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INTRODUCTION: THE BIRTH OF AN IDEA

"Gentlemen, the telephone system of the United States was destroyed last night."
—CEO of Bell Laboratories

Idealized design is a way of thinking about change that is deceptively simple to state: In solving problems of virtually any kind, the way to get the best outcome is to imagine what the ideal solution would be and then work backward to where you are today. This ensures that you do not erect imaginary obstacles before you even know what the ideal is.

Nothing better illustrates the power of this idea in action than the experience that one of the authors, Russell L. Ackoff, had many years ago. The experience both enlightened him and proved to him that the idea could facilitate profound change in a major corporation. To relate the experience, this author "steps forward:"

> In every life, there are seminal experiences that exert their influence on a great deal of experience that follows. The one that is responsible for this

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book took place in 1951. I was then a member of the faculty of Case Institute of Technology in Cleveland, Ohio. (It had not yet merged with Western Reserve University.) On a consulting trip to New York, I drove down to Bell Labs in Murray Hill, New Jersey, to see Peter Meyers, a manager whom I'd met when he had come to Case to recruit promising graduate students for the labs.

It so happened that on the day of my visit he and other managers had been summoned to an important—but last-minute—conference by the vice president of Bell Labs. After some hesitation, Peter Meyers said, "Why don't you come with me?" I pointed out it was a meeting for section heads and I was not even an employee of the labs. He said that no one would know the difference.

We arrived at a typical classroom that held about forty people and was almost full. The vice president was not there yet. Nor did he appear on time. This was very unusual. He was a big man, extroverted, and voluble. He could not get near someone without punching, pinching, pushing, hugging, or pounding them on the back.

About ten minutes after the hour, the door to the room squeaked open. All eyes turned to it, and there he was. He was obviously very upset. He was a pasty gray and bent over as he slowly shuffled down the aisle without a word to anyone. He mounted the platform, stood behind the podium, put his elbows on it, and held his head in his two hands, looking down.

The room was dead silent. Finally, he looked up and in an uncharacteristically meek voice said, "Gentlemen, the telephone system of the United States was destroyed last night." Then he looked down again.

The room broke out in a hubbub of whispered conversations saying that his statement was not true. Many in the room had used a phone that morning. The vice president looked up and said, "You don't believe the system was destroyed last night, do you? Some of you probably used the phone this morning, didn't you?" Most of the heads in the room shook with assent.

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The vice president began to tremble with rage. He shouted, "The telephone system was destroyed last night and you had better believe it. If you don't by noon, you'll be fired."

He then looked down again. "What was wrong with the VP?" everyone was asking each other. But because discretion is the better part of valor where one's boss is involved, the whispers stopped as all waited for further word from him and an explanation of his erratic behavior.

The vice president looked up and glowered at the group. Then he suddenly straightened up, his normal color seemed to return, and he broke out in a great big belly laugh. All those in the room also began to laugh. They did not know why they were laughing, but it released the tension that his unusual behavior had created. It began to dawn on all of us that his behavior had been a trick.

After the laughter died down, he said in his normal voice with his normal demeanor, "What was that all about? Well, in the last issue of the *Scientific American*," he said, "there was an article that said that these laboratories are the best industrially based R&D laboratories in the world. I agreed, but it got me thinking."

He reached into the inside pocket of his jacket and withdrew a piece of paper and said, "I've made a list of those contributions to the development of telephonic communications that I believe have earned us this reputation. Before I share my list with you, I'd like your opinions. What do you think are the most important contributions we have ever made to this development?"

Almost every hand in the room went up. He called on one of those with a raised hand. He said, "The *dial*." "Right," said the vice president. "This is certainly one of the most important. Do any of you know when we introduced the dial?" One in the room volunteered a date in the 1930s. The vice president agreed. He then asked, "When was it developed?" No one knew.

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He said he had not known either but had looked it up before he came to the meeting. He said, "It was before 1900." We were surprised to say the least. He pressed on, asking for another candidate. The next one offered was *multiplexing*, a way of transmitting multiple conversations simultaneously over one wire. This yielded an enormous increase in the capacity of AT&T's network. "Right," the vice president repeated. He once again asked when it has been introduced. Someone knew it had been between the two world wars. The vice president confirmed this and asked, "When was it invented?" No one knew. Again he revealed that it was before 1900.

He asked for one more suggestion. The person he called on said, "The *coaxial cable* that connected the United States and Great Britain." The vice president agreed and asked when it had been built. Someone knew: 1882.

"Doesn't it strike you as odd," he said, "that the three most important contributions this laboratory has ever made to telephonic communications were made before any of you were born? What have you been doing?" he asked. "I'll tell you," he said. "You have been improving the parts of the system taken separately, but you have not significantly improved the system as a whole. The deficiency," he said, "is not yours but mine. We've had the wrong research-and-development strategy. We have been focusing on improving parts of the system rather than focusing on the system as a whole. As a result, we have been improving the parts but not the whole. We have got to restart by focusing on designing the whole and then designing parts that fit it rather than vice versa. Therefore, gentlemen, we are going to begin by designing the system with which we would replace the existing system right now if we were free to replace it with whatever system we wanted, subject to only two not-very-restrictive constraints."

"First," he continued, "let me explain why we will focus on what we want right now, not out five or ten years. Why? Because we know that where we say today we would like to be five years from now is not where we will want to be when we get there. Things will happen between now and then that will affect our goals and objectives. By focusing on what we want right now, we can eliminate that potential source of error."

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"Second, why remove practically all constraints? Because if we don't know what we would do now if we could do whatever we wanted, how can we know what to do when we can't do everything we want? If we knew what we would do with virtually no constraints, we could modify it, if necessary, to become feasible and adapt it to changing internal and external conditions as time goes on."

"Now, here are the two constraints. First, *technological feasibility*. This means we cannot use any but currently available knowledge. No science fiction. We can't replace the phone with mental telepathy. The second constraint," he said, was that "the system we design must be *operationally viable*. What does that mean? Because we are not changing the environment, it means that the system must be able to function and survive in the current environment. For example, it will have to obey current laws and regulations."

The vice president then said, "This group is too large to operate as a single group. Therefore, I am going to divide you into six subgroups of about six each, each with responsibility for a subsystem. Each group will select a representative to meet with other representatives at least once a week to discuss interactions. Let me explain.

"Each group will be able to design whatever it wants as long as it does not affect any other group's design. If what a group wants to do does affect one or more other groups' designs, it must get their agreement before it can be included in their design. I can tell you in advance," he said, "that the groups will do little that does not affect other groups. At the end of the year," he said, "I want to see one completely integrated system design, not six subsystem designs. I don't even want to know what the individual teams came up with. Is that clear?" he asked.

He created a "long lines" (inter-city communication) team, a "short lines" (within city communication) team, a switching stations team, two other teams, and finally the telephone set team, on which I found myself with my friend Peter Meyers.

When the meeting was adjourned, the teams immediately gathered so that their members got to know each other. When

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Peter introduced me to the other members of our team, they thought it very funny that an "outsider" had successfully invaded their meeting. But, they said, the vice president had not precluded their use of "outsiders." Therefore, they invited me to participate in the effort. As a result, I spent a great deal of time in the next year with that team. What a learning experience it was!

The first meeting took place after lunch that day. The seven of us, six from the labs and I, met in a small breakout room. After the amenities, we discussed where we should begin. We decided to list the properties we wanted a telephone to have. We noted suggestions on a pad mounted on an easel. The first few were as follows:

- Every call I receive is intended for me—no wrong numbers.
- I want to know who is calling before I answer the phone so I need not answer it if I don't want to speak to the caller.
- A phone I can use with no hands.
- A phone that comes with me wherever I am, not one I have to go to in a fixed location.

We continued to add to this list for several weeks, ending with just more than ninety properties we wanted a phone to have. These properties became very complicated near the end. For example, we wanted to be able to talk simultaneously to groups in multiple locations, see all of them, and be able to transmit documents or charts instantaneously.

But we ran dry. We noted, however, that we had designed nothing yet, so decided to try our hands at it. We decided to select the first property on our list—no wrong numbers—and see if we could design a phone that met this requirement.

At this point, I almost destroyed my credibility in the group by pointing out that there were two kinds of wrong numbers. One consisted of having the right number in one's head but dialing it incorrectly. The other consisted of having the wrong number in one's head and dialing it correctly. One member of

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the group immediately pointed out that if one had the wrong number in one's head and dialed it incorrectly, one might get the right number. Fortunately, the group decided this was too rare to be of concern but that the percentage of wrong numbers of each type was of concern.

Here I was able to save my credibility a bit because I knew the head of the psychology department at the labs. I called him using the phone in the room. After the amenities, I asked him if he had ever done any work on wrong numbers. He exploded on the other end of the line. It was minutes before I could understand him. It turned out that he had been doing work on wrong numbers for a number of years, and I was the first one to ask him about it. He wanted to unload all his results on me. I had to convince him otherwise. After he calmed down, I learned that four out of five wrong numbers were the result of incorrectly dialing the right number in one's head. We decided to go to work on this.

An amazing thing happened; in less than an hour, we found a way, conceptually, to reduce, if not eliminate, such errors. We replaced the dial by—what did not exist at that time—a small handheld calculator. There were ten keys, one for each digit, a register, and a red key in the lower-right corner. The phone was to be used as follows. Leaving the phone "on the hook," one would put into the phone the number one wanted to call by pressing the appropriate buttons. These numbers would appear on the register. If these numbers, on examination, appear to be correct, one would lift the receiver and the whole number would go through at once. If the number on the register was wrong, one would press the red button in the corner. This would clear the phone, and one would start over.

We were very pleased with ourselves, but nevertheless we recognized that we did not know whether such a phone was technologically feasible. (The handheld calculator was not yet available.) Therefore, we called a department of the lab that worked on miniaturization and asked for technical help. They sent two young men down to our meeting. They appeared to be fresh out of school, still wearing their intellectual diapers.

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As we described what we were trying to do, they began to whisper to each other and were soon more absorbed in their private conversation than in what we were saying. This bothered us, but such behavior was not entirely unexpected in an R&D laboratory. However, they suddenly got up and hurried out of the room with no explanation. We were furious but decided to let it pass for the time being. We went on to another property.

Several weeks later, the two young men appeared at one of our sessions looking sheepish and apologetic. They said, "You probably wondered why we ran out on you when we were here last." We told them this was an understatement. They explained, "We were very excited by what you were doing but not for the reasons you were. We did not want to take the time to explain. That wrong-number stuff was not as interesting as the buttons."

They went on, "We went back and built a push-button telephone and tested it on a very large number of people. It turns out to take about twelve seconds less to put in seven digits by pushing buttons than turning a dial, and additional time is saved by not occupying a line until after the number is put in and the receiver is picked up. The combined saving in time is worth millions to AT&T," they said, "so we have started a project to develop that telephone. We have given it a code name that is being kept secret for now." They looked around the room to be sure no one was listening and then told us, "Touch tone."

Before the year was over, the groups had established the technological feasibility of each of our many design features. The group of design teams continued to work after I was no longer a participant, and they anticipated every change in the telephone system, except two, that has appeared since then. Among these are touch-tone phones, consumer ownership of phones, call waiting, call forwarding, voice mail, caller ID, conference calls, speaker phones, speed dialing of numbers in memory, and mobile phones. They did not anticipate photography by the phone or an Internet connection.

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> The impact of the design we produced was greater than the impact of any other effort to change a system that I had ever seen. As a result, I began to adapt and modify the procedure to fit such other applications that we describe in this book. As you will see, its use has been extensive and is still growing.

This experience is a convincing example of how *idealized design* can literally move mountains of change. However, applying the process involves not only discarding old mindsets that inhibit creative thinking but knowing the steps that we have learned work best in applying it. The book is intended to take you through the process with many examples of different organizations in different industries.

THE PLAN OF THE BOOK

The book is organized to give you a roadmap for finding the most valuable sections that match your particular interests and needs. Part I, "Idealized Design: The Basics," describes the basic ideas of idealized design and the steps that managers need to take to implement it. Chapter 1, "The Stages of Idealized Design," explains the basic stages of a fully implemented idealized design. Chapter 2, "Organizing the Process," describes how to organize a successful design. Chapter 3, "Preparing for an Idealized Design Process," makes the case for the importance of careful preparation and provides essential guidance about how to prepare. The object of these three chapters is to give you a comprehensive understanding of the design process so that in later chapters we can concentrate on the important aspects of each topic without having to repeat all of the steps that led to the outcome.

Part II, "Idealized Design: Applications—The Process in Action," describes idealized design in action and applied in a variety of organizations and processes. Chapter 4, "Business Enterprise," looks at entire business organizations that are forced to respond to market conditions and change or lose out to competitors.

Chapter 5, "Not-for-Profit and Government Organizations," demonstrates that idealized design is as powerful a tool for not-for-profit and government organizations as for business organizations.

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Chapter 6, "Process Improvement," discusses processes and shows how idealized design can be used to improve processes in a widely diverse group of organizations.

Chapter 7, "Problem Dissolving," describes the four ways of approaching problem solving and demonstrates that the most effective approach is "dissolving" the problem. Dissolving a problem invokes idealized design and results in the problem going away permanently.

Chapter 8, "Facilities and Sites Design," looks at facilities and sites and combines the factors of function and space that need to be reconciled to produce the optimum arrangement of elements.

Chapter 9, "Take the Plunge," brings together our accumulated experience in working with idealized designs and provides hands-on practical advice for conducting a successful design.

Part III, "Idealized Design: No Limit—Applications to World Challenges," takes a wider view of what can be achieved using idealized design by applying it to some of the major challenges facing the world today. Chapter 10, "The Urban Challenge," addresses the challenge of urbanism and describes a small car that is ideally suited to operating in cities. The chapter then describes how idealized design was applied to a redesign of Paris—and the national system of which it is a part—in a project that has had a continuing impact on France to this day.

Chapter 11, "The Health-Care Challenge," explores how the seemingly intractable challenge of the health-care system can yield to the power of idealized design. The chapter first describes a national health-care system for the United States that would deliver care equitably to all citizens. It then explains how health-care malls can deliver care at the point of contact between patients and health-care professionals that is both humane and effective.

Chapter 12, "The Challenge to Government," looks at the challenges that governments face and describes how idealized design can be applied to deal with problems of a national and international nature. The chapter first examines a national

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elections system—as a part of a larger redesign of government—that would raise the proportion of eligible voters who turn out in elections and at the same time improve the quality of candidates for public office. It then describes a new international organization that could either replace the present United Nations or be formed in addition to it that would solve many of the problems of international wars and conflict that the U.N. has failed to achieve. Finally, the chapter addresses perhaps the biggest threat to nations today: terrorism. It applies idealized design to one of the root causes of terrorism and explains how if the causes were eliminated, there would be fewer terrorists and terrorist attacks.

Part IV, "Complete Idealized Design," provides three complete idealized designs. These are actual designs drawn from examples in the applications in Part II. We discuss these examples in the applications chapters but only reprint excerpts from their final idealized designs. Readers should find the details of the complete designs of value if they want to embark on an idealized design of the kind described in one or more of these chapters.

A SURPRISING INGREDIENT

If our description of idealized design so far sounds mechanical and dry, our experience with it is exactly the opposite. There is a very important aspect of idealized design that is not normally discussed: Participation in preparing such a design is great fun.

The removal of constraints, allowing the free exercise of imagination, is a liberating and exciting experience. To engage in it is to play god in a limited universe and to enjoy the creative experience that any creator must have. In every design exercise, there is a point, usually fairly early in the process, when an "aha" experience moves the design group through a threshold that takes them out of the existing system into the realm of the newly possible.

Adding to the pleasure, rank is irrelevant within design groups; there is no hierarchy. Rank is deposited at the door. This removes the fear of retribution for what is said in the sessions by

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subordinates. This relief is augmented by the fact that the effort is not directed at criticizing the current system or attributing blame for its deficiencies, but in conceptualizing a better one.

Because participation in idealized design is fun and liberating, it is usually easy to obtain and maintain. And because all who are involved, directly or indirectly, share ownership in the output, implementation is greatly facilitated. The plans directed at realization of the design or an approximation to it are not seen as a separate kind of activity but as an integral part of the design process. The fact that aspects of the design are seen as implementable long before the design is completed reinforces the inclusion of implementation as part of the design process.

USING THIS BOOK

We encourage readers to read this book from beginning to end. However, we know from our own experience—and through talking to others—that many, perhaps most, readers skip around in books looking for the most interesting parts, or the parts that relate to their immediate concerns.

So to help guide those who want to skip, let us suggest that you read all of Part I to get a firm grasp of the process of idealized design. Then skip to those applications chapters in Part II that are of most interest or importance to you.

We also strongly suggest that you read the chapters in Part III to open your thinking to the possibilities of using idealized design to address major challenges in the world today. We think there is no limit to what can be accomplished in the world using the tool of idealized design.

In Part I that follows, we take you through the process of implementing an idealized design. The emphasis is on the general application of the process, not on specific applications. That is the subject of Part II.

We welcome you to the journey you are about to begin.

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