

THE
DEMING
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A Theory of a System
for
Educators and Managers

DISCUSSION GUIDE

VOLUME 21

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A THEORY OF A SYSTEM FOR EDUCATORS AND MANAGERS

OVERVIEW

This introduction to thinking about systems is intended for anyone who wishes a fuller understanding of schools, business and government organizations, and how they might be improved. Do not be put off by references to educators and managers. Workers in any organization are managers, even if they manage only their own work. The principles of systems thinking apply to all organizations.

Unless you understand the meaning of system, analysis, and synthesis, you can only achieve a quality program by luck – much like a monkey at the computer trying to write a novel. Quality circles (QC) will not lead to a quality program. Nor will statistical process control (SPC) or just-in-time (JIT) delivery or attempts at continual improvement or trying to delight your customer or working closely with your supplier. These actions will not lead to a total quality management (TQM) program, a continual improvement of quality program, or any kind of effective, systematic program to improve the management of businesses, services, governments, or schools.

That is because QC, SPC, JIT, customer focus, TQM, continual improvement measures, or working with suppliers – while all good things to do – are just that: *things to do*.

A quality program requires a systematic approach, philosophy. At the center of this philosophy is an understanding of the properties and power of a system. That is what this video is about.

With an appreciation of a system and a factual and cooperative team approach to your business, school, service, or government organization, you will know when and how and why to use QC, SPC, JIT, customer focus, TQM, continual improvement measures, and working with suppliers. The monkey must have in mind a plot, and know the alphabet and the rules of grammar before it has a chance of writing a novel.

Another example of this is the game of baseball. You must know the rules and purpose of the game and the order in which to touch the bases. Quality management demands an aim or purpose for the system, a way of thinking and arriving at improved understanding – not a list of things to do. It requires the continual improvement of the system and its component processes.

This way of thinking is new. It cannot be grafted onto old methods such as management by objectives which focus only on results without regard for the methods by which results are to be obtained. It must begin with an understanding of how a system works and can be improved. There is no other way. There are a number of approaches to understanding a system. This conversation between Dr. W Edwards Deming and Dr. Russell Ackoff is a good start. And it is just a start. You must watch the program several times and continue to discuss it using the questions in the guide and others that come up. The next Deming Library volume will have more on the system and education and management.

We recommend that you consider two preparations for viewing this discussion between Dr. Deming and Dr. Ackoff, a Deming colleague and formerly Silberberg Professor of Systems Sciences and Dean of the Wharton School, University of Pennsylvania. First, see the suggested previewing activity on page 9. This simple exercise of constructing a system will help viewers begin to think about the nature of systems.

Second, copy the following definitions of system, analysis, and synthesis onto a chart or hand out copies to viewers. The distinction between these two ways of thinking (see question 20 for expanded definitions) is crucial for an understanding of systems.

System: Any network of functions or activities within an organization that work together for the aim of the organization. (Dr. W Edwards Deming)

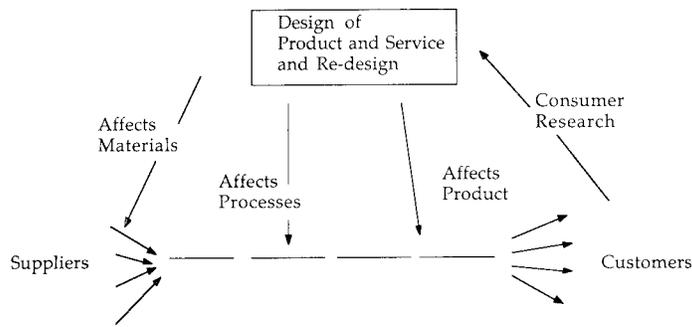
Analysis: To separate the whole into parts and study each part individually.

Synthesis: To put individual parts back together and study the whole.

The guide contains several activities suggested by various contributors.

INTRODUCTION

The flow diagram which Dr. Deming drew on a blackboard in 1950 for the assembled eighteen industrial leaders of Japan described a system of production which incorporated suppliers, customers, and a continual feedback loop of design and redesign of product. This simple but profound idea of a continually improving system has guided the development of the largest Japanese corporations for forty years and, in the last fifteen years, increasing numbers of businesses and other organizations around the world. It allows business to produce better and better quality goods and services for less and less effort and materials. This was revolutionary in 1950 when it was believed that higher quality always cost more to produce than quantity.



SIMPLIFIED FLOW CHART OF PRODUCTION VIEWED AS A SYSTEM
 From Out of the Crisis, W. Edwards Deming, page 4.

A Theory of a System for Educators and Managers is directed to educators and managers because Dr. Deming and Dr. Ackoff agree in this conversation that the need to understand a system applies to education and business – indeed, to any organization.

In addition, the education system affects industry and government by the ways of thinking that people are taught or not taught in schools. Dr. Ackoff challenges the viewer to examine the results of producing "a group of people who think in the way we have been thinking for years rather than departing and developing new concepts and new ways of understanding."

A Theory of a System for Educators and Managers is not a criticism of the people in education or business. It is about the nature of systems and the certainty that people must have an appreciation for the properties and the power of a system if they are to manage and improve their business or school.

This systems theory is an essential part – but only a part – of the knowledge needed to think the new way about managing better. An awareness of the theory of variation, of how people learn and of psychology, and how these factors interact with the system in different ways on different days is vital for an understanding of how to improve any organization. Dr. Deming calls this profound knowledge; it leads to the conclusion that cooperation is more effective than internal competition in leading any organization to work more effectively.

An understanding of the difference between analysis and synthesis is crucial for an introduction to the theory of a system. Dr. Ackoff explains that analysis has been the dominant mode of thought in the Western world for 400 years because, while investigating the nature of mankind and the environment, scientists copied the behavior of children. As they take apart unfamiliar objects, children attempt to understand each part separately and then try to reassemble the whole. That is analysis, and it explains *how* the pieces of a system work. Synthesis is needed to understand the *why* of a system and the interactions between its parts as they work together. It begins with identification of a

larger or containing whole (system) of which the system to be studied is a part. Synthesis yields an understanding of how the thing to be studied serves the purpose of the larger whole. Used together, analysis and synthesis make possible better management – or even the redesign – of society's institutions.

A Theory of a System for Educators and Managers is not the preferred introduction to the Deming philosophy. In most cases it should follow viewing *The Prophet of Quality* (Parts 1, 2) and *Understanding Profound Knowledge; Competition, Cooperation, and the Individual*; and *The Quality Leader* (Volumes 14-16) for the conceptual structure which supports the Deming method. Some leaders have found it useful to introduce groups to the larger issues of the developing global market, changes in the world economy, and the experience of change in various quality-oriented organizations around the world by viewing the three-hour PBS video report, *Quality . . . Or Else*.

After viewing *The Prophet of Quality* you may view *The Deming Library* in whatever sequence is best for you. Here are some suggestions:

1. One manager reports that his people are more receptive to considering the new philosophy after they see *The Red Bead Experiment and Life* (Volume 7) and *Lessons of the Red Bead Experiment* (Volume 8). He says the Red Bead Experiment convinces people that the Deming method will help "because the focus is not on the faults of employees, but on the improvement of systems." After the Red Bead Experiment's dramatic demonstration of how powerfully systems affect individual performance, students are ready to view *The Funnel Experiment* (Volume 9) for an understanding of how tampering with a system only makes things worse. With some awareness of the properties of systems, students are prepared to consider an expanded discussion of *The 14 Points* (Volume 2) with more appreciation of their implications.
2. Alternatively, students who prefer to begin with philosophical theory may choose to view *The Prophet of Quality* or study *Profound Knowledge* (Volumes 14 – 16) first because this is the conceptual structure which supports the Deming method, and then go on to the *Red Bead* and *Funnel Experiments* (Volumes 7 – 9) and *The 14 Points* (Volume 2).
3. A more historical approach would begin with *The New Economic Age* (Volume 1) and *America in the Global Market* (Volume 13) and then *The Prophet of Quality*, *The Red Bead Experiment and Life* (Volumes 7 and 8), *The Funnel Experiment* (Volume 9), and *Profound Knowledge* (Volumes 14-16).
4. You may watch the programs in numerical order, which follows the learning curves of the producer and the reporter.
5. Finally, after study of *The Prophet of Quality* and Volumes 1-9 and 14-16, students may skip ahead to a specific subject.

Experiencing Change

For an understanding of how much our thinking must change and how deep the commitment to change must be, particularly among top management, we suggest the Ford Motor Company story (Volumes 3-6).

Dealing with Resistance to Change

Sooner or later you will run into resistance to change. Continuous improvement is not an easy concept, and there is some frustration in trying to understand and apply it. At that point, we think the Vernay Laboratories story (Volumes 10-12) can encourage people by showing them that their feelings are not unique, and if they will just stick with the Deming method, it does pay off. *The Dangers of Buying on Price Tag Alone* (Volume 12) examines Vernay Laboratories' experience of benefits derived from a long-term relationship with a supplier. You will also find encouragement in the Ford story.

Repeated Study

The philosophy runs counter to traditional management thinking and, as Lloyd Dobyns says, cannot be fully understood the first time it is presented. We suggest you consider studying Volumes 2, 8, 9, 14, 15, 16, and *The Prophet of Quality* more than once. If you do, we predict that you'll discover something new every time you view them.

Other Topics in *The Deming Library*

Volumes 17-20 treat the shift of General Motors' Powertrain Division away from annual performance evaluations to a personal development program (Volume 17) and an examination of the evidence that a cooperative work environment stimulates higher performance and results in more personal enjoyment than competitive conditions (Volume 18). These programs might be viewed following the tapes that deal with change: the Ford Motor Company story (Volumes 3-6) and the Vernay Laboratories story (Volumes 10-12). Volume 18, *Competition Doesn't Work: Cooperation Does*, is a companion to Volume 15, *Competition, Cooperation, and the Individual*.

Profound Knowledge for Leadership (Volume 19) takes the issue of leadership the next step to transformation of the organization for cooperation through the adoption of the theory of Profound Knowledge. In this and *Leadership for the Transformation* (Volume 20), top managers of General Motors discuss their experiences of change and their new roles as teachers and coaches who begin to learn with other employees.

We encourage you to show *The Deming Library* in the order that best meets your needs. Should you find a sequence you believe works particularly well, we'd appreciate hearing about it so that we can tell other viewers. This is, as we've said before, like studying a language. You don't have to learn the parts of speech in any particular order, but you do have to learn them all eventually.

The Deming method does not have to be learned in order, but it has to be learned.

This guide is designed to help you start a general discussion. The idea is to raise questions that participants will try to answer – relating the principles to their experiences and your organization. For this reason, the discussion leader is not limited to these questions. We encourage the leader to help participants raise their own questions about points made in the tape. Always remember: Be sure people in the group understand this is a discussion and not a quiz.

THE 14 POINTS

Following are Dr. Deming's 14 Points. Familiarity with them will help in your discussions.

1. Create Constancy of Purpose.
2. Adopt the New Philosophy.
3. Cease Dependence on Mass Inspection to Achieve Quality.
4. End the Practice of Awarding Business on Price Tag Alone. Instead, Minimize Total Cost, Which Is Often Accomplished by Working with a Single Supplier.
5. Improve Constantly the System of Production and Service.
6. Institute Training on the job.
7. Institute Leadership.
8. Drive Out Fear.
9. Break Down Barriers Between Departments.
10. Eliminate Slogans, Exhortations, and Numerical Targets.
11. Eliminate Work Standards (Quotas) and Management by Objective.
12. Remove Barriers That Rob Workers, Engineers, and Managers of Their Right to Pride of Workmanship.
13. Institute a Vigorous Program of Education and Self-Improvement.
14. Put Everyone in the Company to Work to Accomplish the Transformation.

SUGGESTED PREVIEWING ACTIVITIES *(Contributed by Dr. Ronald Fielder)*

Ask participants to think of the system or a system in which they work. Ask them to identify the components of that system. Ask what steps they would engage in if asked to understand that system.

THE SYSTEM AND UNDERSTANDING ONE'S JOB

1. Dr. Deming says in the first scene, "Understanding a system... that is the way I taught the Japanese top management in 1950... the aim of the system." He continues, "Draw a flow diagram... and anybody may see what his job is. A flow diagram is an organizational chart." Referring to Dr. Deming's flowchart, what is the system? What is the meaning of the aim of the system? How does a person understand what his job is by looking at a flow diagram of the system in which he works? What does Dr. Deming mean by "a flow diagram is an organizational chart"?

PRINCIPLES OF SYSTEMS ARE UNIVERSAL

2. Lloyd Dobyns says in his introduction that "the problem is that a manufacturing flowchart... does not appear to apply to a school or a hospital or a police station. But it does, if we change the labels." What is the problem in applying the flowchart to a factory or a school or a police station? What is the same from one example to the next?

ANALYSIS HAS BEEN SYNONYMOUS WITH THINKING

3. Dr. Russell Ackoff says, "The characteristic way of management that we have taught... is to take a complex system, divide it into parts, and then try to manage each part as well as possible. And if that's done, the system as a whole will behave well, and that's absolutely false because it's possible to improve the performance of each part taken separately and destroy the system at the same time." Do you have any experience of this way of thinking?

Suggested Activities *(Contributed by Dr. Ronald Fielder)*

- Ask the group to give specified examples of how schools and businesses are organized, compartmentalized, etc.
- Lead a discussion about recent efforts at school improvement/transformation. Have we approached these changes by compartment or by the system?

CRITICIZE SYSTEMS, NOT PEOPLE

4. Lloyd Dobyns reminds the viewer, "This is not a criticism of students, parents, teachers, principals, superintendents, or anyone else in education. This is not about people in the system. This is about the system itself." Where does this suggest that most results originate? With individuals? With the system? How can this be so?

EFFECTS OF THE EDUCATIONAL SYSTEM

5. Dr. Ackoff cites an example of a result from the system: "Look what the educational system does to creativity. Every child learns that when they're asked a question in school, they must first ask themselves what answer does the asker expect. That's the way you get through school, providing people with the answers they expect. Now, the one thing about an answer that somebody else expects is it can't be creative because it's already known." Is this an accurate description of the way the system of education works? What is one result of this practice for individuals? How does this work in the business environment?

Suggested Activities (*Contributed by Dr. Susan Leddick*)

- *Activity A:* (1) Self Assess. Keep a card for a few days where you mark the kinds of questions you ask of the people who work with you or of the children you teach. (2) Work with a buddy to track each other's questions.

- *Activity B:* Reflect on the responses of the people to whom you direct questions. How does the reaction change when the type of question changes?

6. Dr. Ackoff suggests a larger scale result from this systematic practice: "What we produce is a group of people who think in the way we have been thinking for years rather than departing and developing new concepts and new ways of understanding." Dr. Deming agrees with Dr. Ackoff and names the consequence of this practice: "That is not teaching... . A student learns information." What does Dr. Deming mean? What is a possible consequence of a whole society following such a practice?

Suggested Activity (*Contributed by Dr. Ronald Fielder*)

- Lead a discussion with this backdrop: "Efforts at transforming schools across the U.S. are running into barriers being established by various parent groups. They seem reluctant to develop new concepts and new ways of understanding." Now ask the question: "Did we create this group of reluctant customers with our traditional approach to education?"

FACTS AND EDUCATION

7. Dr. Deming comments, "And with a lot of things – most everything – maybe there is no right answer." What does he mean?

Suggested Activities (*Contributed by Dr. Susan Leddick*),

- *Classroom Project:* Develop a version of the game "Jeopardy" wherein responses are the conditions under which something might be true. Example from an elementary science class: "The sky is green." Response: "I am wearing yellow lenses in my glasses."
- *Planning:* Do the same thing for planning exercises, except substitute statements of future conditions. Example: "Demand for public education is shrinking." Response: "Private education is affordable and responsive to special needs." Then ask what might be the implication of such a condition for the district or school (or whatever planning unit).
- *Staff Development:* Do the same thing for staff development. Turn generally accepted practices on their ear. Explore what condition might appropriately demand such a response. Use this activity as a way to build flexibility.

8. Lloyd Dobyns suggests an interpretation of Dr. Deming's observation in question 7: "I think the point is that while a fact does exist, by itself it isn't enough. We have to know what context that fact is in and how we are going to use it." What is the "context" of a fact?

9. Next Lloyd Dobyns observes about facts: "[A] fact is only the first step on the learning ladder in the human mind." Now what do you think about multiple, choice questions?

THE PRESENT SYSTEM OF EDUCATION VALUES: RETENTION OF INFORMATION

Some Brief Definitions of "Forms of Content of the Human Mind" or "Levels of Learning"

Data: Symbols that represent characteristics of objects or events.

Information: Processed data. Describes "Who?" "What?" "When?" "Where?" "How many?"

Knowledge: Instructs "How to . . ."

Understanding: Explains "Why?"

Wisdom: Ability to see the consequences of actions by evaluating information, knowledge, and understanding.

10. Dr. Ackoff draws the next conclusion about an educational system dependent on teaching for retention of information: "There's a very basic distinction between the various forms of content of the human mind. There's data, information, knowledge, understanding, and wisdom. The educational system never makes a distinction between them. And as a result, children come through the system with a great deal of information, very little knowledge, no understanding, and virtually zero wisdom." What are the differences between these "forms of content" or levels of learning? How would you apply the notion of "context" from question 8 to these levels of learning?

Suggested Activity (*Contributed by Mr. Mark Richie*)

- Divide the group in two. Quickly review that Dr. Ackoff concludes that children come out of the educational system with a great deal of information, very little knowledge, no understanding, and virtually zero wisdom. Have your small groups compile several examples of how organizations of all kinds can create similar circumstances for themselves. Have them consider that it is possible to have "various forms of content of the human mind" extended to an organizational scale. Ask them to discuss the net effects of an organization (school, business, etc.) that runs on information and very little knowledge or wisdom.

11. Lloyd Dobyns differentiates between facts, information, knowledge, understanding, and wisdom:

- Data are individual **facts**, symbols that represent objects or events. Until those facts can be processed, they have no meaning; they don't tell us anything.
- When data are processed, they become **information**. Information answers the reporter's questions-who, what, when, where, and how.
- To answer how-to questions, you need **knowledge**. Then from explanations, you get understanding.
- Finally, as you understand, you may acquire **wisdom**, which is the ability to see and evaluate the long-term consequences of our actions. The problem with most education is that it rarely gets to wisdom or understanding or even knowledge. Most education is devoted to information.

What does it mean to "process" facts to get information? How is information contained in knowledge? How is knowledge produced from information? What is another term for "understanding"? At what level in the learning process is theory involved? Why do you think most education is concerned with acquiring information?

Can you think of a personal learning experience when your knowledge of a subject evolved into a higher level of understanding? How did that happen? What in your thinking changed?

If retention of facts was a sufficient basis for much of our educational system in the past, why might it not be now? How should our approach to education be changed?

The largest industrial organizations of Japan began to practice systems theory about forty years ago. Do you think there is a connection between the successes of Japanese industry in exporting high-quality products and the application of systems theory? How do you suppose Japanese education supports this practice?

Major Categories in the Cognitive Domain¹

Knowledge: Recognition and recall of facts and specifics.

Comprehension: Interprets, translates, summarizes, or paraphrases given information. Requires knowledge in order to demonstrate comprehension.

Application: Uses information in a situation different from original learning context. Requires comprehension of information in order to apply in new situation.

Analysis: Separates whole into its parts, until relationship among elements is clear. Requires ability to apply information in order to analyze.

Synthesis: Combines elements to form new entity from original one. Requires analysis in order to synthesize.

Evaluation: Involves acts of decision making, judging, or selecting based on criteria and rationale. Requires synthesis in order to evaluate.

¹ Benjamin S. Bloom (Ed.), *Taxonomy of Educational Objectives, Handbook I: Cognitive Domain* (New York, NY: David McKay Company, Inc., 1950).

Suggested Activities (Contributed by Dr. Susan Leddick)

- *Academic Activity:* Compare Dr. Ackoff's forms of content of the human mind with Bloom's *Taxonomy of Educational Objectives*.
- *Teaching Activity:* For a teacher working with a mentor and/or a class or group of students, critique your next week's lesson plans. How do they stack up in light of Dr. Ackoff's comments? How would you like them to stack up? How could you work with your students to alter the lessons so they stack up to suit all of you? Do it, then improve the lessons week by week, building on what you learn.

12. David Langford says about the estimate that students retain only about 10 percent of information learned to pass tests in school: "There's a lot of waste in that system if you're simply focused on trying to memorize information [you] can use later on." Why is unremembered information "waste" in the system of education? What information, if any, is essential to be remembered?

Suggested Activity (*Contributed by Dr. Ronald Fielder*)

- Lead a discussion by asking the participants to predict how their students would be behaving and interacting if indeed students were graduating with high levels of understanding and wisdom.

THE CHALLENGE OF DESIGNING A NEW SYSTEM

13. Dr. Ackoff poses a challenge to improve education by asking the question: "How do we design a system which distributes its effort more evenly across these types of content of the human mind? Information is contained in the descriptions, knowledge in instruction, understanding in explanation." He concludes with the statement: "We don't explain reality to children." What does he mean? Where does he place reality in the progression from information to wisdom?

LEARNING HOW TO LEARN

14. David Langford proposes another purpose of education: "But what's really important is the ability to learn how to learn... to assess what's there, perhaps collect some data that would give me some information about how I might proceed... . Then learn to access other resources such as teams of people or technology." What are the steps that a person must follow in learning for himself? What is the educational benefit of such experience? Is learning to work on a team to formulate a problem and consider alternative solutions a better way of learning than individual study? Of what benefit to the individual learner is working on a team?

ANALYSIS AND SYNTHESIS

15. Dr. Ackoff says, "In the Renaissance, when man began to investigate the nature of man and the environment, he also invented a way of thinking. He actually copied it from children. Confronted with the need to understand [something], a child goes through a three-step process: First, take it apart. Second, try to understand the behavior of each part taken separately. Then try to aggregate the understanding of the parts into an understanding of the whole. That's analysis." How do you use analysis in your work? Can you give examples from your personal life?

16. Dr. Ackoff continues, "Today we use analysis and thinking as synonymous terms. That's the way we manage. We take corporations and schools apart into departments or disciplines, try to run each one, and then aggregate them into a whole." What are possible disadvantages of thinking and managing this way exclusively?

17. Dr. Ackoff explains, "You cannot explain the behavior of a system by analysis. You can reveal its structure and say how it works, but you can't say why it works the way it does." Do you agree with Dr. Ackoff that analysis "cannot explain the behavior of a system"? Why not? What is the difference between the structure Dr. Ackoff is discussing and the flowchart that Dr. Deming said in the beginning of the program was the actual organizational chart? (See the Deming flowchart on page 4.) What does the flowchart reveal that the organizational structure as described by analysis does not?

Dr. Ackoff gives an example of how analysis or analyzing parts of a system can reveal its structure and how it works but cannot tell why it works. He says, "The British drive on the other side of the street. Their steering wheel is on the right, ours is on the left. Now, I can give you all the English and American cars you want and disassemble them from now to doomsday, and you'll never explain why one drives on the right and the other one drives on the left because explanation never lies inside of a system, it lies outside." What does he mean by "lies outside"? How is Dr. Deming's statement in question 18 related to this idea? (For the difference between "behavior" of separate parts and "interaction" between the parts of a system, see question 24.)

Suggested Activity (*Contributed by Mr. Mark Richie*)

- Divide the group in two. Ask them to think about the example Dr. Ackoff gave of driving in the U.S. and the U.K. on different sides of the road. Give the group 10-15 minutes to develop similar analogies that relate to various educational or business practices. Have each group report their thoughts to the other. Allow time to review and discuss. Can the groups find other examples and explain how analysis of the practice will show how they work but not why they function the way they do?

SYSTEMS ARE UNDERSTANDABLE ONLY FROM OUTSIDE

18. Dr. Deming states, "The system cannot understand itself." What does he mean? How can a manager understand the "why" of the system he is in rather than just "how" it works?

19. Lloyd Dobyns says, "In analysis you take the whole apart and study the individual bits. Synthesis is the opposite. You put the individual parts back together and study the whole." How can different understandings come from proceeding in opposite directions with the same information? What is the aim of studying "the whole"? Will study of the whole lead to a better understanding of the structure of the system?

20. Dr. Ackoff elaborates on the differences between analysis and synthesis:

- In the first step of analysis, you take the thing you want to understand apart. **In the first step of synthesis, you take the thing you want to understand as a part of a larger whole.**
- In the second step of analysis, you explain the behavior of each part taken separately. **In the second step of synthesis, you explain the behavior of the containing whole.**
- In the third step of analysis, you aggregate your explanation of the parts into an understanding of the whole. **The third step of synthesis consists of disaggregating the understanding of the containing whole into the role or function of the parts.** The explanation of [the] behavior of a system lies in its role or function in the larger system of which it's a part.

What does Dr. Ackoff mean in the first step in **synthesis** by taking "the thing you want to understand as a part of a larger whole"?

Can you think of an example of a system contained in a "larger whole"?

What is the first thing to be studied in **synthesis**? What is learned by putting a system in the context of a larger, containing system? In the second step of **synthesis** what does an explanation of the behavior of "the containing whole" tell you? Why can't analysis produce this understanding?

What might happen to the existing parts of the smaller, contained system when, in the third step of synthesis, the understanding of the containing whole is "disaggregated" into the role or function of the parts? What is different about this route to understanding the parts from an analysis in which the parts are examined independently and then assembled to complete the whole?

Suggested Activity (*Contributed by Dr. Susan Leddick*)

- *Egg Me On:* Divide the group in two. To group one, give a whole fresh egg and a photo of a cake. To group two, give a whole fresh egg and a photo of a full-grown chicken. Do not let them know what photo the other group has. Tell both groups that you want them to try to understand the system called egg, using the three step method of synthesis. For each group, the item in the photo is the "containing system" in Dr. Ackoff's terms. Give them 10-15 minutes to work on understanding the egg as a system. Then have each group report to the other on their understandings. Discuss why the understandings are so different. (They concentrate on different containing systems.) Have them demonstrate how the analyst would approach understanding an egg. (They will most likely break the egg and describe the contents.)

21. Lloyd Dobyns sums up: "If you want to find out *how* something works, you use analysis. But if you want to understand *why* it works the way it does, then you need synthesis. Analysis tells you how, synthesis tells you why. You need both:" What are examples of situations in which understanding *how* is most important? What are we seeking when we ask *why* something works as it does? When is understanding *why* most important? What do you need to know when you are trying to redesign something or make it better?

22. Dr. Ackoff explains that you don't get a car that works by assembling the best components from different cars – say, a Rolls-Royce engine, a transmission from another car, an alternator from yet another. It doesn't work. Furthermore, it's the working together that's the main contribution of systemic thinking, as opposed to working in parts separately (analysis). Why doesn't analysis reveal how parts work together? How does systemic thinking contribute to the working together of parts?

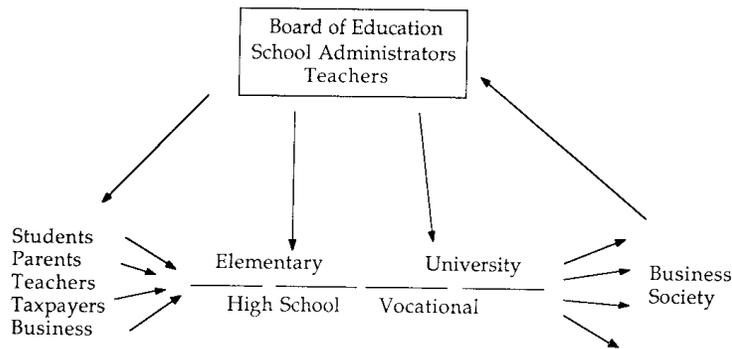
23. Dr. Ackoff continues, "The performance of the whole is never the sum of the performance of the parts taken separately, but it's the product of their interactions. And therefore, the basic managerial idea introduced by systems thinking is that to manage a system effectively you must focus on the interaction of the parts rather than their behavior taken separately" What is the difference between the "behavior" of the separate parts and their "interaction"? What is the purpose of each? Can you think of examples in your organization and in other organizations?

THE EDUCATIONAL SYSTEM

24. Arvin Mueller of General Motors says, "Business is part of the educational system, a receiver of the output or product of educated people. The product of education is inadequate because we're spending a tremendous amount of money in rework. How can we get a definition of the system of education?" How would you answer this question? Do you see business as part of the educational system?

25. Dr. Deming answers, "The system must be defined, the aim stated, and [the system] must be managed." How does stating the aim of a system contribute to the definition of the system? Why does he say the system must be managed? What happens to an unmanaged system or a system managed by someone who does not understand synthesis?

26. Dr. Deming continues, "Quality is what will help a customer and entice him to buy. Now what do we mean by quality in education?" Which is more important, the ability to think or to pass tests? What are some of the traditional measures of quality in education? In the educational system, who determines what quality education is? (See the flowchart of the system of education.) In all cases who is the judge of quality in Dr. Deming's philosophy?



EDUCATION VIEWED AS A SYSTEM

Prepared by W. Edwards Deming, Ernest Mueller, and Arvin Mueller

27. Lloyd Dobyns comments on the flowchart of the educational system drawn by Arvin Mueller, his brother Ernie, and Dr. Deming. "It is not unlike a manufacturing flowchart, and it is one way to get people to think of education as a system. That is difficult because we are always trying to reform parts of it. We keep looking at the parts, rather than the whole." What are the similarities between this simplified flowchart and Dr. Deming's 1950 chart for the Japanese? Do you agree with this definition of the system of education? What would you add? What would you change?

Mr. Mueller says the aim of education is "in the grandest sense, improving the well-being of society." What do you think?

REDESIGNING A SYSTEM

28. Dr. Ackoff says, "The question of how [to] get people to think systematically was best answered by a vice president of Bell Telephone Laboratories, when he invented a procedure that has come to be known as 'idealized redesign'. What he said is, 'The only way we can think creatively about a system is to assume it was destroyed last night – it no longer exists. If you don't know what you would do when you can do whatever you want right now, then how can you possibly know what to do when you can't do whatever you want?'" What is the starting point for "idealized redesign"? Have you ever used this tool for thinking about a problem? What is the advantage of assuming that the present system has been destroyed?

28a. Dr. Ackoff answers the question, "That forces you to study the whole instead of the parts taken separately." What is the direction of inquiry in each study of the whole (of a system)? Toward larger or smaller purposes?

29. Dr. Ackoff explains, "You redesign the system as a whole and then derive the property of the parts from the properties of the whole as opposed to analytical design where you start by taking the parts and extracting the properties of the whole from the characteristics of the parts." What are the likely results of proceeding analytically to design a system? What would be the purpose of proceeding in that way to design a system?

Suggested Activity (*Contributed by Dr. Susan Leddick*)

- *Idealized Redesign:* Do an idealized redesign for your class, school, district, company, department, division, or agency. Ask what you can do today that will start to bring the current system closer to the idealized one.

Suggested Follow-up Questions (Contributed by Mr. Mark Richie)

- Once the idealized redesign activity is complete, ask these follow-up questions: Is your system part of a larger, containing system over which your group has no control? What are the characteristics of the containing system that may impose limitations on the idealized redesign process? Will synthesis help your group understand the relationship of the redesign process to the larger containing system? Is there a place for analysis in the redesign activity?

30. What does Dr. Ackoff refer to when he says, "We've spent an awful lot of time improving the quality of things that ought to be destroyed"?

A NATIONAL NEED FOR SYSTEMS THINKING

31. Dr. Ackoff continues, "You can take almost any aspect of our society; we haven't rethought the design of it for many years. As they become dysfunctional we institutionalize that dysfunctionality. We have to redesign most of our products and not merely improve the quality of the existing product." How does "dysfunctionality" arise in large systems? What are examples of institutionalized dysfunction in education?

32. David Langford states the same thought in this way: "This whole process gets you to look at how your system operates, how you can improve the system, and how you can work with society. Or if you're in business, to improve processes as a whole instead of just trying to improve tiny parts of that system. We've been [doing] that for years, and it hasn't given us any systemic change or improvement in the whole process." Can you think of examples of efforts to "improve tiny parts" of a system instead of looking at the whole?

Suggested Activity (Contributed by Dr. Susan Leddick)

- Map existing mandates or improvement initiatives on the idealized system flow diagram. How many fit several "parts" of the system? How many attempt to change a little piece of the system?

ON LEARNING AND TEACHING

33. Dr. Ackoff says, "Most discussions of education assume that the best way to learn a subject is to have it taught to you. That's nonsense. We've all learned our first language without having it taught to us, and we never learn a second language as well through a teacher. And most of what we use professionally we learned on the job, not in school. Most of what we learned in school is either obsolete, out of date, or wrong. On the other hand, anybody who has ever taught knows that teaching is a wonderful way to learn; therefore, if we want people to learn, we have to make them teach. We have to reexamine the fundamental assumptions about teaching, about courses, the sequence in which subjects are taught." How did you go about learning in school? How were you taught to learn? How did you learn best? What kinds of things have you learned as a result of teaching somebody something that you might not otherwise have learned? Think of an example. What do you think about Dr. Ackoff's assertion that "most of what we learned in school is either obsolete, out of date, or wrong"? How would you make learners teachers?

34. Lloyd Dobyns sums up: "The idea is for students to learn how to learn. The world is changing too quickly for the memorization of facts to be of continuing value. The old school system has to change – at several levels." How should one learn how to learn? Do you agree that the world is changing so fast that self-directed learning must replace memorization? How should curricula be redesigned to facilitate learning? How does this affect your thinking about the redesign of education? About the relationship of education to work? How does it relate to idealized redesign?

INFLUENCING A SYSTEM

35. Dr. Ackoff discusses the challenges of influencing system change: "Which system are we talking about? Are you talking about a school, a city's educational system, the national system, or what? It's always the largest system over which you have control – [that] you have access to. There is no point in designing a system that you can't affect, and therefore you design the largest system you *can* affect." What does Dr. Ackoff mean by "largest system over which you have control... access to"? Why do you want to design (or redesign) the largest system that you can affect? What does this have to do with synthesis versus analytical thinking?

Suggested Activity *(Contributed by Dr. Ronald Fielder)*

- Lead a discussion to identify the worker. Is it the teacher or the student? Who is the customer? Who is the supplier? What is the changing role of the teacher? Are there corresponding roles and changes of roles in business?

Dr. Ackoff continues, "But that is the beginning, not the end. Because once you've designed – from scratch ideally – the system that you can do something about, you must then confront the following question: How can the containing system be modified so as to enable you to improve your design of the system you have just completed? So you enlarge the scope of your design effort." Why not try to redesign the larger; containing system that you are aware of but cannot affect (influence)? Is the sequence of system design efforts important? Why is it important to modify the larger containing system so as to enable you to go back and make more improvements to the design of the system you have just completed? (See Questions 36 and 37 for the story of Eastman Kodak. How were the larger and smaller containing systems modified to make further improvements to the smaller systems?)

THE PROGRESSION TO REDESIGN OF LARGER SYSTEMS

36. Lloyd Dobyns suggests an important effect of system redesign: "Because the changes can be so huge, idealized redesign can lead you to places you never thought you'd go." Is the process of idealized redesign likely to result in innovative ideas? Does everybody welcome innovation? Do you? Dr. Ackoff tells the story of Henry Pfendt and the redesign of corporate computing centers and Eastman Kodak that led to the combining of three centers; the combining of three telecommunications centers; the joining of computing and telecommunications into a corporate technology department; and finally partnership with IBM to do all computing for Eastman Kodak, and Digital Computing to do all telecommunications for the company.

37. Lloyd Dobyns sums up: "By looking at progressively larger systems as a whole – by using synthesis instead of analysis – Henry Pfendt changed Kodak. If we continue to think of progressively larger systems, eventually we will get our entire society and how it is organized." What are the steps in thinking progressively of larger systems? Was Henry Pfendt able to influence the larger systems of Kodak and Kodak in partnership with IBM and Digital Computing alone?

PLAYING, LEARNING, AND WORKING

38. Dr. Ackoff says, "The greatest sin of analytical thinking – it goes back to the Renaissance where we analyzed human activity and divided it into three categories: work, play, and learning. We then developed institutions for each of them taken separately so that you have a school where you're supposed to learn but not do anything

useful, and certainly not have any fun. You have things like country clubs or baseball stadiums where you're supposed to have fun but not do anything useful or learn anything. And you have a place of work where you're supposed to get something done, but not learn anything or have any fun. We're beginning to become aware that we need a reintegration of work, play, and learning." Why has society organized itself in these ways? What could be some of the results of reintegrating working and learning, playing and working, or learning and playing as Dr. Ackoff suggests? How could this be done? Are there reasons not to?

39. Dr. Ackoff observes, "The distinction between work and learning is beginning to break down. The quality of work life movement is trying to break down the distinction between work and play." Where do you observe this happening? How do you feel about it?

EDUCATION AND THE ECONOMY

40. Lloyd Dobyns cautions, "It would be a mistake to think that if education meets our economic needs, that's all we should ask." What other needs besides preparing people to do useful work should education satisfy?

Dr. Deming draws a connection between the quality of work life movement – breaking down the distinction between work and fun – and joy in work. He says, "When I understand who depends on me, I may take joy in my work:" Think about this in terms of the flowchart on page 24. Do you agree that this is a major ingredient in joy in work and quality of work life? What else contributes to the integration of fun and work or joy in work?

DEVELOPMENT OR GROWTH

41. Dr. Ackoff proposes, "The appropriate end of a social system is development, not growth. And our society doesn't yet understand the distinction between them. You can develop without growing, and you can grow without developing. A rubbish heap grows, but it doesn't develop. The measure of growth is standard of living, but the measure of development is quality of life. Development is an increase in ability and competence, and growth is an increase in resources... . Robinson Crusoe was a very developed man because he built a high quality of life with very little resources. We have other people who are loaded with resources that have a very poor quality of life." What is the difference between standard of living and quality of life? Do you think our nation is developing or growing? What are the most important indications of development? Of growth? What contribution is our system of education making to growth in terms of increasing resources? To development in terms of increasing competence and ability to use available resources? What contribution is our industrial system making to

development? To growth? In a time of shrinking natural resources and increasing global economic competition, why might development be more critical than growth?

42. Lloyd Dobyns concludes, "We now have an expensive school system that does not educate. It's not the people, it's the system. The educational system is not organized to produce more for less, which is the aim of the Deming quality method." What does it mean to produce more for less in an educational system? Why is this an important aim today? What do you now think the educational system is organized to produce? What has this to do with quality?

SUGGESTED CLOSURE ACTIVITY (*Contributed by Dr. Ronald Fielder*)

Ask participants to identify one practice or approach they will change as a result of their learning. Have them identify the practice or approach, design steps for change, and build in future opportunities of the group to share in their progress as a group or one on one.

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