in the way when we try to communicate. Before writing things up, we have to identify and tear away the scaffolding so we can see the creation we worked so hard to build. Now, we want to communicate what we've exposed by removing the extraneous stuff and crisply stating the important stuff.

1.5.8.3.3. GUIDES FOR WRITING

To write effectively, keep it simple, spill the beans, consider your audience, and be active.

Guides for writing are legion. Here are a few from Lou Middleman.

1. Writing is an highly idiosyncratic, nonlinear, recursive process of inventing and rehearsing, drafting, revising, and rewriting. Writing begins anywhere between "Oh, Oh!" and "Aha!" and ends when the written product is abandoned. Writing begins before the first word and ends before the last.

2. Write first to find your thoughts, then to please yourself, finally to shape the message to the reader's needs.

3. All effective writing is persuasive: it must persuade a reader to go on.

4. Audience plus purpose equals design.

5. Trust your sense of simplicity, clarity, and conciseness. It is easier to muddy a clear statement than to rescue clarity from gobbledygook or drivel. When appropriate, inform your audience, up front, that for the sake of clarity you have deliberately departed from its formal expectations of style and word choice (specify), so he or she won't respond to your writing as an accident, a mistake from which you must be saved.

You abandon any communication. When I speak, I can see people shift their attention. Then I know I have to do something to get them back. You abandon any written document. Your eyes may look at the words, but your mind has gone somewhere else. To transfer information, I need your mind, not your eyes. When you write, do so knowing that your audience will mentally and then physically abandon what you write. The question is : How long can you keep his or her attention?

Crispness is a guiding rule for the management process. Crispness means simplicity, clarity, and conciseness and also means strength. I'll discuss crispness at length when I discuss the guiding rules for the management process.

One way to be unclear is to write in the passive voice. I suggest you write in the active voice. When you want to be obtuse or unclear (and, unfortunately, you'll want to do that sometime), you can go back and change the wording. If you write clearly, you can be unclear on purpose. If you write unclearly, you can't be clear on purpose.

You can write about your writing or speak about your speaking. You can write that you're using a certain kind of jargon or that you're writing in a very personal style for a purpose.

Lou Middleman likes to list six rules to help us write better. I've included the six rules in Figure 1.5.8.3.3.

SIX “RULES THAT ONE CAN RELY ON WHEN INSTINCT FAILS”*

- Never use a metaphor, simile, or other figure of speech which you are used to seeing in print.
- Never use a long word where a short one will do.
- If it is possible to cut a word out, always cut it out.
- Never use the passive where you can use the active.
- Never use a foreign phrase, a scientific word, or a jargon word if you can think of an everyday English equivalent.
- Break any of these rules sooner than say anything outright barbarous.

*from George Orwell’s “Politics and the English Language”

Figure 1.5.8.3.3. *These six rules will help you write better.*

1.5.8.3.4. USAGE OF THE PASSIVE VOICE

Read Kent Porter, "Usage of the Passive Voice,"
Technical Communication, First Quarter 1991,
Vol. 33, pp. 87-88.

1.5.8.3.5. To Be or Not

Read DeWitt Scott, "To Be or Not," *Journal of Management Consulting*, Spring 1992, pp. 50-51.

1.5.8.4. COMMUNICATION IN BITS—GEORGE SEURAT