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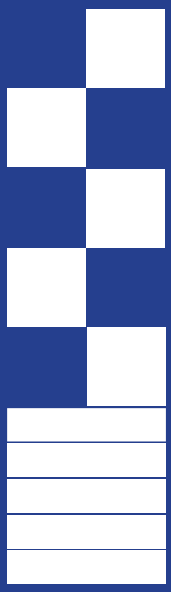
Creativity: Process and Personality

Larry Gross



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CREATIVITY

Process and Personality

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Chapter III: Herbert A. Simon: How do People Make Decisions?

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The interview on which this case-study is based, differed in some aspects from the interviews which form the bases for the other case-studies presented in this paper. It took place on April 27, 1963, at the Carnegie Institute of Technology Graduate School of Industrial Administration in Pittsburgh. The actual interview lasted approximately 6 1/2 hours, of which 4 1/2 hours are recorded on tape. At that time the research project was in its planning stage and this first interview served as a pilot study. It was only after this interview that the outline-structure presented in Chapter II was developed, partly on the basis of this first experience. However, the structure of that interview was fairly similar to the later outline. The main difference was that, while the main headings were the same, there was more emphasis on the production of the specific products discussed and on the preparatory processes (especially education) than on the motivational and personality factors. For that reason the case-study that follows will be more detailed in some areas and practically blank in others. In many ways it is better than the others, mainly due to the time available and to the ability of the subject to recollect relevant details.

The subject in this interview was given an outline of questions and topic headings, which served the same function as the one given in Chapter II. This outline was 8 pages in length, and I will not reproduce it here. The questions were more specifically related to Simon's work than those in the later outline. This contributes to the lack of comparability. However, the headings were substantially the same: "Social environment (teachers, colleagues, students, clients); Personal background, motivation; Preparation; Production; Product characteristics; Judgment." The presentation will follow this general outline, and, insofar as feasible, the outline of the other studies as given in Chapter II.

Herbert Simon can certainly be termed a psychologist, although this would be far from an exclusive definition. Although currently a Professor of Psychology (in the Graduate

School of Industrial Administration, Carnegie Institute of Technology), he never had so much as a single course in psychology. His formal training, as we shall see, was in political science and administration. He has been a Professor of administration and has made some of the most significant contributions to modern administrative theory. He has pioneered in the use of mathematical tools in the social sciences and particularly in the use of the computer as a tool for investigating human cognitive processes. He is one of the most prolific social scientists alive. He has written, alone or in collaboration, fourteen books, and approximately 200 articles. He might easily hold the record for distribution of publications in many fields. His books range from administrative theory to mathematical-psychological models to economic and fiscal theory. His articles have been published in administrative, economic, sociological, psychological, mathematical, engineering, political, and industrial journals. Yet Herbert Simon claims that all of his work has been essentially unified, and that there is a central theme which runs through all of his varied products, however disparate they may seem superficially. This theme may be termed as a preoccupation with one question, and with its many implications, namely: "How do people make decisions?"

Background—Childhood

Herbert Simon was born in 1915, in Milwaukee, Wisconsin. His father, an engineer, had emigrated from Germany. "My father had a younger sister, and no other siblings. He grew up on a farm in Germany and was sent away to be educated. His father thought he ought to be a banker, but he thought he ought to be an engineer, so he became an engineer. He came over here just after he finished his engineering work."

An important influence on the young boy was his maternal uncle, an economist. "My mother had a younger brother, he was 2 or 3 years younger than she. He didn't live in Milwaukee, but he would come home for vacations. He was the favorite uncle, who always brought presents. There was always a warm relation but not any intellectual contact. But he was then sort of a symbol—for my mother and my grandmother. (My mother, I am sure, had very ambivalent feelings toward him. I am sure that underneath there was a fair amount of hostility.) My grandmother lived with us off and on through most of my life till high school. My grandfather died about the time the uncle died, when I was very young. My uncle was the symbol of about all that was perfect to my grandmother. When I got Phi Beta Kappa, I inherited his Phi Beta Kappa key, which was something I knew I was going to do for ten or fifteen years."

"I had one brother who was five years older than I. I was sort of close to being an only child, although I had a good deal to do with him, we fought like cats and dogs. But I ran after him, which maybe was the reason we fought." The question of sibling rivalry here is, I think, a relevant one. Simon's response to the question as to whether there was real

sibling rivalry was quite positive, and it illuminated an important factor, I think, in the development of strong achievement motivation. He recalled an incident in point, taking place when he was quite young.

"My brother was and is a pretty bright guy, who had a terrible time in authority relations with my father. My father still was a German when he came over, was much milder by the time I was born. He and my brother had their problems, in the usual way, and I was sort of the fair-haired child. Which I am sure my brother resented, and if he didn't, I don't know why not. I never had a real feeling of competition with him, in any conscious sense, but I am sure I competed with him like the devil. And I am sure I made his school life miserable for him, so that he lost all ambitions in this direction. He finally went into law, but not through any love, any love he was willing to express, at least, of academic things. So he got the short end of the stick." (It is important in this case, as in others, to remember that we are dealing with subjective impressions from a biased source. This is one of the advantages as well as a disadvantage of this method. The value of this data, where it is better than dry vita data, is in the recollections of the adult and the choice of incidents and facts as well as impressions. In many ways this is more informative than the actual facts, which will not necessarily reveal anything of the individuality and uniqueness of each subject. Certainly as much, if not more, can be learned from the coincidence and divergence of opinion, as from the comparison of such facts as constellation and religion. One further point—we should, it seems to me, keep in mind the nature of the sample. These subjects are all academic psychologists, as well as creative thinkers. We must expect their values and opinions to be influenced by their professional affiliations. By this I mean that they will tend to over-emphasize the value of the academic and scientific professions over other, perhaps equally open to creative endeavor, professions.)

Back to sibling rivalry. "I recall one incident when my brother was doing some problem in algebra—four men plow five fields in two days and so on—and my father was helping him, which was pretty rare because my brother was pretty good at math. And I walked up and said 'Oh, I can do those.' And my father said something like 'I don't think you can, but if you think you can, and you can do them, I'll give you five bucks.' And so I worked and slaved, I didn't know a bit of algebra, and I didn't get anywhere. It's an example of brashness which I am sure was not the only one."

The question of religion is tied up with the subject of feelings of apartness that Simon felt as a boy. In this area he covered a number of factors, personal and social, which contributed to a general feeling of distinctness and individuality, which seems to have been fairly strong. This is one factor which is common to most of the subjects here and is probably one of the more important characteristics of their personality formation in childhood.

I asked Simon whether he thought that as a child he felt apart from his peers. "Yeah, I think this would fit. First of all, anyone who is real smart feels excluded, that may be too strong a word, but feels different, separate. And I always had this feeling. Spent a lot of my time in intellectual pursuits of one sort or another. Outdoor pursuits of a less social variety, collecting insects. Though I did a good deal of camping and hiking. Some social isolation, though not a tremendous amount of real social isolation. I always managed to find friends who were intellectuals also, some are college professors now—two of my high school friends I can think of right offhand are. But still a kind of feeling that there was a good deal of differentness between people who liked intellectual things and other people. Secondly, always a consciousness of being Jewish. Even though my family was not religiously Jewish. Still a consciousness of being a minority group member who couldn't get up in church and say, 'I believe in Jesus Christ and all the saints.' Although in that community I was very close to a church group, a congregational church, which maybe emphasized the separateness. I grew up in a community where there were no Jewish families around. We were not connected with the Milwaukee Jewish community. It consisted simply of a consciousness, an unwillingness to reject the identity with the Jewish background."

To the question, "did you feel that you were persecuted because of your intelligence or your religion?" he answered: "I don't really think so. I was pretty successful academically. I usually got the kind of things I wanted, life wasn't always happy, but I don't recall any feelings of persecution. In fact, I can recall much more poignant feelings of persecution when somebody jumps on me in print than anything I remember from my childhood."

It is probable that these feelings were more a matter of subjective feelings than of overt manifestations, for he was clearly not a social isolate. "I recall, in junior high school, taking some kind of personality test that had an extroversion-introversion scale, and I scored way out on the end of the introversion scale. Which probably reflected some inner attitudes, because at the same time I was extremely active in high school organizations. There was the debating club, which I was president of at one time, the Hi-Y Club (nonsectarian religious organization), the science club... I was a campus politician... I was interested in political phenomena. A friend and I built a little political machine which we had fun with... We liked to participate in organizations like this, we liked to run them and found means of doing it. We were active enough in voluntary organizations—the active people who get elected to office because they will do something."

This liking for participating in groups has characterized Simon's professional life also. It is expressed in an ability and a liking for working in collaborative groups, and an interest in administrative affairs that characterizes much of his academic work.

One of the most interesting elements in the factor of apartness is a physical one. This, too, we shall find to be frequently important for our subjects, though none as unusual as this case, and may be quite readily interpreted in Adlerian terms, as far as they go.

"On the separateness, it's a curious thing, but I don't think it is irrelevant—from a very early age I was quite conscious of being color blind. This always seemed to me to be as much a matter of separateness as either my intellectual abilities or my Jewishness. I am sure I didn't phrase it that way then, but later on, I always thought that this had something to do with my intellectual development. If you were color blind, you had to be a nominalist, and if you were a Jew in a Christian society, you couldn't be ethnocentric. So, it always seemed to me that this was quite congruent with the unproblematic character of my positivism. The reason why positivism just seemed obviously right to me. Well, this may be a rationalization. But, from the time I was quite young, the fact that people would ask me, 'Well, how does it look to you?' was quite striking and I understood the fallacy of the question."

"One other thing. I was left-handed. The left-handedness was ambiguous enough so that they were able to get me to write with my right hand... As a result I am kind of ambidextrous."

Intellectual Development

Herbert Simon began to develop intellectual interests at a young age. These interests included both mathematical-physical and social scientific areas. And while the social sciences predominated after a while the mathematical interest was always very strong.

"In high school I always liked my math and science courses, well, I liked most things pretty well. But I liked math and sciences a good deal, sciences more than mathematics. Why didn't I go into the physical sciences? Because I had, among other reasons, an excellent high school physics teacher who made physics sound like the completed science. It wasn't that we didn't do things; we had a good lab, and we worked hard at it. But somehow or other it was classical physics, and you got the impression that all the exciting stuff had been done. I like excitement. So I think this had a good deal to do with it."

There was also an interest in games and game theory that has figured in much of his later work. "I played chess fairly seriously for a couple of years, kind of a passion, got interested in the theory of what was going on, and in that connection I wrote out the complete game tree for tic-tac-toe to persuade myself that the game is drawn if both players play correctly. It was a little more manageable than chess." (Simon is currently working on a program, among others, for chess.)

The influence in the direction of the social sciences came more from independent reading and family factors. "We had an old economic textbook around the house; I went through that pretty carefully. I went through William James pretty carefully. I had an uncle who was a student of John R. Commons, and although he died when I was 5 or 6, I suspect this made the idea of social sciences, economics, much more meaningful to me."

"My father was an engineer with a strong scientific bend. Very much interested in public affairs. During the depression, like most engineers, who are really technocrats at heart, he got interested in ways of dealing with the economy. He fell in with an engineer who had an economic theory, it doesn't sound quite so wild now, he had an hydraulic model of the economy, it sounded pretty wild then. But, again, the idea that you could deal with this thing as a system and make theory about it, I am sure rubbed off a bit. And I think it was some combination of exposure to the social sciences, more than most kids had, and I wanted to be a scientist, oh!, certainly from the time I was a junior in high school. But the idea that there was no reason why you couldn't do it right here in the social sciences, as well as the natural sciences, and that the bigger and more exciting problems were there. When I went to the University of Chicago I pretty much knew that I was going to be in the social sciences. I guess I started out to major in economics, and I worked within a mixture of economics and political science, which I think turned out well."

It was while taking a course in political science at Chicago that Simon chanced on a situation that provoked him to ask the question that he has been answering, in one way or another, ever since. This questioning resulted, eventually, in his doctoral dissertation, at the heart of which lies his most creative concept. The development of this concept is tied in with his entire professional life from the time he initially posed the question, so I think it would be best at this point to abandon the chronological sequence and discuss the nature of this concept.

Bounded Rationality

The product that I identified as Simon's most creative, which judgment he concurred with, is the development of the concept of "Bounded rationality" (Simon, 1957) and the demonstration of why this is crucial to organization and decision making theory.

Bounded rationality is a conceptualization about the nature of the relation of the organism to the world in general, which makes clear the necessity for specific processes such as "satisficing" in order for it to behave adaptively in the world. The concept of satisficing is a definition of the decision making process, which is derived from, and seen with the help of the general definition of cognitive processes as being characterized by bounded rationality (1947, introduction; 1957, Chaps. 14–17).

Bounded rationality was formulated as a contrast to, and qualification of, the mathematical-economic model of rational decision-making. This view of behavior may be summarized as postulating objective rationality as the criteria of choice. The implication must be that the behaving subject "molds all his behavior into an integrated pattern by (a) viewing the behavior alternatives prior to decision in panoramic fashion, (b) considering the whole complex of consequences that would follow on each choice, and (c) with

the system of values as criterion singling out one from the whole set of alternatives" (Simon, 194, p. 80). This one alternative, by this view, is the "optimal" or "maximizing" choice, i.e. the one that will yield the maximum positive consequences.

However, Simon objected, actual behavior is not described by this model. Not only is it an idealized model, it is misleading. Actual behavior falls short of this model in at least three ways.

> (1) Rationality requires a complete knowledge and anticipation of the consequences that will follow on each choice. In fact, knowledge of consequences is always fragmentary. (2) Since these consequences lie in the future, imagination must supply the lack of experienced feeling in attaching value to them. But values can be only imperfectly anticipated. (3) Rationality requires a choice among all possible behavior alternatives. In actual behavior, only a few of these alternatives ever come to mind (Simon, 1947, p. 81).

Simon's argument, presented in slightly more general terms, will be easily understandable to those familiar with the psychological theories of cognitive processes. It was much less acceptable at the time it was originally stated, in 1941, and in particular it was in opposition to the body of economic and administrative theory.

> It is impossible for the behavior of a single, isolated individual to reach any high degree of rationality. The number of alternatives he must explore is so great, the information he would need to evaluate them so vast that even an approximation to objective rationality is hard to conceive. Individual choice takes place in an environment of "givens"—premises that are accepted by the subject as bases for his choice; and behavior is adaptive only within the limits set by these "givens" (Simon, 1947, p. 79).

This is the essential conceptualization of bounded rationality; namely, that completely objective and rational behavior is not possible for human beings because of inherent perceptual and conceptual boundaries of their cognitive processes. From this general proposition he then derived descriptive hypotheses about the nature of decision making in organizations. The final formulation of these was that if we consider decision making the essence of administration, and Simon does, then the "central concern of administrative theory is with the boundary between the rational and the non-rational aspects of social behavior. Administrative theory is peculiarly the theory of intended and bounded rationality–of the behavior of human beings who satisfice because they have not the wits to maximize" (Simon, 197, p. xxiv).

The application of the principle of bounded rationality to organization theory allow us, then, to show that people do not find optimal solutions, but settle for satisfactory ones. This opposes "economic (maximizing) man" with "administrative (satisficing) man." Satisficing man perceives a limited number of alternatives, and he does very limited amounts of consequence probability computation. He sets his level of aspiration—which is determined by the alternatives he hopes to find, and modified by those he does encounter—and he chooses the first alternative that is above this threshold. Rarely does he consider more than a few alternatives at once, usually those he does consider are encountered sequentially, not panoramically, and the first satisfactory possibility is usually "it."

This conception of the nature of rational perception and the resulting nature of rational decision making was presented, in Simon's doctoral dissertation—later the book *Administrative Behavior* (1947), as a more adequate model of descriptions, and as a guide for improved administrative behavior. If one realizes the boundaries of one's rational abilities, one is able to perform better because one can make an accurate appraisal of means-ends relationships and of alternative strategies of action. If one is aware of one's limits, one can more realistically set one's aspiration level, and not waste time trying to maximize when this is impossible. There are many derivative implications from these principles, in fact, the book (1947) might be seen as a thorough application of these principles to formulating an administrative theory.

The concept of bounded rationality extends beyond the limits of administrative theory. It is a model of all rational cognition, and satisficing is a model of most decision making. Simon later used these concepts, for example, in developing a method for computer simulation of human behavior. By postulating a satisficing model he was able to arrive at heuristics for problem solving which did not need to consider the problems of optimal solutions and the processes which characterize them.

Paradigmatic Formulation

In order to trace the process by which Simon developed the concept of bounded rationality, and the influences in this process of various teachers and mentors, we must back-track to the year 1934, when Simon was nineteen.

"In 1934 I was taking a course with Jerry Kerwin in political science. As a term paper I decided to go up to Milwaukee and find out about the organization of recreational facilities up there. Kerwin was writing a book at that time on city governments and independent boards, and recreation was one of them, the Milwaukee system was an interesting set-up, so I guess he suggested that I go up there. I don't know whether I went up between terms or just took off one day, I didn't pay much attention to classes." The accidental nature of the decision to do this study is something we shall encounter in some of the other studies.

"So I wrote a long paper on the organization of recreational facilities in Milwaukee. Mostly it was just a description of how things were organized, and since I hadn't had any organizational theory or the like, I wrote as a journalist might. Someone just describing what he saw in front of his face, and what people told him. But, first of all, Kerwin said, 'Well, this is all very interesting, but why don't you draw any conclusions about how it ought to be organized?' And this kind of amazed me. How was I supposed to draw any conclusions? I had observed an organization, I could tell you how it operated, within limits, and what did this have to do with good, bad or indifferent operation. That comment amazed me. But even before he made it, one thing had struck me about

the organization more than anything else. The recreation activities were run by the school system, but were maintained by a group in the public works department and they got along fine, but they squabbled about the budget. The public works department always wanted to spend more on maintenance and the education department wanted to spend more for hiring recreation leaders. I thought, well, this needs some explaining. I probably tried to understand what went on in terms of what I had learned about decision making in economics, of course in those terms, it doesn't make a bit of sense (demonstrates this). Why is this? I think the kernel of the idea of bounded rationality came out of worrying about that."

The influence of the teacher, Kerwin, was not so much in directing him to perceive this particular question, but in a general push toward more analytical and evaluative observation, toward a more scientific attitude. And it was such an attitude which made it possible to ask the question which engendered his dissatisfaction with economic theories of decision making.

The problem of how people made decisions remained with him during the next few years, and was dealt within some of the courses he took, albeit in terms of the economic model. "I took a course from Clarence Ridley, on municipal measurement, and got interested in the problems of evaluating civil administration, we did the work that resulted in that monograph of ours, in 1936 I think (Ridley & Simon, 1938). And there again, I came up against the problem of how decisions are made, but there we were dealing with it normatively, and I worked within the framework of the economic model. . . Meanwhile I was taking courses in mathematics from Henry Schultz, and a fair amount of economics, and I was taking logic from Carnap. I hadn't had any formal psychology, although I had read William James."

In puzzling over the decision making that went on in administering the Milwaukee recreation facilities, Simon had realized that he had no analytic tools to study these processes. All he know of where the theories of rational decision making as described in economic-mathematical frameworks. But he realized, these did not describe what did actually occur, at best they showed what should occur, in the best of all possible municipalities. From here, we can see how he arrived at the idea that it was necessary either to stipulate that rational decision making was not characteristic of the behavior of the administrators in the Milwaukee recreational facilities, or that it was possibly not characteristic of administrative decision making in general. It was here that he decided to reject this model, and the conceptual framework it presupposed, and to formulate a new one. This corresponds to what we have termed independence of judgment, which allows one to distinguish information from source and to evaluate each on its own merits, in light of empirical experience; which allows one to discriminately select those parts of accepted frameworks which one will accept and those one will reject in the process of formulating significant questions. This was the first step in posing a significant, paradigmatic question, and in outlining significant, implication-laden solutions.

The idea of bounded rationality was clearly formulated in his doctoral dissertation, written in 1941–42. By that time he had already become acquainted with the work of Chester Barnard, his one real mentor. However, he does not report any strong influence on this formulation of any of his teachers at Chicago.

"The thesis was done under Leonard White, but I thought up the project, and I wrote it while I was out in Berkeley. I went out there before I had even started on my thesis in 1939, to head up some studies the Rockefeller Foundation was financing on measurement. And while I was out there I took my preliminaries, then I was writing my thesis while I was there. The Chicago department was fairly permissive, and had been terribly permissive under Merriam, but now White had taken over, but he couldn't remember who had taken what. All he knew about me, really, was that I was a guy who had been around the department when he came back, and people apparently spoke well enough of me so that I was kosher enough around the department. So when I proposed a thesis topic, that was all right with him. He later discovered that I hadn't had any graduate courses, and that disturbed him a bit, but he didn't know that till the day I came up for my orals."

"Political science, though Merriam and the department in the 30's had tried to make it so, has never been a science; it's a form of belles lettres. The notion of a thesis is that you write an essay about something, and it's very scholarly, and has lots of footnotes... So it wasn't particularly unusual that I should just pick a topic and start working. And so I did, and I submitted a draft and Leonard White read it, and Charner Perry in philosophy, and someone else, and they gave me some comments which were neither very broad nor very deep. White never claimed to understand it. As a matter of fact I always resented this. His attitude was always sort of, 'gee, well you are an awful bright guy, and if you wrote this it must be so, but I don't really understand it.' I guess I must have been known as someone who began to use mathematics in political science because there was a little bit of a hands off attitude: 'Gee, this guy is using mathematical tools, and we don't know what they are, but he must be right.' So the honest truth is that I hardly had any criticism on it—I made some minor changes, shipped it in, and they approved it."

If Simon does not give his teachers much credit for helping him develop the concept of bounded rationality, he clearly gives a great deal of credit to Chester Barnard, whose book *The Functions of the Executive* (1938) had a major influence on his ideas.

"I found in Barnard's book another way of looking at decision making, besides the economist's, that seemed to me to make sense, that seemed to begin to show me how to deal with this. And so, from the day I picked up Barnard's book, it seemed to me that he was pointing in the generally right direction, and that this was something I could build on."

Barnard pointed out "how little rationality people were capable of," anticipating Stone's intuition of this. But he did not use this idea as the basis for formulating a new paradigm. It was Simon who asked the paradigmatic question, "How do people make decisions?" and its sub-questions, "What are the limits of rationality, and how do people react to them?" (Here in the context of organizational theory.) However much Simon might owe Barnard, his work still has the nature of formulating a new paradigm, and involves the rejection of much accepted theory on the basis of empirical testing. He recentered administrative theory in stating that human beings are not capable of making decisions in the rational manner described by existing economic-mathematic theories, and showing that the central concern of administrative theory "is with the boundary between the rational and the non-rational aspects of human social behavior."

The rejection of a belief system, and the formulation of a new perspective within a new paradigmatic formulation is, then, an achievement of Simon in which he was assisted but not really preceded by Barnard. "I had the problem with the recreation thing, before I'd read Barnard. Also when I was working with Ridley on the measurement of municipal activities, and I thought a great deal about rational choice. So I don't even know to what extent I got these ideas from Barnard and to what extent I just found them terribly simpatico in Barnard and further developed than I'd gone–this is very vague."

In any case, once he became aware of Barnard's work, he went through the book very carefully, and he clearly considers Barnard his chief teacher in this area. He even organized "a little Sunday morning study group (at Berkeley) which went through Barnard line by line."

In 1945, while at the Illinois Institute of Technology, Simon prepared an extended version of the thesis, and sent it to a number of people, one of whom was Barnard. "I got a very long analysis from him, about a 15 to 20 page letter, in which he analyzed it very sympathetically, but in great detail." Barnard's help and advice was useful in the preparation of the thesis for publication, and he wrote a foreword to the book that resulted (1947).

I think that we can say the process described above fulfills the requirements of the Proposition A of our definition of the creative process (Chapter I). There is the formulation of significant, paradigmatic questions, involving independence of judgment, rejection of former belief systems, and generation of novel ones to replace them. The book was a very important one in the development of modern administrative science (Gross, 1964, Chap. 7). Furthermore, we have here the paradigm that will figure in all of Simon's successive work in many disciplines.

Before going on to discuss Simon's further work, it would be worthwhile to note some of his views which directly relate to the question of acceptance and rejection of belief systems.

"The terrible thing in the social sciences is the extent to which everybody feels they have to start over again from scratch, instead of building... It always seemed to me that there is Barnard, he said most of the things right, so you start from there and improve, clarify, etc. But you don't just hit him over the head for the sake of showing that you are smarter than he is. He was a very smart and original man." This is welcome, because it stresses that one can use independent judgment to accept and not only to reject received ideas. When a paradigm is adequate, Simon is saying, use it, don't destroy it just to show off, because it includes much that is valuable that you will not replace easily. Indeed, what one often discovers is that although one may have a novel insight, and want to generate a new paradigm, the novelty may be only personal (which doesn't make it less creative), and it is necessary to be careful about junking an old paradigm that might contain your idea, and much else besides. "It's sometimes appalling—I write something that I think is a new insight—and I got back and find it in Barnard." One should have the courage and perception to reject inadequate theories and ideas, but also the integrity and thoroughness to recognize the value of existing theories.

> The independent person is often highly conventional in those ways of social behavior that facilitate life in the group and yet do not impede his own aims. The truly independent person—in whom creative thinking is at its best—is someone who can accept society without rejecting himself (Crutchfield, 1962, p. 139).

Productive Thinking

We have already seen that Simon proceeded to generate, with Barnard's help in pointing the way, a new paradigmatic system for conceptualizing perception in general, rationality in particular, and decision making in specific. What can we say about the nature of the thinking in this process we are terming creative?

The process of arriving at such a new system is one, I think, in which one is able to first suspend one's demand for tight structure and search freely and intuitively for a solution to the significant question posed. And, second, to re-structure around, or deriving from, the solution that one finds. By then testing the new structure we are testing the solution. This is consistent with the theories of Wertheimer (1959), Rokeach (1962), and Maslow (1954) among many.

Simon makes clear his recognition of the value of the unstructured part of this process. "One thing that differentiates people—the stronger your need to have one tight consistent framework, all the time, the more you are driven to limiting yourself to dealing with small problems where a framework will hold for a while. And the more you are driven to dealing with the large hairy problems, the more you tolerate some ambiguity and oscillation in framework. So it's no mystery that people who write about organizational theory and motivation or personality can be shown to, if not contradict themselves, at least to frequently talk this way, that way and the other way; whereas people who are willing to stick to something quite precise often read much more consistently. My at-

titude has been that you don't withdraw to the safe, do-able problems. You played a kind of mixed strategy. So you ought to be able to move back and forth between messy things and neat tight things. And you ought to use what you learn with messy ones to handle and build tools for when you retreat to tighter ones, and use them to go back and do a little better with messy ones... I do have strong urges to be consistent, to find a framework that covers things, but I realize I am just going to fall a long way short of that if I study the kinds of problems I want to study."

One of the characteristics of generation of new belief systems is a difficulty in finding ways to symbolize, represent and communicate them clearly. One may have a feeling of what one has formulated, but representation is still a problem.

"I was trying to verbalize why this notion of bounded rationality, of limits of rationality, was so crucial to the construction of administrative theory, and I was having just very great difficulty finding the right words for this, and I still do." One of the methods he used was that of mathematical models, a method he finds frequently of great value. "The model I was using at that time was a model of a formal proof in logic... even to the extent where there is a vague picture in my head of a proof when I think about decision making premises." He also used an analogy, which "popped" into his head. The analogy was that if you look at a glass bowl of molasses, all you learn about is the shape of the bowl; only if you can see the molasses being poured in, and see how it achieves an equilibrium, will you learn about the properties of the molasses. Once it has settled there is no room for theory.

He described his thinking in general in terms which are relevant here. "It seems pretty clear to me that I don't much use words in the usual sense in my thinking. I use schemes which are more abstract and more like mathematical structures in a lot of my thinking. Particularly when I am trying to get at the real framework—what the real guts of the thing are... I think in the mathematics and then translate it into English... The idea started out, in that recreational case, with a kind of a representation of decision making."

Another method, which is most important in the communicating process, is that of finding a good label for a new concept. Simon is aware of this method. "The term satisficing is a quite deliberate invention, which dates probably to 1955; I made it up on a Sunday morning, about the beginning of 1955, and the reason was the observation that it was just terribly difficult to communicate abstract ideas to people, to get them to focus their attention on them unless you labelled them appropriately. Something I had not been very conscious of when I wrote *Administrative Behavior*, not until the middle 50's. When you file information away, you file it in relation to whatever index of objects you have, and I had been kind of frustrated in trying to communicate about bounded rationality and its centrality in talking about administrative behavior theory. And it occurred to me that it wasn't going to get communicated until people had a piece to file this away, and bounded rationality didn't have the right umph."

In what way did Simon think these new belief assumptions were helpful in answering the paradigmatic question? "A belief that a framework like this one comes fairly close to giving one boxes to put things in at least." Such a belief gives one a "feeling that in this world, the really big pay-offs almost always come from restructuring situations."

Elaborations and Extensions

"I had always thought of *Administrative Behavior* as being a blank check that I had signed. I had said, here is the way we ought to conceptualize this, now let's see if we can use this to go out and do some research. And I guess one of my main driving motives ever since has been to pay off that check which has been filled in for a rather large amount."

Simon was motivated, we can say, by the sort of tension Rokeach was describing. He also defines this drive in terms which illustrate the idea of the paradigm as the assumed, but not continually re-established conceptual and instrumental framework, that presents a range of problems, and some heuristics for their solution. "Bounded rationality and satisficing are residual categories or models or warnings—all they do is give you a hunting license to now go out and find out empirically—how do people structure decision making processes in those situations where they cannot optimize?"

The major step in this process of filling out the implications of the paradigm (Proposition B) was one which generated a new paradigm, this time a methodological paradigm. This is something we will encounter again. The attempt to work out a conceptual paradigm often results in the production of new paradigmatic methods, in itself a significant creative achievement. In this case the methodological innovation was the development of computer simulation of human decision making processes. This was, in a sense, a concentric paradigm, building on the first one, and extending it into a new field, with immense potentialities. This step deserve the paradigmatic label for its social value if nothing else. There is good logic in the fact that Simon listed as the second of his most creative products, "in terms of the consequences they had for whole bodies of knowledge," the discovery of "how to use a computer to simulate these processes."

Simon was certainly aware of the value of this methodological innovation, for his work in particular. "I know how tough it was to get from a conceptualization like this to a concrete verifiable, objective description of the decision making process. And I still believed that was the thing to be done, but I was well aware of what the difficulties were and how inadequate our tools were. And a part of the effort I put into learning some math was to see if I couldn't find better formalism. My work for the Cowles Commission I regarded as an exercise in developing language and technique for handling these kinds of things. I never felt I had a good language for this till Al Newell and I got the gleam of using the computer. So I regard December 15, 1955, the day we got the first hand-simulated proofs, as the beginning of a new era."

The use of the computer has wide implications for the understanding of human cognitive processes. The ability to simulate human decision making, Simon saw as fundamental for simulating all human cognition. For Simon, "all cognition can be described as decision making."

"One of the things I have always been aware of, since I was an undergraduate, was the ease with which people could concoct plausible and even empirically verifiable little tiny micro-theories of behavior—all of which was sort of true in their time and place, but no one of which, obviously, was a whole theory, and nobody had any way of putting these together. So one of the things I have always been very conscious of is that fact that until we get technical means that allow us to deal with the simultaneous interactions of this complexity, we are going to have darn poor social sciences. Computers allow you to take these darn pieces, and start shoving them in one by one, which is all we can say a human being should be expected to do—and then find out what happens when they interact in a way that was never possible before!"

Ever since then Simon has been largely occupied with the use of computer simulation to understand human behavior with the assumption that as you can make a computer simulate a process that a human being goes through, and as it is possible to describe exactly what the computer is doing, then that description can be termed a theory of human behavior of creativity (discussed in Chapter I above).

The work with computers has been, as has much of Simon's work, largely collaborative. The original realization of the possibility of using computers arose out of discussions with Alan Newell of the RAND Corporation. "I didn't really think of computers as a tool for research until Newell and I got talking about the beginning of 1955. I was out at RAND in '54, and while I was there we were trying to make sense out of this data from the Systems Research Lab, and my way of making sense was to see if we could construct what I would not call a program of the decision making process. Newell and I tried to do it by hand, and failed. We couldn't get to the necessary level of detail. About that time we drove out to an air base, to see some air exercises, and while driving we talked about human problem solving, talked very vaguely about the possibility that one could really set down and formalize this process—that was probably in 1954—but we weren't specific." It was sometime later that they hit on the idea of computer simulation.

Simon has collaborated, to a greater or lesser extent, for many years. This is both specific collaboration, as in the writing of a paper or book, and general interpersonal stimulation and fertilization. But the collaborators have been relatively few, most of his collaborations have been with one or more of a small group of colleagues, in particular Alan Newell, J. C. Shaw, Harold Guetzkow, and James March. He feels that "Collaboration is not an easy business," and that it only works with "really smart and tough people." It must be symmetrical, not a teaching relationship. He values teaching as a way to clarify ideas, but not in a collaborative context. "It doesn't work if I have to pull

punches." One has to know when to criticize something, and also, "there were certain things, which, if you labelled them as half-thoughts, were not subject to severe criticism." Collaboration also fills another function, besides mutual feed-back. "You have extra ideas, in a university you can put them out into the environment and someone will take them up. Those that don't get taken up, you try and provide a home for."

But, while much of his work has been collaborative, in particular the work on computer simulation, all of Simon's work is based on the fundamental paradigm of bounded rationality and satisficing as conceptualizations of human cognition and decision making, a formulation that is clearly identifiable as his innovation. In this sense, he collaborates within his framework on the working out of various implications of the paradigmatic question that he originally formulated: how do people make decisions?

Motivation and Personality

Simon would certainly seem to be strongly achievement motivated, and this observation is borne out by his statements, as well as by his prolific productivity. He is conscious of a sense of destiny, as should be clear from his feeling that computer simulation heralded a "new era."

"When I was a kid I resented Columbus considerably for making a great discovery that I could not make." He always had an urge "to do something new, discover something." We have already noted that he lost interest in physics because it sounded "as though all the exciting problems had been solved... It was too crowded a country—too much exploration already done." There was more to it than the aspect of public appreciation, although he admits, "I have a pretty strong glory motive." It was also a love of discovering things, because they were there. "As a child, and still today, I just love to solve puzzles, if you want to put it that way, learning things, exploring things... I don't like to admit anything is impossible for me. There is an awful lot of drive here to prove I can do real hard things, a form of vanity I guess... Of course, I climb mountains for the same reason. If I start up a mountain it's very hard not to go to the top—and I hate every step of the way down."

The element of social interest is not lacking. It is manifested in the sense of destiny, the feeling that his work is opening new paths for human knowledge, "discovering the great laws of nature." This is one of the reasons for his prolific writing, and widespread distribution, although he hates writing. There is a "Missionary sense... I want to get people to use these ideas." Does he have a crusader's zeal? "Oh sure, sure I do."

Combined with the sense of destiny is a clear enjoyment of the iconoclastic role. "Satisfaction out of being right and different—being right about a judgment the world doesn't share. I am sure that kind of satisfaction is pretty strong with me."

Simon is predicting, prophetically, that cognitive processes are of a certain nature. He is basing his statements upon the two interconnected paradigmatic formulations that we have seen, and excluding from consideration, quite consciously, other factors and possibilities. He is confident, "I am placing my bets there," but he is also aware of the nature of this confidence. "Science gets done if there are a few opposing leads, and a few people who believe passionately enough in each one so that both get done."

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