An Inquiry Into Certain Human Determinants of Organizational Creativity.

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by

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ABSTRACT

This paper examines the human determinants of organizational creativity. Information is derived from the reports of scientists, administrators, and educators, who are intensifying study of this topic.

An understanding of the creative process facilitates appreciation of the nature of creative work, appraisal of creativity training programs, evaluation of environmental factors, and utilization of operational techniques. The creative process consists of seven interdependent and interweaving stages: early preparation, in which the mind assimilates great volumes of diverse information; intense encounter with the problem; conscious probing into the problem, its factors, and possible solutions; incubation, wherein subconscious processes attack the problem; illumination, the conscious recognition of momentous insight; verification or elaboration of the idea; and gaining acceptance of the creation.

Recent psychological studies have isolated traits underlying creative ability. Tests are in use which measure these traits. Prominent traits of the creative person are intelligence, sensitivity, fluency, flexibility, originality, and redefinition. He tends to be inner directed, sensitive to his own emotions, independent, self-confident, dominating, and inhibited by exacting internal standards. He manifests a personality sufficiently integrated to reconcile
internal ambiguities. Slight variations in personality profiles may
determine the fields in which individuals excel creatively.
Creativity normally declines gradually with age, after reaching a peak,
usually between 25 and 40 years of age.

Evidence suggests that creative ability may be increased
through training. Participation in brainstorming sessions is found to
increase ideational fluency and the production of good quality ideas.
Other training techniques seem to enhance originality, sometimes at the
expense of ideational fluency. Laboratory evidence suggests that
subjects can be trained to be more original, that such behavior can be
reinforced, and that such training has enduring effects.

Environmental factors may encourage or inhibit creativity. In
the creative environment, administrators evince a sincere desire for
creativity and work toward achieving pervasive communications, flexible
schedules, and some relief from routine work. The past is not wor­
shipped, but regarded as a step toward a greater future. Incentives
are based upon administrative insights into the need hierarchies and
abilities of subordinates. The tendency toward conformity within groups
may be weakened through manipulating group composition and attraction,
and through encouraging productive interaction patterns. Full group
participation and tolerance of goal-directed disagreement facilitate
creative decisions.

Augmenting general organizational creativity are techniques
designed to help solve specific problems. Thought provokers (analytical
techniques, forced choice techniques, and checklists) may aid individu­
duals to visualize novel solutions not otherwise perceived. Group
assault upon appropriate problems is also practiced, particularly
brainstorming. Objective evidence suggests that brainstorming is a superior conference technique for obtaining many diverse ideas about open-end problems. It seems, however, that individual brainstorming may excel group brainstorming in number of ideas produced and number of good quality ideas. Worthy of watching is the Gordon technique, wherein a permanent panel is gradually informed of the problem during the session.

To maximize organizational creativity, an integrated program appears advisable, including the use of material contained herein to staff the organization with creative personnel, to develop the creative abilities and propensities of all personnel, to provide a climate conducive to creativity, and to select judiciously from among operational techniques.
CHAPTER I

INTRODUCTION

Purpose

During the past decade the subject of creativity has received growing attention from business executives, psychologists, and those concerned with the sciences and fine arts, among other groups. Perhaps this newfound emphasis has been precipitated by a growing volume of complex problems facing political, social, and economic organizations. It also appears possible that the behavioral sciences are developing to the point where the factors affecting creativity may at last be analyzed effectively.

Whatever the causes, widespread research is endowing us with a growing body of insights into various phases of creativity. The secrets of the creative process are slowly yielding to sustained multifarious probings; the minds of creative giants are being analyzed and compared with those of "normal" individuals; cautiously, administrators are putting into practice hypotheses and theories concerning creativity and reporting the effects of such experiments on their organizations. It is the purpose of this study to collect, organize, and analyze the published results of such basic research and to indicate how insights thus gained are or may be applied in attempts to improve organizational creativity.
Perspective

It is difficult to exaggerate the significance of creativity in the modern world. One may relate so many instances in which one fundamental new construction of ideas has profoundly affected the entire world. Examples include Freud's concept of the subconscious, Darwin's theory of evolution, and Einstein's theory of relativity. In Paul Smith's animated language:

And the world is suddenly discovering that creativity is important. It has become big business. A mathematical formula written by an impractical dreamer named Einstein has devastated two cities, loused up the international situation, and is right now furnishing the electric power for Pittsburgh. A screwball notion by a bunch of pure scientists has resulted in the collection of very expensive miscellaneous hardware that is now orbiting around the earth at better than 18,000 miles per hour. A mathematical curiosity dreamed up by the author of *Alice in Wonderland* is the basis for most electronic brains...the Univacs and Monrobots that are right this minute reorganizing your lives and mine.

Less glorious today than "breakthroughs" in the areas of atomic energy and space technology are past creative developments now considered mundane. How many distinct discoveries and inventions are part of the automobiles we drive, the x-ray machines which map our internal malfunctions, the hi-fi stereos and television sets we relax by. Each is the current culmination of growing aggregates of insights and innovations.

Nor are new products and theories the only outcomes of creativity. The standard of living enjoyed in the United States is secured through high productivity in our factories, again a result of man's search for new, more efficient means for achieving his goals. The same drive is increasing the effectiveness of our systems of distribution.

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In an age wherein growing productivity contributes to national survival as well as business profitability, high wages, and the feeling of personal accomplishment, it is of little wonder that emphasis upon creativity is expanding.

It is said, in fact, that too little weight has been allocated to the role of innovations as a determinant of productivity and economic growth. Three separate studies recently concluded that 87.5% to 90% of the increases in productivity over the past several decades may be attributed to advancing technology and only 10% to 12.5% to increasing investment in plant and equipment. It is creativity, then, the generation of "new knowledge, new techniques, new skill, and new organizational schemes," which accounts for the bulk of our productivity increases and economic growth.²

While man's creativity has led to the easing or solution of some problems, other long-standing dilemmas defy solution despite their vast ramifications. Thus it appears the atomic sword of Damocles hanging over the heads of humanity grows heavier and sharper while the thread supporting it grows thinner. The prophetic words of Graham Wallas,³ written in 1926, eloquently express the gravity of this imbalance:

In the sphere of international and interracial relations, our chemists and engineers are now contriving by technical methods inconceivable to our grandfathers, plans for the destruction of London and Paris, but when French and British statesmen meet to prevent those plans from being put into operation, they find it no easier than would the leaders of two Stone-Age tribes to form a common purpose, and they generally part with nothing better than a vague hope that war may be averted by accident or inertia.

---

²"Growth Force That Can't Be Overlooked," Business Week, No. 1614 (August 6, 1960), 68.
Still cautioning about the serious implications of this ingenuity imbalance, Wallas continued:

We are...rapidly learning so to conquer insect-borne disease as to make possible the residence of a largely increased number of white men in the tropics; but throughout the greater part of Africa neither the white invaders nor the European governments...have thought out any better policy than the reduction of the black population to a condition of statutory servitude, leading some day to pitiless massacres of masters by slaves and of slaves by masters.4

Nor are problems existant solely on the international scene. Internally, the United States government faces complex, enduring problems in the areas of racial relations, unemployment, agriculture, depressed areas, crime prevention, etc. State and local governments face these and other problems. Business leaders are concerned over increasing domestic and international competition, declining profit margins, public reaction to "unethical" business practices and the like. Perhaps some of these problems will yield to time and persistence. It seems likely, however, that the development and application of new concepts, new approaches, new refinements must also play a prominent role if organizations are successfully to adapt to their rapidly changing, complex environments.

Definitions

In order to maximize the fruitfulness of further discussion, it is necessary to insure that the reader and the writer define certain much-used terms in the same manner. Terms such as "creativity" and "imagination" share the penalty of multiple meanings which so often accompanies ubiquity. Let us first examine some definitions of

creativity, along with its siblings, "creative process" and "creative thinking." From common elements in these definitions and from insights into the unarticulated elements imputed to these terms we shall derive our definitions. We may then indicate relationships among creativity, imagination, and the "scientific method" of problem solving. Other technical terms are defined in the text as they are encountered.

Creativity

The terms "creativity," "creative process," and "creative thinking" are variously defined by students of the subject. There exist, nevertheless, certain broad similarities among these definitions which indicate substantial agreement concerning the topic's nature and scope. With the aid of these concurrences we shall construct our definitions.

Innovation

The principal point of substantial concurrence is that creativity involves the generation of something new. Thus Steichen says, "Creativity is seeing something, feeling something, having an emotion about something--whether it's a subject or a thought or a concept--and bringing those things together and putting them through the crucible of the intellect until a new thing is born."\(^5\)

Similarly, J. P. Guilford states, "Creativity is the production of new mental constructs that become evident in such things as scientific theories, novels, paintings, and musical compositions."\(^6\)


according to Kubie,

Creativity implies invention: e.g., the making of new machines or processes by the application of old and new facts and principles or a combination of them in order to uncover still newer facts and newer combinations and to synthesize new patterns out of data whose interdependence had hitherto gone unnoted and unused. It is this which is common to all creativeness.\(^7\)

Relating the Unrelated

While this is not the place for intensive discussion of the creative process, it is useful to note here that most definitions of creativity or its siblings include, implicitly or explicitly, some reference to the combining or recombining of ideas into new clusters or configurations. Paul Smith is quite explicit here:

...whether it occurs in painting a picture, writing a poem or symphony, inventing a new jet propulsion system or a new marketing technique or a new wonder drug, the creative process is a manifestation of the same fundamental ability: namely the ability to relate previously unrelated things.\(^8\)

Concurring with this view, Rogers defines the creative process as, "the emergence in action of a novel relational product, growing out of the uniqueness of the individual on the one hand, and the materials, events, people, or circumstances of his life on the other."\(^9\)

Utility

It should be noted that in none of the preceding definitions is


\(^8\)Smith, *op. cit.*, p. 18.

usefulness or value articulated as a criterion of creativity. The new marketing technique may be unrealistic, the symphony a failure, etc.; yet they might be cited as creative products, for they involve new mental synthesis. Some authorities, noting this apparent definitional weakness, define creativity to include the criterion of value or utility. Clearest on this issue is Whiting:

...it is helpful to make distinction between creative thinking and what I shall call original thinking. Original thinking produces ideas which are new (at least to the individual concerned) even though they are not necessarily useful. An original idea that is also useful, in terms of meeting one of man's needs, is also a creative idea. Thus creative thinking differs from original thinking in that ideas must be useful in addition to being original.10

This definitional disagreement seems more apparent than real, however. Close perusal of the literature concerning creativity reveals that the utility criterion is indeed universal. Ideas cited as creative are always the bases for the satisfaction of some desire. Men designated as creative are among the most successful of men. And rarely are the weird ideational constructs of the psychotic referred to as creative.

**Action or Attitude**

Lasswell has defined creativity as "the disposition to make and to recognize valuable innovations."11 One's mental attitude toward one's own ideas and those of others is stressed in this unusual definition. As we shall see, this attitude factor does play a prominent role in determining the ability and willingness of individuals to evolve and

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communicate new ideas. It is, then, a determinant of creativity, but does not appear to be an essential component of the term's meaning.

**Synthesis**

We have found in the preceding that the concept of creativity usually includes, implicitly or explicitly, (1) the generation of something new, (2) the relating of data or phenomena in a novel manner, and (3) the generation of value. The second point seems inherent in the first and will be deleted in order to avoid redundancy. We may now state our definitions. Creativity is the generation of valuable innovation. The creative process is the sequence of mental steps leading to creativity. Creative thought is designated as any type of thought which contributes to creativity. Finally, organizational creativity is the generation of innovation of value to the organization.

**Imagination**

Like the term creativity, the word imagination is given many meanings. It appears that imagination and creativity are often used interchangeably. We shall find it useful to differentiate between the two, defining imagination as "the process of producing...thought products which differ markedly in form and/or content from their perceptual origins."\(^{12}\) Perhaps more precise is the definition of imagination as, "the conscious and subconscious workings of the dissociative and associative processes, producing an unending series of new images, from which

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the conscious mind culls the most productive.\textsuperscript{13}

\textbf{Problem Solving}

Creative thought is considered in this paper as a component of problem-solving thought. A quick glance at some of the steps generally listed within the "scientific method of problem solving" should indicate the valuable, pervasive role of creativity. The process of formulating hypotheses may call for novel ideational constructs. Creativity is often needed in the developing of methods and equipment needed to test effectively these hypotheses. Moreover, the ability to synthesize and communicate the results of such an investigation often requires creative ability.

We shall, accordingly, accept the view that creativity is helpful in every phase of life and its pursuits, wherever problems are joined in combat. Perhaps the level of creativity needed will differ with the complexity and profundity of the problem; nonetheless the need for creative thought appears universal.

\textbf{Boundaries}

Any subject involving a subject so broad as creativity must be carefully delineated at the start in order to keep the problem manageable. Accordingly, certain aspects of the subject are emphasized while other phases receive only the treatment necessary to help fully grasp the more significant material.

In terms of time, the most recent developments are stressed,

\textsuperscript{13}This definition is derived from an analysis appearing on pages 24-28.
while conjectures and inferences of the distant past are presented summarily to provide perspective. And while insight into creativity may be valuable in such spheres as art, science, education, politics, etc., greatest emphasis is allocated to the application of such insight to the field of business administration, this having attracted the author's primary interests and competence.

Specifically, this study inquires into the nature of the creative process and the factors which contribute to organizational creativity. These include personnel traits and training, environmental factors, and certain techniques for eliciting new approaches to specific problems.

Itinerary

An understanding of the creative process should provide a useful framework within which to analyze efforts to achieve organizational creativity. We shall, accordingly, begin with a meticulous investigation of insights into the creative process, seeking to identify the stages within this process and to indicate their relationships with the entire act of creativity.

From the creative process, it is but a small step to a discussion of the creative mind. Here we are concerned with attempts of modern psychologists to isolate the mental factors closely associated with individual creativity. Substantial attention is devoted to recent findings concerning specific intellectual traits which appear to underlie creative ability. Similar treatment is accorded relevant personality traits. Tests designed to measure these intellectual and personality traits are mentioned. Finally, the effects of age upon
creative ability are considered. Knowledge of this nature should prove exceedingly helpful in evaluating candidates for positions requiring various degrees of creativity.

Because it is widely believed that all persons possess some degree of creative ability, and that this ability may be developed through training programs, many organizations are encouraging their personnel to acquire such training. Some institutions are themselves sponsoring such programs. These efforts at developing creative abilities through training are next discussed with emphasis upon the objectives of such training, the techniques used, and the apparent results. Also reported herein are the findings of experiments inquiring into the effectiveness of training in originality and other areas relevant to creativity.

Effective selection and training procedures alone cannot insure organizational creativity, however. Even the most creative individuals find themselves impotent in an environment apathetic or hostile to new ideas and approaches. It behooves us, then, to examine at this point the environmental factors which are being found to inhibit or encourage creativity.

Finally are presented a variety of techniques being used for eliciting novel and valuable ideas in attempts to solve specific problems. Initially discussed are methods being used to provoke novel solutions within individual minds. These include analytical techniques, forced-choice techniques, and checklists. Next are presented and analyzed two techniques calling for group assault on problems. The much-publicized brainstorming receives elaborate appraisal since it
appears to be the most popular of "operational techniques," and also because evidence permitting objective evaluation is available. A presentation of the Gordon technique for group creativity ends this section.

We thus "run the gamut" of human factors and techniques affecting organizational creativity. Through these insights, it is hoped that organizations of all types will be better prepared to cope with the challenges of tomorrow.
CHAPTER II

THE CREATIVE PROCESS

Until recently, our knowledge of the creative process has progressed slowly. Often new creations themselves challenge our ability to understand, thus focusing attention on the products of creativity rather than the process which gave them birth. The creative person is frequently unaware of his mental processes. Moreover, some very creative individuals reject attempts to analyze the workings of their minds, fearing that such probings might cause injury to their precious gift. Still others reject analysis for aesthetic reasons, refusing to lay bare the "strings and pulleys" of their minds. The relative youth of psychology, the crudeness of its early techniques, and the concern by psychologists over other facets of the human personality and intellect are also factors which have limited our comprehension of the creative process.\(^1\)

Yet this understanding appears fundamental to the achievement of organizational creativity. Such insight should facilitate the selection of individuals with great creative potential, development of their creative powers, and provision of the climate conducive to constructive innovation. Familiarity with this process is also useful in

formulating and evaluating techniques commonly being used today for solving complex operating problems.

Fortunately there are beams of illumination cutting the darkness, beams which, of late, are growing in number, size, and intensity. A few highly successful, truly original thinkers have recorded the mental steps which attended their greatest achievements. Other scholars have gathered such recordings and induced from them generalizations which have provided hypotheses for further, more precise study by psychologists. The studies of psychologists have been augmented by the efforts of people in many fields who are concerned with creativity, such as educators, artists, sociologists, administrators, and physical scientists. Material concerning the creative process is being provided through interviews with creators, questionnaires, observation of creative persons in experimental situations, and through close acquaintance with such individuals.

Graham Wallas: A Beginning

Piecemeal insights into isolated phases of the creative process may be found in literature on many subjects, written over a vast period of time. Among the first writers to induce from these fragments an integrated process, with a specific sequence of steps was Graham Wallas. He envisioned four steps within the creative process: preparation, incubation, illumination, and verification. By preparation, Wallas meant the activity of consciously gathering and analyzing information relevant to a problem. Incubation denotes a period of time during which

the investigator does not consciously think about the problem. The sudden conscious emergence of the solution with the attendant joy and release of tension compose the stage of illumination. Finally, the thinker utilizes his conscious, rational faculties to test the solution, thus the designation verification.

Wallas's work set off a series of experiments by psychologists to determine whether these discrete stages existed. Thus Catherine Patrick, after experimenting with groups of artists and poets, concluded that Wallas's four stages could be distinguished, although there was considerable overlapping among the stages. Later experiments, however, educed little evidence of discrete stages, the conclusions tending toward the existence of "one whole process consisting of all the various aspects participating concurrently." Thus while the four stages proposed by Wallas retain their value as identifiable currents within the stream of creative thought, the concept of a definite sequence of steps is of doubtful validity. The designation of such "currents" does, however, provide the researcher with a basis for organizing his investigations into the creative process. Accordingly, we shall make use of Wallas's approach, refining and supplementing his terms when further differentiation among phases of the creative process appears useful.


4For example, see Eindhoven and Vinacke, "Creative Processes in Painting," Journal of General Psychology, XLVII (1952), 139-64.
Stages in the Creative Process

For our purposes, the stages or phases of the creative process are designated early preparation, encounter with the problem, conscious probing, incubation, illumination, verification, and communication. Each phase is now discussed in the order indicated. It should be kept in mind, nevertheless, that we are discussing an integrated process in which stages may not develop in any given order every time. When the discussion of each phase is completed, we shall indicate how the phases interact, although the alert reader will already have perceived various possible interrelationships among them.

Early Preparation

In early twentieth century literature pertaining to the creative process, there was a tendency to emphasize mental activities which immediately preceded and succeeded magnificent inspirations. As one traces relevant literature back to more ancient days, one finds only the sudden inspiration discussed, without reference to any underlying mental activities. In fact, inspiration was typically attributed to divine causes.

More recent analyses disclose that the creative process has at its roots the rather earthy experiences which shape the mind from the

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6 An enlightening treatment of this topic may be found in Ernst Kris, Psychoanalytic Explorations in Art, (New York: International Universities Press, Inc., 1952), pp. 291-302.
moment the individual is able to perceive internal and environmental phenomena. It is believed that creative persons evince a voracious appetite for experience in their formative and productive years. Such individuals display an unwillingness to permit idea structures to rigidify. Their minds remain open to numerous possible meanings of new perceptions. The creative individual thus obtains "an abundance and freedom of raw perceptual materials" which remain perpetually in a state of flux.\textsuperscript{7}

Upon this broad perceptual base is built the intensive understanding of the discipline in which the individual specializes. He acquires the skills and the conceptual framework necessary to success within this field of special interest to him. The individual may also develop a somewhat less intensive grasp of related disciplines or subjects. All the while, the individual's perceptual store expands. Impressions from the "general store" find their way into idea clusters relevant to the specialized area, and \textit{vice versa}, as the mind attempts to assimilate and integrate its knowledge. These broad accumulations and integrations of percepts and concepts are the building blocks of creativity.\textsuperscript{8}

\textbf{Encounter with the Problem}

As the individual's life progresses, he develops various objectives toward which he strives. At some point in time he finds that obstacles or problems are making achievement of certain objectives

\textsuperscript{7}Taylor, \textit{op. cit.}, pp. 59-60.

\textsuperscript{8}Ibid.
difficult. Tensions build within the individual as he finds his progress slowed or altogether blocked. A given problem may have occurred previously; there may be a routine solution readily available; or the problem may be simple, involving a limited number of factors and alternate solutions. Thus little or no original thought may be necessary.

In contrast are problems involving many complex factors, and presenting the problem-solver with an infinite variety of alternate solutions. Among these possible solutions may be some never before visualized or applied, at least to the knowledge of the problem-solver. There may be relationships among the problem factors not previously recognized. Certain ramifications of specific alternate solutions may never have been considered. It is also conceivable that the objective being sought is unique to the individual, as seems the case where the painter or composer uses his medium to express his deeply subjective experiences, moods, or emotions. One element of the creative situation arises, then, when the individual attempts to achieve unique objectives, or when a problem is encountered which permits the widest use of the imagination in grasping the relationships among the problem factors and in generating solutions.⁹

The likelihood of creative thinking is further enhanced when the individual becomes seriously concerned with the problem. If the objective is important and the problem stubborn, then the encounter with the problem may be intense. If the encounter is extremely intense, certain neurological changes may occur within the individual. The heartbeat

⁹J. E. Arnold, "Creativity in Engineering," in Smith, op. cit., p. 35.
quICKENS, blood pressure rises, and there is a loss of interest in food. In brief, there is an excitement of the parasympathetic nervous system. At the same time there develops an "intensity of awareness, a heightened consciousness" to phenomena related with the problem.\textsuperscript{10} Thus the body and the conscious mind prepare to attack the problem.

The subconscious mind is also energized by the intense encounter. Thus, when the individual temporarily diverts his conscious attention from the problem to the other pressing matters of a complex life, his subconscious thought processes continue to focus upon the problem. He may find himself dreaming about the problem while sleeping, and possibly even while awake. Aspects of the problem may come to mind in the most unlikely moments: while mowing the lawn, taking a bath, or playing golf. Events seemingly unrelated to the problem may suddenly remind him of some phase of it. The person's whole being, then, becomes absorbed in the problem.\textsuperscript{11} Where the encounter is this intense, all of the individual's latent mental resources may be tapped for effective, and possibly original, solutions.

\textbf{Conscious Probing}

The conscious thought processes are now focused upon the objective and the impediment. There is an attempt, probably, to gain insight into the structure of the problem, to understand which factors are significant and how those factors are related. Depending upon the nature


\textsuperscript{11}\textit{Ibid.}, p. 62.
of the problem, measurements may be made, research may be essayed, and opinions of others may be sought. In short, the unromantic activity of consciously seeking facts and ideas plays an essential role in the creative process.

Agreement concerning the importance of conscious probing to creativity is universal. For example, upon questioning 200 scientists who had achieved sudden insights into problems of intense interest to them, it was concluded that "Typically these sudden flashes of genius follow long periods of study..." 12 The noted physiologist, Helmholtz, states in discussing his own scientific insights,

It was always necessary, first of all, that I should have turned my problem over on all sides to such an extent that I had all its angles and complexities "in my head" and could run through them freely....To bring the matter to that point is usually impossible without long preliminary labor. 13

Poincare, who struggled with the frontiers of mathematics, hypothesized that this conscious effort set the subconscious mind in motion. 14

In his monumental study of Samuel Taylor Coleridge, Lowes emphasizes the role of conscious preparation which preceded Coleridge's greatest poems. 15 At the time Coleridge wrote "The Rime of the Ancient Mariner," he had never left England's shores. But he had studied voraciously the accounts of seamen returning from wide-flung travels, from the tropics to the polar regions. His vivid imagery is remarkably


similar to the wordings in some of these accounts, leaving little doubt that these were the raw materials from which he forged his awesome poem.

Rossman's study of the inventor's methods and mental processes also substantiates the conclusion that serious conscious study of a problem underlies the development of the subsequent "creative imagination" and insight. After the problem has been encountered and delineated by the inventor, he typically performs "a survey of all available information bearing on the problem at hand,"\(^{16}\) often including search through existing patents and technical journals, and consultations with others who have some understanding of, or concern with, the subject. This information "provides them with ideas or mental elements which are employed in the inventive process to make new combinations."\(^{17}\)

**Incubation**

To incubate means "to keep...in a favorable environment for hatching or developing."\(^{18}\) We shall apply the term to the development in the mind of new idea clusters, of new forms, of new relationships, all with the purpose of progressing toward the individual's objectives. Thus after the individual has been stymied in his conscious attempts to understand or solve a problem, he may "give up," at least temporarily, and turn his attention elsewhere. But his subconscious mind, energized by the intensity of the encounter, continues striving for a solution.

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\(^{16}\)Rossman, *op. cit.*, p. 59.

\(^{17}\)Ibid.

Subsequently, the "answer" may suddenly surface, despite his lack of conscious concern over the matter at that moment. Let us see whether we can reconstruct approximately the subconscious cerebrations which lead toward this insight.

**Mental Strata and Creativity**

It is useful to differentiate between two aspects of the subconscious thought processes: the preconscious and the unconscious. For just as the conscious mind plays a prominent role in the creative process, so may both of these subconscious processes.\(^{19}\)

The preconscious refers to those mental processes which retain and utilize information after it has been learned. One's abilities to perform effectively routine activities (walking, eating, shaving) are controlled by preconscious processes; that is, we can execute these activities without conscious effort, which is thus economized. Further development of the preconscious permits the synergetic movements of the pianist and the juggler; and it facilitates the swift calculations of the mathematician, wherein he may leap past intermittent steps toward solutions as a result of practice and insight.\(^{20}\)

Here, moreover, lie the mental symbols of all that was previously experienced and the associations previously made. It should be emphasized that not all learning passes through the conscious mind. Many

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\(^{19}\) We do not wish to suggest that the mind is composed of somewhat independent, discrete elements. Rather, the mind is seen as performing many different thought functions, some of which may be grouped and designated for the sake of simplicity and conciseness.

\(^{20}\) Kubie, *op. cit.*, pp. 30-33.
experiences, internal and external to the individual, elude conscious attention, but are received by the preconscious. Here, then, is held the treasure of human learning.\textsuperscript{21}

A well deep with knowledge may be necessary for creativity, but it is hardly sufficient in itself. Mental plasticity is another essential, for rigid conceptualizations do not generate innovations. In this regard, a brief comparison of the three levels of psychic functions is enlightening. The conscious mind focuses upon perception and analysis of external and internal phenomena. These have specific material and conceptual dimensions. Thus the conscious mind is somewhat rigidified by its need to maintain contact with reality, by "what is." The unconscious seems even more rigidly anchored to unreality. Here, "inaccessible to conscious introspection and to the corrective influence of experience,"\textsuperscript{22} are hidden inadmissible desires, ideas, and impulses. If the unconscious retains hold over vast areas of human thought and behavior, creativity is unlikely.\textsuperscript{23}

The key positive role of the preconscious processes is now readily seen. Anchored neither by rigid reality nor adamant unreality, the preconscious is the seat of the huge store of highly plastic, mobile, accessible impressions which are the bases of original thought. Small wonder discerning students of creativity stress the preconscious using such terms as "the antechamber full of more or less allied ideas..."

\textsuperscript{21}\textit{Ibid.}, p. 35-36.

\textsuperscript{22}\textit{Ibid.}, p. 38.

\textsuperscript{23}\textit{Ibid.}, p. 65.
situated just beyond the ken of consciousness;"^ or the "subliminal self;"^ or "just on the vestibule of consciousness."^ Subconscious Creation

We may now proceed to discuss the mechanics of new-idea formulation. In some manner the creative mind decomposes stereotypes and reconstitutes their elements in a novel, more valuable pattern. Associations not previously formed may occur, building a conceptual complex which is joyfully received when it rises to consciousness. Thus there is a dual process of decomposition and combination, which may be termed dissociation and association, respectively. These mechanisms are the fundamentals of imagination.

Dissociation. Dissociation refers to the decomposition or distortion of mental combinations. Ribot suggests several forms of dissociation which may be relevant to creativity. "Incomplete images," caused by blurred or partial perceptions, may be filled in mentally. Also, the individual may perceive many similar images, so that no single image is entirely retained. In such instances the transfer of image components may occur. Even "complete images" tend to become modified with time to suit the perceiver. Of extreme significance to creativity is the tendency to abstract concepts from concrete images, thus forming "schematic images"

^ Poincare, op. cit., p. 394.
^ Lowes, op. cit., p. 55.
or generalizations. It would seem that these tendencies of decay and mutation are as essential to mental creativity as they are to the evolution of living organisms.28

Association. Out of decay and mutation, a new and possibly more valuable complex of ideas may evolve. For while these processes occur, the mind is absorbing new impressions, integrating them with its existing inventory, erecting new idea constellations, new sets of relationships. The relationships among these thought elements are determined by the laws of association. While elaborate exposition of these laws and their evolution would take us too far afield, three generally accepted laws are discussed briefly. These are the "law of contiguity," the "law of similarity," and the "law of contrast."29

According to the law of contiguity, "when two or more items of experience are associated in time or place, the recall of one facilitates the recall of the other."30 Examples of the operation of this law include the learning and recalling of the alphabet and numerical sequences, the memorization of symbols and verbal definitions, of price lists, of dates and places of historical events, of melodies, etc. It is readily seen that given thoughts may excite a variety of associative streams within different individuals, assuming that the nature and sequence of each individual's experiences has been somewhat unique.

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28 Ibid.

29 The role of these three associational mechanisms in recollection was known to the ancient Greeks. See W. D. Ross, editor, Aristotle Selections, (New York: Charles Scribner's Sons, 1927), p. 217.

Probably of greater concern to students of creativity is the law of similarity, which states, "whenever two or more items of experience are similar, and this similarity is known, the learning or recall of one tends to facilitate the recall of the others." The similarity may be a sensory one, as when words have similar sounds or when foods taste alike; or the similarity may be conceptual. Under the latter we may cite the recognition of the similarities between plants and animals, law and religion, nerve impulses and electrical currents, birds and airplanes. This ability to transfer the elements of one concept to another in an attempt to further insight appears a prominent creative factor. Thus Spearman proposes that the projection of ascertained relationships among one set of ideas to another set of ideas represents the highest form of human creativity.

The third "law," which many consider a corollary to the law of similarity, is the law of contrast, wherein "the recall of one item facilitates the recall of another that stands in contrast to it, when this contrast has been perceived." Thus the mind conceives such contrasting relationships as black and white, acute and obtuse, source of light and reflection of light, the falling of an apple and the suspension of the moon. The mind grasps not only relevant similarities, but also pertinent differences. An individual's capacity to differentiate among phenomena which might seem altogether similar to casual observers might lead him to highly original and useful ideas and approaches.

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31Ibid., p. 217.
33Schneiders, op. cit., p. 218.
Imagination. Imagination may now be conceived as the conscious and subconscious workings of the dissociative and associative processes, producing an unending series of new images, from which the conscious mind culls the most productive. It should be emphasized that imagination is a conscious phenomenon, as well as subconscious. The conscious goal-seeker often utilizes his capacity to abstract, to analogize, to contrast.

But the subconscious forms of imagination are also strong creative factors. The conscious is often so possessed by "reality," by "what is," that it is unable to permit the imagination sufficient rein to make the broad abstractions, the distant similarities, the indistinct contrasts which may be necessary to the derivation of truly creative solutions. Often a restricting "mental set" develops within the mind after some degree of probing into the problem. That is, the approach to the problem becomes rigid, perhaps confined by too much emphasis upon certain aspects of the situation, while too little or no attention is devoted to other pertinent factors.\(^{34}\)

Relegation of the problem to subconscious thought mechanisms often frees the mind to revue the situation in its entirety. Free also from the rigors and inhibitions of the ego, the stream of associations flows faster, over a wider range. Dissociations and associations which were rejected consciously as useless or even dangerous may now become elements within image-complexes vastly superior to those previously aggregated. Moreover, unconscious bonds may be loosened temporarily so

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that thoughts never consciously recognized may be brought to bear upon
the problem.\textsuperscript{35}

There exist other possible explanations for the relative effect-
tiveness of the subconscious in solving problems which have stumped the
conscious. It is often proposed that the strain of conscious probing
fatigues the mind. After some period of relative relaxation, the mind
is said to regain its previous productivity. Others emphasize that the
mind is uninterrupted by perceptions of the environment during its
cerebrations and is thus better able to concentrate upon the problem.
Then there is the belief that the passage of time promotes the processes
of dissociation and association.\textsuperscript{36}

Common manifestations of subconscious imagery include dreams
(both night and day), hypnagogic imagery, and hallucination. In the last
instance, imagery may be so vivid that the individual mistakes it for
reality. It is significant that psychologists, including Freud, believe
that dreams reflect the unsatisfied needs and desires of the dreamer.
Furthermore, the forms taken by dreams seem clearly associated with the
individual's recent experiences. Thus the intensity of the encounter
with the problem and the conscious probing into the situation may help
cause the "creative dream" and provide it with its images.\textsuperscript{37}

\textbf{Illumination}

Illumination may be said to occur when the individual becomes

\begin{footnotes}
35\textsuperscript{Kris, op. cit.}, pp. 306, 312.
36\textsuperscript{McKellar, op. cit.}, pp. 119-120.
37\textsuperscript{Vinacke, op. cit.}, pp. 228-229.
\end{footnotes}
conscious of the existence within his mind of a momentous insight into the problem or the solution of the problem. This recognition is usually attended by a release of tension and a feeling of joy. Often illumination occurs suddenly, although it may be preceded by a vague feeling of anticipation as key ideas combine to form felicitous configurations. As previously noted, such insights may occur during periods of conscious probing; they may also occur during conscious relaxation or concern with other matters.38

Recordings of Illuminations

One rarely finds elaborate description of illuminations which occur during conscious analysis. The very reason for the conscious effort is this achievement. There is apparently small surprise, therefore, when insight does occur, and the thinker sees no cause for elaboration.

In contrast, great emphasis and elaboration are accorded inspirations achieved as a result of subconscious processes. When "Kubla Khan" was first published, Coleridge preceded it with an explanation of the poem's subconscious derivation. According to his account, he fell asleep after taking a prescribed anodyne. During the waking moments immediately preceding sleep, he had been reading "Purchas's Pilgrimage."39


The author continued for about three hours in a profound sleep, at least of the external senses, during which he has the most vivid confidence, that he could not have composed less than two to three hundred lines; ...all the images rose up before him as things, with a parallel production of correspondent expressions, without any sensation of conscious effort. On awakening, he appeared to himself to have a distinct recollection of the whole, and taking his pen, ink, and paper, instantly and eagerly wrote down the lines that are here preserved.  

Coleridge continues that an interruption during his transcription caused him to forget the later passages of his poem.

Other prominent writers have recorded experiences similar to Coleridge's. The list includes such prominent names as Longfellow, Goethe, Dickens, Walpole, Wharton, Shaw, and Stevenson. Numerous musical compositions and paintings also owe their existence to dreams or other mental states in which the subconscious dominates.

Poincare, the creative mathematician, experienced his most momentous insights during periods of relaxation or concern with other matters. One illumination took place during a night when he could not sleep; another significant insight struck him suddenly as he stepped aboard a bus during an archaeological expedition; and a third reached consciousness while he was strolling down a boulevard during a period of military service.

Illuminations, then, occur under a variety of circumstances. A doctor is forced to pay a patient ten dollars because she has broken her false teeth upon a dry cereal he prescribed. This starts him thinking.

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40 Ibid.
Not long afterward he dreams about a process for producing flaked cereals. But he is awakened to perform an emergency operation before the dream is completed. Upon returning to sleep, he consummates the dream. Next morning he demonstrates the process in the hospital kitchen. The flaked breakfast cereal is born.\textsuperscript{43}

Rossman's studies of great American inventors led him to say about inspirations:

They may come at any hour and at any place. One inventor states that he gets his best flashes when he is alone in the bathroom. Another gets his ideas at the theatre or during a sermon. Others awake in the early morning hours with a clear solution.\textsuperscript{44}

It seems such momentous insights occur while the person is occupied in a manner which does not challenge the conscious mind. The activities of bathing, dressing, shaving, listening to a concert often permit one to concentrate, consciously or subconsciously, upon other matters. Almost all of the successful inventors questioned by Rossman attributed their achievements to hard conscious analysis and subsequent subconscious thinking.\textsuperscript{45}

\textbf{Serendipity}

Since so many stories are told about the role of chance in creativity, it seems worthwhile to consider this factor briefly. The usual story portrays an individual striving mightily to solve a most complex problem, but as yet unable to do so. Suddenly a chance event

\begin{itemize}
  \item \textsuperscript{43}Rossman, \textit{op. cit.}, p. 61.
  \item \textsuperscript{44}Ibid.
  \item \textsuperscript{45}Ibid., p. 62.
\end{itemize}
clarifies all, illumination occurs, and the problem is solved. Thus Newton, by observing an apple fall, is said to have discovered the "law of gravity." The vulcanization process for rubber was supposedly inspired by an accident in which a small amount of rubber being mixed with sulphur fell on a hot stove. In his famous Hawthorne experiments, Elton Mayo was originally seeking to determine the effects of physical working conditions on productivity. While correlations between these two factors proved low, he was quick to discern more meaningful correlations between productivity and human relationships.\footnote{Elton Mayo, \textit{Human Problems of Industrial Civilization}, (New York: Macmillan Company, 1933), pp. 55-56.} Many other such instances of serendipity may be cited.

Undoubtedly, chance does frequently affect the timing of the creative process. The danger lies in overemphasizing the role of accidents. Unless these accidents are perceived by minds which are prepared to recognize their significance, no creativity results. Moreover, those intensely concerned with a problem become acutely aware of phenomena which may be related to the problem.\footnote{German psychologists use the term \textit{Aufgabe} to signify the problem attitude or concentration upon the problem and its factors. Where such concentration exists, there is a heightened awareness of events which bear upon the problem. See Vinacke, \textit{op. cit.}, p. 53.} These accidents are not likely to evade their attention. Thus discovery and invention cannot be attributed to mere chance. Apples fell from trees long before such phenomena were integrated with other concepts to form an over-all theory which applied as well to the suspension of the moon (or a space station) in its orbit. There was present a mind teeming with related knowledge,
seeking to fill the gaps in its understanding. Such knowledge, concern, and ability to integrate perceptions seem the real bases of creativity, rather than the chance events, many of which would otherwise go unperceived or disregarded.

Verification

Having achieved what the thinker believes is significant insight, he now goes about the work of testing, judging, and refining his achievement. Thus a writer may write swiftly when a flood of ideas inspires him, neglecting the niceties of grammar and style. Later, when his ideas are safe from the fickleness of memory, he may tackle the task of choosing the proper words, the most communicative sentence structures, and the appropriate over-all organization. The inventor may build a prototype and test it, altering it as further insights aggregate. The scientist may test his new theory and integrate it with existing theory. Throughout this stage conscious thought processes usually prevail, attempting to suit the new insights to the realities of the situation. By the termination of this stage, the innovation is somewhat polished, having been validated, refined, and elaborated.48

Gaining Acceptance

Because we are concerned with organizational creativity, let us add as a last stage of the creative process the efforts involved in gaining organizational acceptance of the innovation. For the process to be complete, the innovation must be accepted by those who decide upon

and otherwise affect its application. This phase of the creative process may be the toughest, as many creative individuals have discovered.

Few could be more qualified than Thomas Edison to comment upon resistance to innovation. In his words, "Society is never prepared to receive any invention. Every new thing is resisted, and it takes years for the inventor to get people to listen to him and years more before it can be introduced." Perhaps this view is too extreme to be true of today's organizations. Record expenditures for research and development are being made and planned by American businessmen and government leaders. Suggestion systems have achieved considerable popularity. New products are hitting the market at record rates.

Yet there exist factors which tend to inhibit rapid and full acceptance of new ideas within organizations. At first glance, the new idea may appear absurd to those lacking the unique insights of the creator. Others may refuse to accept the innovation because they find older ways of thinking and acting more comfortable. Some may see acceptance of the new idea as a threat to their positions. Pride may be a factor leading to resistance, when, for example, individuals who have developed the currently accepted approach see crumbling the elaborate theoretical or physical structures with which they are iden-

49Ibid., p. 205.
50"R & D Outlays Hit New Peak," Iron Age CLXXXVII, No. 1, (January 5, 1961), 94.
tified. There may be expenditures involved in introducing the change, and possibly an element of risk. Still another cause for inertia may exist when managers are so concerned with current operating problems that they refuse to spend "valuable time" in the consideration of "wild notions" and "radical departures."^53

The innovator, therefore, may now be called upon to utilize his creative talents to speed acceptance and application of his creation. For example, he may attempt to simplify concepts for ready understanding. He may stress the benefits of his ideas to the organization and the strategic personnel, while seeking ways to overcome objections. In this stage, then, the innovator is in essence a salesman. As we shall see when we discuss the attributes of creative people, the innovator may have severe limitations when it comes to communicating and selling his ideas.

**Currents in the Stream**

As noted earlier, these stages of the creative process are not independent of each other, nor need they occur in the order described. For example, intermediary insights may redirect conscious probing, which may lead to further insights, and so on until full insight is achieved. All this time the individual may be adding to his store of general impressions, as well as those closely relevant to the problem. Some amount of testing and refinement may occur after each intermediary insight. Thus, conscious efforts may lead to subconscious incubation, and

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vice versa. The interweaving of these conscious and subconscious threads form the creative fabric from which the valuable contributions may emerge. If one more metaphor may be permitted, the continuing processes of perception, conscious probing, subconscious thinking, and conscious verification are the currents within the stream of creative thought; currents which interplay throughout the stream's travels, determining its speed and direction.
CHAPTER III

THE CREATIVE MIND

There appears to be general agreement among psychologists that creative ability is a universal trait, possessed to varying degrees by all persons. Just as each individual possesses a certain height, intelligence, and visual acuity, he also commands some creative ability. Thus the child may conceive a new and enjoyable game, the housewife an original and tasteful recipe, and the laborer a novel reason for being late to work. It therefore behooves administrators interested in organizational creativity to find ways of predicting the probable extent to which a given applicant will contribute innovations of value. More specifically, answers must be found to these questions: (1) What kind of intellect and personality is most likely to be creative within this situation? (2) How can those possessing the desired traits be identified?

Before intellectual or personality traits can be tested for their correlation with creative ability, it is necessary to decide upon measures of creative ability, to formulate criteria which differentiate between those who are highly creative and those who are less creative within a certain organization or discipline. Examples of such criteria

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in use include: (1) the number of products attributed to the individual which are deemed creative; (2) the quality of creative products; (3) creativity ratings of individuals by their peers and superiors within organizations; (4) number of citations or amount of space accorded a person in text books, history books, or reference books; (5) judgements of "professionally qualified" people; (6) general acknowledgements of creative eminence; and many more.\(^2\) The typical study first attempts to identify highly creative individuals through some combination of such criteria. After these individuals are classified along a continuum of creativity, they are tested to measure the extent to which they possess traits which are hypothesized as closely related to one's creativity ability. Should significant correlations result between creativity and the existence of these traits, then these traits are measured in other individuals in order to predict the degree to which they are likely to be creative within the same organization or discipline.\(^3\)

Hypotheses

As a result of such efforts, there has been developed a variety of tests designed to measure an individual's creative abilities and propensities. Such tests are based upon hypotheses concerning mental and personality traits deemed relevant to one's capacity to introduce

\[^2\text{A more comprehensive discussion of such criteria may be found in C. W. Taylor, W. R. Smith, and Brewster Ghiselin, "Analyses of Multiple Criteria of Creativity and Productivity of Scientists," The Third (1959) University of Utah Research Conference on the Identification of Creative Scientific Talent,(Salt Lake City: University of Utah Press, 1959), pp. 5-28.}\]

\[^3\text{M. I. Stein, "Problems Involved in Predictors of Creativity," Ibid., pp. 178-180.}\]
useful and novel ideas. To some extent, these hypotheses are deduced from the very concept of creativity. Insight into the creative process has also contributed hypotheses, as have observation of creative persons and interviews with them. Rigorous validation studies appear to have substantiated the validity of some hypotheses, although others have been discarded.

Hypotheses concerning the creative mind fall in two broad categories. The first group is based upon the idea that creative ability is determined by certain intellectual traits which may be isolated and measured. This approach, called factor analysis, attempts to designate the primary intellectual abilities which combine to form one's creative aptitude.

The second broad approach toward understanding the creative mind examines personality factors such as temperament and motivation. Intellectual factors may indicate creative potential, but these factors, it is believed, cannot in themselves determine how creative the individual will be. We shall concern ourselves with both approaches in our attempts to depict the creative mind.

**Creativity and the Intellect**

There persisted until recently the general feeling that creativity and intelligence were substantially synonymous. The term "genius" has often been used to describe the most creative people in history, and also to designate those obtaining extremely high scores on IQ examinations. Furthermore, studies of distinguished men through the ages

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usually concluded that such men typically possessed high I Q's. Such findings do not in themselves call for the conclusion that high intelligence is sufficient for a high degree of creativity. Large numbers of individuals with extremely high I Q's have been studied from childhood until middle age. While these individuals have achieved superior scholastic heights and appear much better adjusted socially and vocationally than the "average I Q's," there has not occurred among them as a group an appropriately high level of creativity.

There is growing belief, therefore, in the existence of intellectual traits closely associated with creative ability, some of which are measured in I Q examinations while others are ignored. Thus while one might expect a significant correlation between one's intelligence quotient and one's "creativity quotient," the two are not identical. A prominent proponent of this theory is J. P. Guilford, who suggested in 1950 several measurable traits which appeared fundamental to creative ability. He and a number of other noted psychologists have since been striving to obtain evidence which might serve to confirm or invalidate these hypotheses.

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5 For example, see Francis Galton, Hereditary Genius, (New York: D. Appleton, 1870), pp. 316-335.
6 Guilford, loc. cit.
8 Guilford, op. cit., pp. 444-454.
Guilford's Hypotheses: 1950

Before listing Guilford's initial hypotheses, we should note that he was primarily concerned in 1950 with creativity among scientists and technologists. He recognized, however, that the hypothesized traits might be relevant to other spheres of creative endeavor. He submitted that some of his hypotheses seemed to overlap others, and that some proposed creative traits might subsequently be subdivided into even more basic traits. With these qualifications in mind, let us turn to the intellectual traits considered by Guilford in 1950 to be fundamental to creative ability.

1. Sensitivity to problems: the creative person tends to be uniquely aware of the existence of problems within a situation.

2. Ideational Fluency: the creative person is able to generate large numbers of ideas within a given time period.

3. Ideational Novelty: the creative person is able to associate remote ideas to arrive at unusual conceptual combinations.

4. Flexibility: the creative thinker tends to switch from unproductive mental sets to more effective thought patterns. Time spent in associational "ruts" is minimized.

5. Synthesizing Ability: the creative person possesses the ability to combine thought elements into more inclusive patterns.

6. Analyzing Ability: the creative mind is able to break down symbolic structures in order to free elements for recombination.

7. Redefinition: the creative person has the ability to "give up old interpretations of familiar objects in order to use their parts in some new way."

8. Scope of Conceptual Structure: the creative person can manipulate many interrelated ideas. He has "high resistance to confusion."
Evaluating Ability: the creative person works with some "degree of evaluative restraint."

Guilford proposed specific tests which might indicate the validity of each hypothesized trait. Then, he and his associates commenced validation studies. As a result, some traits were discarded, others were broken down into more basic factors, and new traits were added.\(^9\)

Guilford's Hypotheses: 1959

In 1959, Guilford published his findings up to that time. Along with his presentation of the primary intellectual traits which has survived or had been added, he discussed the type of test which had been used to measure each trait. Let us closely examine those factors, for they furnish the very kind of information we seek.

The sensitivity-to-problems hypothesis was confirmed by Guilford's studies. The degree to which this trait existed in an individual was measured by asking him to "state defects or deficiencies in common implements or social institutions." Another question often utilized had the examinee state what problems he thought created by certain familiar objects or actions.\(^{10}\)

Also verified was the hypothesis that fluency of thinking was an important creative aptitude. That is, an individual's creative ability is significantly affected by his capacity to generate large quantities of ideas relevant to a given subject within a limited time period.

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\(^{10}\) Ibid., p. 145.
Further analysis indicated four measurable fluency factors which seem related to creative ability, although the exact relationship, he admits, is difficult to see at times.\textsuperscript{11}

The factor termed "word fluency" involves an ability to generate words which contain a given letter or a number of specified letters. "Associational fluency" is reflected by one's capacity to produce words related in some prescribed manner, for example synonyms of a given word. Thus the examinee's conceptual store is tested, as well as his powers of recollection. A factor which Guilford calls "expressional fluency" reflects one's ability to rapidly juxtapose given words to meet required sentence structures. Last among the fluency factors, and of extreme importance, is "ideational fluency." This is one's faculty for producing ideas to meet specific requirements within a limited time. For example, the examinee may be asked to present different uses for a common brick, or he may be requested to formulate a number of appropriate titles for a given story. His grade is based upon the quantity of appropriate answers. Since one phase of problem solving often involves scanning among available alternatives, one's ability to generate quantities of widely varying alternatives rapidly certainly appears relevant to his creative ability.\textsuperscript{12}

Flexibility of thinking has also been confirmed as a basic trait of the creative mind. This trait has been subdivided into two more specific types of mental flexibility. The first is "spontaneous flexi-\textsuperscript{11}\textsuperscript{Ibid.}
\textsuperscript{12}\textsuperscript{Ibid., pp. 145-147.}
bility," which is defined as the "ability or disposition to produce a
great variety of ideas with freedom from inertia or perseveration."
The emphasis here is upon the range of responses, rather than sheer
quantity. Thus a pair of pliers may be utilized as a tool (in various
ways), a weight, a missile, a conductor of heat or electricity, a prop,
etc. The creative mind possesses the capacity to generate improvisa-
tions, avoiding "functional fixity."

The second flexibility trait is termed "adaptive flexibility."
This involves the ability to change set, to alter one's assumptions,
one's direction of thought, when the approach taken appears unreward-
ing. One test of adaptive flexibility may be the following problem:

Connect the nine dots below, using four connected
straight lines. You may cross over lines, but you
may not trace back over lines.

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   .   .   .
   .   .   .
   .   .   .
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Often the problem solver assumes that the straight lines must be drawn
within the dotted area. But application of this assumption makes solu-
tion impossible. After striving unsuccessfully to solve this problem,
the person with adaptive flexibility will likely reassess his assump-
tions and change his approach. The following solution is then possible.\footnote{14}

\footnote{13}Ibid., p. 147.
\footnote{14}The problem (and solution) is taken from W. V. Haney, Communication Patterns and Incidents, (Homewood, Illinois: Richard D. Irwin, Inc., 1960), pp. 209-211.
This trait, then, is particularly valuable when problems include cues which tend to mislead the thinker, or when the more felicitous solutions are obscured by tempting, but less satisfactory, alternatives.

Guilford changed the title of "ideational novelty" to "originality." The existence of this factor was measured in three ways: (1) rarity of responses, (2) remoteness of associations, and (3) number of responses rated by the examiners as "clever." By rarity of responses, Guilford means the statistical infrequency with which a given answer occurs. Remoteness of associations might be measured through grading responses to a question such as, "List all of the consequences of a discovery which makes eating unnecessary." Answers concerning effects on industries other than those directly related with food might score high, as might answers involving effects on space exploration, sales taxes, and securities prices, for example. Cleverness of responses are subjectively evaluated by a panel of psychologists. The examinee may also be graded for cleverness of responses when plotting titles for specified stories.\(^\text{15}\)

The hypothesized factor of "redefinition" has also been found closely related to creative ability. The ability to "give up old inter-
pretations of familiar objects in order to use them or their parts in some new way" may be measured through questions such as, "Which of the following objects or their parts can best be adapted to making a needle: pencil, radish, shoe, fish, or carnation?" This factor appears intimately related with spontaneous flexibility, the difference apparently lying in the fact that the former emphasizes the ability to choose from among alternatives in the solution of problems, while the latter reflects the capacity to generate alternatives.16

We may classify the fluency, flexibility, and originality factors as types of "divergent thinking," in that they involve the process of seeking new ideas and associations in relation to a problem. Sensitivity to problems and redefinition may be categorized as "convergent thinking" since they involve an evaluation of the situation and its factors so as to narrow the range of possible alternative solutions, thus to converge upon the answer. It is said that I.Q. is primarily a measure of convergent thinking aptitude, while neglecting divergent thinking capacity.17

The hypotheses concerning analysis, synthesis, scope of intellectual structure, and evaluating ability have been discarded either because they were found to overlap other traits or because they were not found to differentiate between highly creative and less creative individuals. At the same time, one more hypothesis has been added, but needs further testing. This factor, termed "elaboration," apparently measures one's ability to plan, either through having the examinee build complex

16 Ibid., p. 148.
objects, or having him visualize the details involved in making a broad plan work.18

Other Factor Analytic Studies

It must be emphasized that the validity of factor analytic tests has not been fully established. Besides the studies of Guilford and his associates, only a few factor analytic validation studies have been made. These do tend to confirm Guilford's findings. For example, Barron conducted an originality study of one-hundred U. S. Air Force officers, using as the criteria of originality the ratings of a panel of psychologists who "live in" with these officers for three days, observing their behavior under various circumstances (informal interactions, group discussions, charades, and interviews). These officers were then given a battery of Guilford-type tests designed to measure originality, supplemented by other tests chosen by Barron. Total scores from the originality composite correlated .55 with average ratings of psychologists. Barron considers this correlation as evidence that "inexpensive, objective, and efficient measurement of originality is possible."19

A study by T. B. Sprecher correlated (among other things) ability of one hundred engineers to solve complex, open-end engineering problems with scores on a battery of Guilford-type tests, including tests of originality, idea fluency, associative fluency, and adaptive flexibility. He found a coefficient of correlation of .38 between the scores on the test battery and the scores earned for solutions, signi-


significant at the .01 level. This correlation rose to .52 when a verbal comprehension test was added to the battery.  

Drevdahl also found a significant correlation between scores for verbal comprehension and creativity in his study of graduate and undergraduate students of arts and sciences at the University of Nebraska. Criteria of creativity were ratings by faculty members directly in charge of students' artistic and scientific endeavors. On the originality trait, Guilford-type tests differentiated significantly between the group rated above the fiftieth percentile in creativity and the group below. Small correlations were found between other primary intellectual traits and the ratings of supervisors. Drevdahl concludes that more highly loaded tests and comparison between upper and lower extremes in creativity rankings will indicate more clearly the traits fundamental to creativity.  

Conclusions Concerning Creative Aptitude

Although much work still must be done before tests of creative aptitude achieve high reliability, some progress is being made in this direction. Such tests must now be used with caution and in conjunction with other criteria for judging an individual's creative talent, although extreme scores on such tests would appear to provide firm evidence of an

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individual's creative potential. As psychologists pursue their research further, new measures of relevant traits may be found, and new aptitude traits may be uncovered. For the present, however, prevailing opinion appears to accept Guilford's hypotheses, according to which creative ability is a function of the following intellectual abilities:

1. sensitivity to problems
2. fluency of thinking: word fluency, associational fluency, expressional fluency, ideational fluency
3. flexibility of thinking: spontaneous flexibility, adaptive flexibility
4. originality
5. redefinition

Unfortunately, none of the studies attempts to differentiate among the intellectual traits found to be related to creativity in particular fields of endeavor. Thus we cannot now designate intellectual traits which are more relevant to scientific creativity, for example, than they are to artistic or administrative creativity. There is some feeling that the primary traits hypothesized by Gilford may be basic to creative ability in all fields. It may be, as we shall see shortly, that the determinants of the field in which an individual creates may lie within his personality and interests, rather than his primary intellectual traits.

22 For an example of a widely used test of Creative ability which incorporates many Guilford-type questions, see AC Sparkplug Division, General Motors Corporation, "AC Test of Creative Ability," (Chicago: Education-Industry Service, 1954). Copies of the test and the "Test Administration Manual" may be obtained for a nominal fee by writing the Industrial Relations Center, University of Chicago.

23 For example, see J. P. Guilford, "Creative Ability in the Arts," Psychological Review, LIV (1957), 110-118.
Creativity and Personality

Studies of creative individuals have led many psychologists to believe that creative ability is a function of temperament and motivation, as well as intellectual factors. We shall now examine the findings of such studies in order to point out which personality traits appear particularly relevant to eminence in specific fields of endeavor. In this regard, Dr. D. W. MacKinnon\(^{24}\) offers a useful method for classifying creativity. He suggests a continuum, on one extreme of which creations are the manifestations of the creator's inner states. Included in this group would be expressionistic painters and sculptors, creative writers, and composers. At the other extreme is creativity designed to satisfy externally imposed goals, using objective evidence to generate valuable innovations. In this extreme of the continuum we would include research scientists, mathematicians, engineers, and inventors. As we move toward the center of this scale, creative efforts become some combination of objectivity and subjectivity; there is an integration of important objective impressions with substantial elements of the creator's attitudes, emotions, and feelings. Examples of such intermediate areas could include architects, advertising copywriters and artists, musical performers, administrators, and the like.

Perhaps through analyses of creative individuals at various points on our progression, we may be able to detect those personality traits most pertinent to each type of creativity. Moreover, we may uncover traits of universal relevance to creativity by isolating personal-

Personality Traits of Creative Scientists

Recent studies by R. B. Cattell and J. E. Drevdahl have shed much light on the personality traits of creative scientists. Initially, Cattell studied biographies of eminent research scientists and rated them on a personality profile consisting of sixteen traits. He subsequently subjected 144 creative scientists to batteries of tests designed to measure the existence of these sixteen personality traits. These tests substantiated the biographical findings for each of the sixteen dimensions. The consistency of his findings caused Cattell to reach "definite conclusions" concerning the typical personality of creative scientists.25

When compared with the average man, states Cattell, the creative research scientist evinces the following pronounced personality traits:

(1) more internally oriented and more concerned with things and ideas than with people; interests directed more to the inner life than the external world; tendency toward introspection.

(2) more dominant, seeking mastery; dislikes convention and censorship; self-assertive, aggressive; aware of his dominant nature and the dislike it provokes.

(3) more inhibited and sober; tending toward the attitude that life is "bleak, hostile, and insecure."

(4) less concerned with the moral systems of the group, although a strong individualized moral system may exist.

(5) more emotionally sensitive, considerate, and sentimental.

(6) less prone to feelings of guilt.

(7) more independent and radical in his thinking; more inclined to question.

(8) more self-sufficient; prefers to work alone and to solve personal problems without others' help; reaches decisions without difficulty.

Other personality traits differentiate between the average man and the creative scientist to a smaller degree. The creative scientist is somewhat more inclined toward boldness and less susceptible to threat. His behavior pattern tends to be more controlled by an "exacting self concept." He is less often plagued by feelings of tension and restlessness.26

Drevdahl administered the Sixteen Personality Factor test to fifty-two graduate and undergraduate science and art students at the University of Nebraska. Among the science students rated creative by their directing professors, Drevdahl found significant variation from the general population in four basic personality traits: the creative science students were more radical, more self-sufficient, more internally oriented, more pessimistic and restrained. The directions of these personality deviations match those found by Cattell, although Drevdahl uncovered no significant differences in the other twelve dimensions.27

26 Ibid., pp. 77-83. Cattell also found creative scientists to be considerably more intelligent than the average man.

27 Drevdahl, op. cit., pp. 25-26. It should be noted that Cattell compared eminent scientists with the general population, while Drevdahl compared one set of college students majoring in science with a similar, but less creative group. One might expect Cattell's groups to be more clearly differentiated.
In contrast, a joint study of eminent researchers by Cattell and Drevdahl elicited the same decided personality traits as did Cattell's solo study.28

Taking a different approach, Barron attempted to differentiate between the esthetic preferences of creative and less creative scientists. He found that creative scientists preferred complex-assymetrical drawings to simple-symmetrical ones. Adding to this the finding that creative scientists earned higher scores on organizing responses to projective materials, Barron concluded that creative people are driven by a desire to integrate diverse perceptions into "an elegant new order more satisfying than any that could be evoked by a simpler configuration."29 Barron also sees the preferences of creative scientists as indications of their independence of judgement. Despite the different study techniques used and the diversity of terms describing personality traits, Barron's findings seem consistent with those of Cattell and Drevdahl. The need to reorder diverse phenomena may reflect the boldness and dominance traits, and the preference for complexity-assymmetry may manifest the radical, self-sufficient nature of the creative scientist.30


In summary, the creative scientist emerges as a self-sufficient introvert whose standards are based more upon his own perceptions and conceptions than those of society. His behavior tends to be integrated toward the manifestation of his much-considered self image; thus he is freer from feelings of guilt and anxiety than the average man. The creative scientist is confident in his own abilities and thus acts boldly in his efforts to understand and mold his environment. He is typically less comfortable with people than with ideas, but his tendency to dominate is pervasive. His radical learnings reflect his independence, his superior intelligence, and his great emotional sensitivity, rather than a conscious rejection of consensus. At the same time, he tends to be somewhat pessimistic and somber. He is, then a peculiar combination of positive dynamism and reserve, of strong ties to his "self" and weak ties to the group, of confidence in his ability and insecurity, of sharp rationality and emotionality.

Personality Traits of Creative Artists

Let us move now to the opposite extreme of our continuum to analyze the personality traits of those who translate their moods, emotions, and feelings into paintings, music, sculptures, and creative writing. Perhaps the most significant study of personality traits in creative artists was undertaken by Drevdahl and Cattell.\(^{31}\) They administered the Sixteen Personality Factor Test to 153 eminent individuals, 58 of whom were artists, 64 science fiction writers, and 31 general

writers. When compared with the general population, the creative artists and writers as a group display the following marked personality traits:

- (1) more internally oriented and more concerned with things and ideas than with people.
- (2) more dominant.
- (3) more inhibited and sober.
- (4) less identified with group standards.
- (5) more bold and less sensitive to threat.
- (6) more sensitive emotionally.
- (7) more absorbed in imaginative thought, fantasy, and daydreams.
- (8) more radical.
- (9) more self-sufficient.
- (10) more often plagued by feelings of tension and unrest.

In addition, this creative group is slightly more controlled by an "exacting self concept."\(^{32}\)

There are differences among the sub-groups. For example, writers tend to be more intelligent and less often lost in deeply imaginative thought and daydreaming, when compared with artists. Writers also tend to be generally more introverted than artists. Science fiction writers are significantly more radical, less sensitive emotionally, and less stable and self-controlled than the other two groups.\(^{33}\)

Of great interest is the finding that the eminent artists deviate from the general population in the same direction in 10 of the 11 traits which are associated with creative scientists. Both groups

\(^{32}\)Ibid., p. 110.

\(^{33}\)Ibid.
are more internally oriented, more intelligent, more dominant, more inhibited, less concerned with the moral standards of society, more radical, more self-sufficient, more bold and adventurous, more sensitive emotionally, and more self-controlled. The similarity of these personality patterns leads Drevdahl and Cattell to hypothesize that there are personality traits which may be basic to all fields.\(^{34}\)

The results of other studies lead toward the same conclusion. For example, Barron's studies of creative and noncreative people in a variety of fields, including the arts and sciences, cause him to believe that creative people typically prefer complex and asymmetrical structures, as we noted previously. The creative mind, Barron avers, seeks satisfaction from the creation of order from disorder. To the painter, the white canvas represents the height of ambiguity, for innumerable combinations of colors, forms, and textures could be used to express his feelings. The research scientist seeks to grasp momentous relationships among phenomena, to create from these insights a model which may then be used for diagnosis and prediction.

A study presently underway may provide us with further insight into the personality of the creative artist. Dr. E. F. Hammer of New York University is attempting to predict the creative capacities of outstanding young art students through their protocols on a group of projective tests.\(^{35}\) His hypotheses have been derived by comparing traits deduced from such protocols with ratings of the subjects (18 in the pilot

\(^{34}\)Ibid., p. 111.

group) by their supervisors. The prediction value of these hypotheses has been tested upon a new group of 13 students. Hammer classified six students as "truly creative" and five as "merely facile" (able to draw or paint with ease, but relatively unoriginal, stereotyped), the classifications based solely upon the protocols of each student.36

When Hammer's predictions were matched with the creativity ratings of the students' supervisors, there was agreement in five of the six cases designated "truly creative" and in four of the five cases termed "merely facile." The study is to continue for at least ten years during which time Hammer's hypotheses will be tested upon many new students, while those who graduate will be observed to see how accurate are the predictions of Hammer and the ratings of supervisors.37

Since the results of Hammer's first predictions were so encouraging, let us note the personality traits which he believes associated with artistic creativity.

(1) greater depth of feelings, willingness to experience inner emotions, sensitivity to emotional subtleties.
(2) more ease of contact with the subconscious, "flexibility of repression."
(3) tendency to retreat from people, detached, "cold."
(4) confidence, determination, self-assertion, optimism.
(5) ambition.
(6) striving for power.
(7) feelings of feminine interests and emotion.

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36 Hammer did not classify the other two students because he found their protocols ambiguous.
37 Ibid., pp. 96-103.
(8) feelings of uniqueness and individuality, more "inner directed."

(9) rebelliousness, skepticism, internal sense of freedom.

(10) masochistic tolerance for suffering.

(11) open to the full range of feeling, to life's positive and negative experiences.

(12) feelings of emotional imbalance, inner chaos.

Some of the personality dimensions hypothesized by Hammer are not directly measured in the studies by Cattell and Drevdahl. Among those measured in common, there is substantial agreement concerning the personality traits of creative artists. The findings are clearly consistent with regard to the tendencies of creative artists to be more detached, inner directed, independent, self-assertive, confident, and emotionally sensitive. In turn, the attributes which Hammer calls "ambition" and "striving for power" appear closely related to the "dominance" trait elicited by Cattell and Drevdahl. The "feelings of feminine components" trait seems intimately related to Cattell's "emotional sensitivity." Finally, "feelings of inner chaos" could well describe the "feelings of tension and unrest" uncovered by Cattell.

Hammer's findings concerning three other personality traits are more difficult to relate to those of Drevdahl and Cattell, for these dimensions are not directly measured in the latter's studies. Other researchers have found at least two of these three personality traits to be relevant to artistic creativity. For example, Munsterberg and Mussen appear to substantiate Hammer's "masochistic tolerance for suffering" with their finding that outstanding art students are "willing to sacrifice material pleasures, personal success, and personal acceptance" in order
to pursue their art careers. The trait called by Hoffman "ease of contact with the subconscious" finds substantiation in the studies of Kris, Maslow, and Bellak. For empirical confirmation of Hammer's hypothesis that the creative person is "open to the full range of feeling, positive and negative," we must await further developments in his study, or new tests designed to measure this trait in creative and noncreative artists.

It is readily seen from the studies discussed above that the creative artist exhibits a pattern of personality traits remarkably similar to those of the creative research scientist. When compared with the average man, both tend to be more intelligent, detached from people, independent, self-controlled, confident, emotionally sensitive, and inhibited. Both have been found to prefer complex-assymetrical designs to simply symmetry, possibly indicating a deep need to create order from disorder. These same traits also differentiate the creative from the less creative in both the arts and sciences. Perhaps, then, we have isolated personality variables associated with creativity in any field.

Some noteworthy personality differences between creative artists

39 Kris, *op. cit.* , pp. 292-293.
and creative scientists also appear. The typical creative artist elicits considerably more guilt feelings and a higher level of tension. He is more independent, more radical, more self-sufficient, and is more emotionally sensitive than is the creative artist. It well may be that certain traits are basic to creativity in any field, while specific combinations and magnitudes of traits are more suited to some fields than to others. The expressionistic painter must have feelings within him which urgently demand expression. Moreover, to become eminent in his field, he must produce singular and powerful compositions upon a sheet of canvas. It is, therefore, not difficult to understand why eminence in this field would be associated with a high degree of radicalness, self-sufficiency, emotional sensitivity, and "inner chaos."

The creative research scientist, on the other hand, cannot afford to be quite so independent and self-sufficient, although he too tends in this direction. He must keep abreast of developments in his field. He may work as part of a team, possibly supervising a group of technicians. Deep feelings of guilt or tension might detract from his ability to focus his entire attention (conscious and subconscious) upon his work. Creativity in a given field, then, rests upon the proper combination of traits in the appropriate magnitude.

**Personality Traits of Eminent Administrators and Teachers**

Whereas the creative ability of research scientists and those engaged in the fine arts is frequently measured through their products, the creativity of other groups, such as administrators and teachers, is not readily gauged in the same fashion. Thus, while administrators and teachers may be considered highly effective or successful, the causes of
their eminence are often considered to be factors other than creativity. It would appear, nevertheless, that in either endeavor, the ability to conceive and apply useful innovations is relevant to effectiveness.

Perhaps with this in mind, Cattell and Drevdahl compared the personality profiles of "eminent researchers" with those of "eminent administrators" and "eminent teachers."\(^{42}\) The same traits that differentiate the creative scientists from the general population also differentiate the teachers and administrators from the general population, all significant deviations among the three profiles agreeing in direction. As might be expected, teachers and administrators were found to be less withdrawn and inner directed, less self-sufficient, less emotionally unstable, less radical, and more concerned with the views and standards of society than were creative scientists.\(^{43}\)

When Barron related the personalities of 100 U. S. Air Force officers to their scores on originality examinations, he found the more original individuals to be more intelligent, socially effective, dominant, verbally fluent, and possessed of initiative. He then partialled out the intelligence factor and found the more original individuals to be more dominant and striving for power, more able to permit complexity and contradiction into consciousness, more masculine in general while integrating more feminine components, more impulsive, energetic, and impressionable.\(^{44}\)

In a follow-up study, Barron administered to 343 Air Force

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\(^{42}\) Cattell and Drevdahl, \textit{op. cit.}, pp. 260-261.

\(^{43}\) Ibid.

\(^{44}\) Barron, \textit{op. cit.}, pp. 741-742.
officers the four parts of his eight-part test for originality which seemed least related to intelligence. Each subject also chose from an adjective checklist the adjectives which he thought most accurately described him. Those men who combined high originality scores with low scores on intelligence tests given previously described themselves as "affected, aggressive, demanding, dependent, dominant, forceful, impatient, initiative, out-spoken, sarcastic, strong, suggestible." The high I Q-low originality individuals described themselves as "mild, optimistic, pleasant, quiet, unselfish." Barron concludes that "primary process thinking" dominates in the original but unintelligent person, while "secondary process thinking" governs the individual with high intelligence and low originality. The truly creative person combines effective utilization of both processes to achieve "adaptive originality." He has close contact with his needs, desires, and impulses, and is able to integrate all levels of mental functioning (conscious, preconscious, and subconscious) to attain id satisfactions.  

Conclusions Concerning the Creative Personality  

Having examined the findings of prominent psychologists who have studied the personalities of creative individuals in specific occupations, let us attempt to visualize a composite of personality traits which appear to differentiate the highly creative from the general public. The typical creative individual is notably inner directed, sensitive to his own emotions, formulating and living by his unique objectives and standards. He is an independent thinker and thus often a radical one, his

radical ideas frequently reflecting his unconcern with consensus rather than its rejection. There is evidence, however, that in some instances there exists within the individual an attitude of defiance and rebellion. The creative person tends to feel confident in his own capacities and quite self-sufficient. He tends to dominate his environment, both people and things, although he is usually more comfortable dealing with the latter. His behavior is often controlled and inhibited by the exacting standards and role images which he has evolved deep within him.

The creative personality often appears to combine contradictory traits. Thus he evinces highly masculine traits (dominance, self-sufficiency, radicalness) while exhibiting also traits more often associated with femininity (emotional sensitivity, awareness of self, and wide range of interests). He is rational and passionate, introverted yet self-assertive. He drives his conscious aptitudes toward solutions and is able to utilize and even enjoy the fantasies which flow from the subconscious. These apparent inconsistencies are probably manifestations of a well-integrated personality, able to accept and to reconcile the ambiguities within itself. Because of this wholeness, such a person is able to unite a tremendous range of experiences and approaches with his drive to dominate, his intelligence, and his propensity toward solitary contemplation, forming a fertile field for the generation and growth of creative ideas.

While these traits seem to differentiate between the creative man and the general population, there are also traits which may indicate the fields of endeavor within which an individual is most likely to do creative work. Thus the creative individual whose productions flow from his deepest feelings through an expressive art form is found to be
typically more tense, more plagued with guilt feelings, more emotionally sensitive, and more radical than creative scientists, although the latter is himself differentiated from the general population by the last two of these traits. Evidence also points to a high tolerance for suffering among creative artists.

There are significant trait variations within each group. For example, writers of science fiction tend to be more intelligent and more radical than are general writers and artists. Creative physicists tend to be more detached from people than are other creative scientists.

As we move toward the mid-point between the extremes of subjective and objective creativity, we find a moderation of certain traits, rather than a new family of traits. The eminent (and thus possibly creative) administrator exhibits the same personality traits as the creative scientist, although the former is not quite so detached, inner directed, self-sufficient, emotionally unstable, and radical. Moreover, administrators are more concerned with the views and standards of society. Similar traits are possessed by eminent teachers.

**Age and Creativity**

Studies of the intellect indicate that changes in this factor with age underlie variations in the creative ability of individuals. For example, Bilash and Zubek found a gradual decline in general mental ability from the teens to the 70's, although such factors as comprehension, verbal fluency, numerical ability, and spatial abilities seem to deteriorate less rapidly than do memory, perception, reasoning ability,
and dexterity. Critical thinking ability appears to increase until the age of 25, holds steady to about 35, and thereafter declines gradually. Bromley has found that when different age groups are asked to arrange sets of blocks in as many meaningful sequences as possible, the youngest group (17-35) excelled groups of older individuals in both quantity and quality of sequences. He concluded that both quality and quantity of creative output declines with age, although quality declines faster. After testing thousands of subjects ranging in age from early childhood to 60 years, Raven concludes that most people attain a plateau in ability to reason by analogy at about 14 years of age, this ability declining gradually after about 25 years of age. In contrast, one's capacity to recall shows no such general decline. For those who early exhibit an average or below average ability to recall, this ability begins to decline gradually after the mid-twenties. Those who exhibit recall ability considerably above average, however, tend to show an increase in such capacity with age. Thus ability to recall may continue to grow, while one's ability to think in new ways declines.

Such evidence appears to indicate that creative ability declines with age, a conclusion which is substantiated by empirical studies.


Lehman's most elaborate studies of large numbers of creative individuals in a number of fields lead him to believe that creative productivity generally reaches its peak in the thirties and declines gradually thereafter. He also presents findings concerning the age ranges during which greatest contributions have been made in specific fields. In chemistry, for example, greatest contributions were made by persons from 26-30 years old. In mathematics, 30-34 was the most creative age range. Similar figures for other fields are enlightening and are thus listed.50

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<th>Field</th>
<th>Most Creative Age Range</th>
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Further generalizations proposed by Lehman may be useful in evaluating individuals for creative potential:

(1) The maximum production rate for output of highest quality usually occurs at an earlier age than the maximum rate for less distinguished works by the same individuals.

(2) The rate of good production usually does not change much in the middle years, and the decline when it comes is gradual.

(3) Production of highest quality tends to fall off not only at an earlier age but also at a more rapid rate than does output of lesser merit. ¹¹

We must take care, however, to differentiate between actual creative productivity and creative ability or potential. One's creative productivity may not be an accurate measure of his capacity to generate useful innovations. It may be that some portion of the decrease in creativity with age is caused by the tendency to saddle highly capable individuals with administrative duties which involve much routine activity and a heavy emphasis upon coordinating the efforts of others. ¹²

It would seem that the creative personality is often ill suited to such pursuits. Moreover, his creative contributions as an administrator are not likely to be of the type which lead to eminence as an artist, scientist, or philosopher.

The decline in intellectual capacities found in the studies discussed above do indicate, nevertheless, that there tends to occur a gradual decline in creative ability with increasing age. Other factors which may contribute to this decline include loss of physical vigor, sensory capacity, and motivation. Little study of consequence has been

¹¹Ibid., p. 326.

devoted to the changes in personality which occur with age, but this, too, may be an important factor.\textsuperscript{53} Again, the general inverse relationship between creative ability with age must not be applied too rigorously in the search for creative individuals, for there are great differences in the ages at which individuals achieve peak creativity, as well as individual differences in the rate of decline of creative powers.\textsuperscript{54}

Organizational Creativity Through Testing

With these clues as starting points, it appears that organizations should be able to generate programs designed to determine the personality traits associated with creativity within various fields of occupation. It is suggested that each organization test those constituents considered highly creative in order to measure the degree to which they possess the intellectual and personality traits found particularly relevant to creativity within that organization. Pertinent traits might be uncovered by comparing the results of such tests with the scores earned by individuals in similar occupations who are deemed substantially less creative than the first group. Candidates for such positions might then be evaluated with the aid of such tests. The progress of those selected (and those rejected, if practicable) for positions requiring creative ability should then be systematically recorded to provide evidence concerning the validity of examinations used.


\textsuperscript{54}Bilash and Zubek, \textit{op. cit.}, p. 181. An imposing list of creations produced by men at advanced ages may be found in Lehman, \textit{op. cit.}, pp. 220-240.
With the current stress on creativity, the variety and validity of such tests will probably grow. Organizations should, accordingly, keep track of such developments, maintaining flexibility within the testing programs. At present, however, the most validated examinations measuring creative ability appear to be those developed by Guilford (factor analysis of intellectual traits) and those by Cattell (16 personality factor test). While these tests overlap each other, the use of both types should increase prediction certainty. Other tests which may supplement the forementioned include the Barron-Welsh Art Scale (measuring complexity-symmetry preferences) and various projective techniques such as those being utilized by Hoffman (thematic apperception test, rorschach, and house-tree-person).
CHAPTER IV

TRAINING IN CREATIVITY

We have seen that there is growing evidence concerning intellectual and personality traits which differentiate creative persons from noncreative individuals in a variety of endeavors. Methods of measuring these traits are also being developed so that administrators are finding available to them a growing panorama of concepts and tools which should facilitate the selection and placement of creative persons.

It seems unlikely, however, that organizations will require creative giants in every position; nor is it probable that sufficient numbers of highly creative individuals could be hired even should managers desire to do so. An organization composed predominantly of persons with the personality traits ascribed to creative individuals might be too disjointed, too chaotic to survive. Ideally, an organization must balance within it components of creativity and those of stability. Routine activities must be performed along with those which have as the objective the generation of valuable innovation. We may deduce, then, a true need within organizations for those whose temperaments and intellects suit them for routine, stable activity.\(^1\)

The fact that certain functions are relatively stable and routinized should not imply that they cannot be performed more efficiently through the introduction of new procedures. The person performing these functions is often in a unique position to gain valuable insights into the problems involved in the current operation. Should he become sufficiently concerned with these problems to cause a focusing of his attention upon them, he, too, may evolve innovations of value to the organization. If we accept the premise that all persons possess some creative ability, then it follows that the efforts of all members may contribute toward organizational creativity. Such reasoning undoubtedly underlies the great popularity of suggestion systems, which are designed to elicit creative ideas from employees engaged in "noncreative" activities.²

Recently, organizations have taken some new approaches to the generation of creativity among their personnel. Prominent among these approaches is the attempt to develop the latent creative abilities of individuals through training. In addition, numerous publications urge individuals to cultivate their own creativeness through the application of certain rules and procedures. Creative ability is thus considered a skill which can be developed through training, within the limits imposed by an individual's genetic makeup and his basic personality. Perhaps, then, organizational creativity may be increased through the provision of training for individuals in positions requiring high degrees of creative ability as well as those persons in more routine activities. It

is the function of this chapter to describe attempts to apply such training and to analyze evidence concerning the degrees to which this training has been successful.

Developmental Techniques

Attempts to develop the creative abilities of individuals may be classified in two broad categories: advice and participation. Under the first category typically fall various publications in which are stated a variety of rules or procedures designed to facilitate useful and original thinking. Training through doing is the essence of the second approach, in which "trainees" perform mental exercises which presumably develop creative powers. Combinations of the two approaches have found considerable favor in American organizations. Let us examine each approach in turn, first in an attempt to understand their forms and content. Subsequently, we shall analyze evidence being uncovered by those who are studying the effectiveness of these techniques.

Advice

Insights into the creative process and the traits associated with creativity provide the bases for publications offering recommendations for increasing creative ability. For example, Raudsepp apparently draws heavily from his understanding of the creative process, deriving six broad rules designed to increase one's creativity. These rules follow, along with explanatory statements or sub-rules in parentheses:

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(1) Stretch your horizons (Diversify education and back­background)

(2) Cultivate your field (Intensify understanding of specialty)

(3) Pinpoint the problem (Define boundaries, determine the fundamental problem)

(4) Hunt for ideas (Let imagination soar, seek analogous solutions in other fields, do research)

(5) Boost your enthusiasm (Set idea quotas, jot down ideas, suspend critical judgement, find best conditions and times for creative thinking, concentrate)

(6) Prepare for premiere (Polish the creation: check all ramifications, anticipate objections, find creative ways to express ideas)

Raudsepp also admonishes that one may not solve the problem even after long, concentrated effort. One should then "back off," concern himself with other matters, and return to the problem later. Thus the sub­conscious processes are given their opportunity to achieve insight and a rested mind renews its attack on the problem. Using Edison's words, Raudsepp concludes that creativity is "1% inspiration and 99% perspiration."

A recent article in Nation's Business provides an example of advice for developing creative ability based upon intellectual traits found associated with highly creative individuals. More specifically, Guilford's findings concerning problem sensitivity, idea fluency, originality, and flexibility are utilized to provide clues to becoming more creative.

A quick glance at the more important advisory statements in this paper indicates its consistency with those of Raudsepp.

\[5\text{Ibid.}, \ p. \ 40.\]
(1) Develop problem sensitivity (The attitude that all things and procedures can be improved)

(2) Generate idea fluency (Seek large numbers of ideas on the subject without evaluating them, record ideas, pick a time to be creative, set quotas and deadlines to prod the mind)

(3) Seek original ideas (Cultivate the habit of asking searching questions, search for ideas and answers from other fields)

(4) Work for flexibility (Consider many approaches to problems, become conscious of mental "sets" or "blocks" and work to break them.

Further suggestions are offered toward facilitating the creative process, including the following: define the problem clearly; seek the facts and large numbers of ideas; don't evaluate ideas immediately; permit the subconscious to play its role; finally evaluate ideas.  

It is difficult to evaluate the effects of such advice on one's creative ability, for there have been no systematic studies of the matter. Certainly the statements are consistent with each other, and the rules and procedures appear derived from the rigorous studies of psychologists. It is questionable, nevertheless, that one is likely to change substantially his manner of approaching problems solely on the basis of written or spoken advice. Possibly such advice would form a valuable part in a more inclusive program for developing creative ability.

Training by Participation

Typical programs designed to increase creative ability of individuals within interested organizations stress development through participation in solving novel and difficult problems, although there are also included in such programs lectures and readings on the nature of creativity and advice such as discussed above. Two basic approaches dominate current programs of creativity training through participation. Probably most used is the widely publicized brainstorming technique, while the other may be termed the "out-of-this-world" technique. We shall examine each of these in turn and shall subsequently present such evidence as exists which indicates the effectiveness of these techniques.

Brainstorming

Brainstorming is possibly more often considered as a device for solving current problems than as a training device. Recently, however, there have been instituted in universities and other organizations courses designed to develop creative ability of individuals through their participation in a series of brainstorming sessions.

This technique, developed and popularized by Alex Osborn, emphasizes the production of large quantities of ideas relevant to a specific problem. The problem is presented to a group of persons who are

7An analysis of brainstorming as an operational technique is found on pages

8For lists of firms and schools which have adopted such courses, see "How to Keep Ideas Coming," Business Week, No. 1364 (October 22, 1955), 112-118. Also "Train Your Own Inventors," Nation's Business, Vol. XLIII (February, 1955), 28ff.

more or less acquainted with the subject. This group then submits ideas orally, the presumption being that each stated idea may initiate new trains of thought in the minds of other participants, who then present other ideas, and so on until a point is reached where new ideas are coming slowly due to fatigue or to saturation of the topic. "Freewheeling," or "free association," is encouraged, while judicial or critical thinking is prohibited, for quantities of ideas are the fundamental goal. It is felt that criticism (either of one's own ideas or those of others) inhibits ideation and thus would defeat the purpose of the session.

Creativity training through brainstorming is evidently based upon the hypothesis that participation is freewheeling, uncritical ideation sessions develops within the participant a greater proclivity for such thinking. He is thought to be more likely than before to seek quantities of somewhat relevant ideas, to keep his mind "open" while ideating, reserving for a later period his tendencies to set firm boundaries upon his thoughts and to evaluate them. It is also thought that the technique's very emphasis upon creative thinking may help free participants from a strong propensity to conform. Thus such training aims to develop (in Guilford's terms) idea fluency and originality. Moreover, specific problems can be utilized to develop one's capacity to redefine common objects. For example, the group may be asked to generate a large number of varying uses for a brick, a rubber tire, a pair of spectacles. Strengthening of one's problem sensitivity may also occur as a result of questions such

\[10\] An individual may conduct a solo brainstorming session by following the same rules.
as "How can the common pop-up toaster be improved?" or "What factors stand in the way of world peace?"

The brainstorming technique may, then, be utilized in an attempt to develop intellectual traits found to be associated with creativity. It is also conceivable that brainstorming may affect some of the personality variables relevant to creative ability. Perhaps participation in these activities augments one's confidence, his assertiveness, his willingness to think independently and to express unique ideas.

"Out-of-this-World"

Among other techniques used in conjunction with brainstorming for developing creativity is the "out-of-this-world" problem. Such a problem is usually presented within a bizarre environment, calling for novel approaches and solutions. Professor John Arnold is credited with popularizing this approach in his Creative Engineering course at the Massachusetts Institute of Technology. At the beginning of such a course, Arnold might propose to the class a situation similar to the following:

Uranium has just been discovered in ideal concentrations on the Antarctic continent, inland of the Luitpold coast on the Weddell Sea. Unfortunately, there is a solid sheet of ice many hundreds of feet thick covering all the land. You're a group of engineers in charge of working out the methods of getting down to, and mining the ore.11

Later in the course, the problems become more exotic, for the locus is changed to a unique planet, Arcturus IV, inhabited by intelligent beings with two legs, three eyes (one with x-ray vision), and a frail, bird-like body structure. The planet's atmosphere consists of methane,

while the oceans are masses of liquid ammonia. Temperatures range from 
\(-122^\circ\) to \(-230^\circ\) Fahrenheit. A rather complete picture of Arcturus IV 
has evolved over the years, as students and Professor Arnold have added 
ingredients designed to indicate both the varied products which might 
be of use to Arcturans (and visiting Earthmen) as well as the physical 
and cultural limitations to be imposed upon product design.\(^{12}\)

Problems to be solved by individual students include designing 
mechanical means of transportation for Arcturans, creating tools for 
harvesting crops (trees grow upside down), developing calendars, clocks, 
furniture, mining procedures, etc. Professor Arnold's intention is to 
strip problems, to the extent practicable, of elements which permit 
standard approaches and the application of habits and preconceptions.\(^{13}\)

Arnold's approach was adapted by an Air Force experimental work­
shop and expanded to include problems in providing for the inhabitants 
of "Globule II" a monetary system, entertainment, production systems, and 
communications systems, in addition to problems similar to Arnold's. 
Along with this multiphased problem, subjects participated in brain­
storming sessions and other exercises.\(^{14}\)

**Other Training Techniques**

Additional techniques utilized in the Air Force workshop included 
one in which subjects were asked to combine from two to four commonplace

\(^{12}\)Ibid., 186-187.

\(^{13}\)Ibid., 188, 190.

\(^{14}\)R. Gerry, L. De Veau, and M. Chorness, *A Review of Some Recent 
Research in the Field of Creativity and the Examination of an Experimental 
Creativity Workshop*, (Lackland Air Force Base, Texas: Training Analysis 
and Development Division, 1957), pp. 28-29.
objects so as to form a new, useful product. Thus a vacuum cleaner and a tennis racket might be combined to form a trap for small insects. Subjects were also called upon to define problems found in routine situations, the emphasis being placed upon conceiving the problem in its broadest terms, thus permitting novel solutions. In the same vein, objects were to be defined in their "most elementary, broad, and functional terms." It was hoped that practice in defining and redefining problems and objects might develop a general tendency to react to new problems similarly.\(^\text{15}\)

The General Electric Creative Approach Seminar utilizes group brainstorming as well as individual effort. Along with solutions to weekly problems in design, students must submit each week an idea either for a new product or for solving a current operating problem. Emphasized is the need for a productive approach to problems, much discussion concerning the steps in the problem-solving process.\(^\text{16}\)

**Effectiveness of Creativity Training**

Training programs in creativity are seen to take various forms and to include combinations of techniques. Because each program includes a number of techniques, possibly including brainstorming, out-of-this-world problems, lectures, other exercises, etc., the effectiveness of a given program is not firm evidence of the effectiveness of a specific technique. We can, however, examine evidence related to the overall effectiveness of such programs.

\(^{15}\)Ibid., pp. 29-30.

At the University of Buffalo, three comparable groups of students (54 per group) were tested for personality traits and creative ability before a semester began. The experimental group then took the 30-hour course in "Creative Problem Solving," in which brainstorming plays a prominent role. The control groups did not take this course. The groups were retested at the semester's end, and it was found that the experimental group "attained significant increments in quantity of ideas produced when compared with the control groups." The experimental group also outperformed the control group on "three out of five measures of quality of ideas." Of three personality traits measured before and after the semester (self control, need achievement, and dominance), one showed a significantly different rate of change for control and experimental groups: the experimental group exhibited a significantly greater increase in dominance, which we recall has been found to be a fundamental personality trait of highly creative individuals.

A second experiment at the University of Buffalo disclosed that groups which had been trained in brainstorming achieved both a larger number of ideas and a greater number of "good quality ideas" than did untrained groups when working on identical problems. A consistently positive correlation has been noted between quantity and quality of ideas.


18Ibid., 194.

19Ibid., 193. As used here, the dominance measure assesses "factors of leadership ability, dominance, persistance, and social initiative....High scorers tend to be seen as ... self-reliant and independent...."
in these experiments. Thus brainstorming, through encouraging the production of great quantities of ideas, may also enable participants to develop a tendency to produce more "high quality" ideas.

Subjects of the Air Force experimental workshop took creativity examinations before and after the training. The results indicated that there had occurred a decrease in ideational fluency, but an increase in originality, i.e., there had resulted an increase in the quality of ideas but a decrease in quantity. Perhaps, speculate the researchers, the increase in originality is of greater significance to creativity than is the production of great numbers of mediocre ideas. The subjects of this experiment considered the workshop a worthwhile experience, averring that it had contributed to their flexibility, confidence and perspective.

In a one-semester course at the University of Houston, 32 students attended lectures and discussions of traditional approaches to problem solving. They subsequently participated in brainstorming sessions and solved problems on "Globule II," the Air Force's adaptation of

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21 While the training received did give students practice on the type of problem included in some of these tests, specific subjects covered in tests were carefully avoided in the course. Thus the experimenters view the test results as indicating a tendency to transfer learned behavior, to generalize the tendency to think creatively. Meadow and Parnes, Ibid., p. 193.


23 Gerry et al, op. cit., p. 34.
Arnold's new frontier. Testing before and after the course indicated that during the semester there had occurred in the 32 students a significant improvement in the production of remote and uncommon responses, as well as an increase in the total number of ideas.24

The four studies just cited appear to indicate that training in creative thinking may actually increase the creative abilities of trainees. In each study, there developed within trainees a greater proclivity toward remote and uncommon responses. There is, however, some question concerning the effect of such training upon the quantity of ideas generated by subjects, three studies finding an increase in ideational fluency, while a decrease occurred in the other group. This seemingly contradictory finding may have been caused by greater emphasis upon originality and "quality of ideas" in the latter study. Such stress is thought to inhibit expression of ideas which are subjectively considered common or mediocre.25 While a decrease in ideational fluency may result from such training, the increased tendency to generate remote and uncommon ideas is believed more relevant to creativity. Great quantities of common or lackluster ideas are believed less likely to produce useful innovation than a smaller number of novel responses. In all the studies, training did improve the quantity of high quality responses. Thus the creative abilities of participants in the programs


were probably increased, even in the instance of the apparent decrease in ideational fluency.

Laboratory Experiments

Although the just-cited studies appear to justify a conclusion that creative ability can be developed through training, the conglomerate nature of these training programs precludes firm conclusions concerning the effectiveness of specific training techniques. To achieve insight into the effectiveness of particular techniques we must turn to more definitive experiments. Such experiments have been performed in attempts to determine proper methods for developing originality and flexibility.

Studies in Originality Development

A series of experiments recently completed by Dr. Maltzman and several associates at the University of California sheds much light on the effects of certain training techniques on creative ability. In the first study it was found that subjects who were required to give many responses in word association exercises later gave more original responses to new word lists than did subjects required to give only single responses to words on the original list. The hypothesis underlying this study states that subjects trained to generate responses low in the response hierarchy will transfer this tendency to new unrelated situations. Such a transfer did clearly occur in responses to the new word list. Although results on an unusual uses test were ambiguous, there existed positive indications of some transfer effect here also. Collat-

eral findings revealed that the group whose unique responses were reinforced (verbally rewarded by supervisors) produced more original responses, while instructions to be original also affected group originality positively.\(^{27}\)

In a second experiment it was found that subjects required to render multiple responses in word association exercises subsequently performed significantly better on the Unusual Uses Test than did the group required to render single responses, thereby substantiating the previously suspected transfer effect. Individuals in a new experimental group were asked to respond with the same word each time a given stimulus word appeared, thus limiting responses to repetitions of initial responses. This group subsequently displayed the least originality on the Unusual Uses Test, indicating that it is possible to develop stereotypy in individuals, as well as originality.\(^{28}\)

Having found that training through multiple word responses appeared effective in developing originality, Maltzman and his associates performed a new experiment, this time designed to determine whether originality could be increased by requiring subjects to respond with several different uses for a common object. Interestingly, groups with this training exhibited no significant increase in originality, scoring significantly lower on originality tests than did groups trained through multiple responses to words. Maltzman hypothesizes that the number of unusual uses for common objects is small relative to the possible associa-

\(^{27}\)Ibid., p. 398.

tional responses to words. Thus subjects tend to run out of unusual uses, present common uses, thereby inhibiting originality.29

In still another experiment, different groups received varying amounts of training through the word association technique. One group was required to respond once to each word in the list. For the second group, the list was repeated once, calling for a new response for each word. The third group was required to render new responses to five repetitions of the word list, while the fourth group did the same through ten repetitions. Subsequently originality tests indicated a significant positive relationship between increasing training and greater originality.30

Finally an investigation was undertaken to determine whether such originality training caused an enduring increase in originality. First an experimental and a control group took an originality test one hour after the experimental group had been trained. Then a similar duel of groups took the test two days after training. In both instances the experimental group displayed "a significant training effect on each of two tests of originality (word association and unusual uses)."31

We may summarize that Maltzman's studies of originality training support the following inferences:

(1) Individuals can be trained to be more original.


30 Ibid., 11-14.

31 Ibid., 14-16.
(2) Rewards for original ideas tend to strengthen the tendency to generate and articulate such ideas.

(3) One method found successful is the requirement that subjects respond to words with a number of different associations, thus developing a tendency to present ideas low in the response hierarchy.

(4) The length of such training directly affects the development of originality (at least up to some undefined point).

(5) Training in originality has enduring effects (again the rate of deterioration being undefined).

Modifying Functional Fixidity

While most of Maltzman's studies concern the development of originality in trainees, other investigations test the possibility that, through training, spontaneous flexibility and redefinition can be increased by decreasing functional fixidity. Underlying these studies is the hypothesis that solutions to difficult problems may be facilitated by developing within problem solvers a tendency to regard common items in uncommon ways. If a brick is subjectively defined as a building block, then the brick is of little use in solving non-building problems. When redefined as a missile, a weight, an abrasive (powdered or solid), a form (rectangular parallelepiped) or a structure of forms (angles, rectangles, etc.), a crude writing implement, or a noise maker, that same brick makes available solutions to a wide range of problems.

Several experiments have established that functional fixidity does affect problem-solving behavior and that functional fixidity can
be altered through training. A study by Birch and Rabinowitz, for example, indicates how readily functional fixidness can be developed in individuals. The individuals who composed two control groups and one experimental group were asked to solve Maier's two string problem. Two items, a switch and a relay, were available for use as weights for pendulums. One experimental group was pretrained in completing an electric circuit with the switch, while the second experimental group did the same with a relay. The control group, composed of six engineering students, received no pretest experience. In solving the problem, all ten subjects trained to use the switch as an electrical device chose the relay as the pendulum bob. The switch was chosen by seven of the nine students who used the relay for the circuit assembly. Of the six subjects in the control group, three chose the relay and three the switch. The pretest training is seen to have "changed the perceived properties of the object previously used in a different context to such a degree that its problem solving characteristic could not be readily seen."^34

In another experiment,^35 a control group was asked to solve the

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^33 In this problem, two strings hang from the ceiling. They are far enough apart so that the subject cannot reach both at the same time, even by grasping one and reaching for the other. The solution involves tying a sufficiently heavy object to one string, setting the "pendulum" in motion, then grasping the other string and reaching for the weight as it swings toward the subject. See N. R. F. Maier, "Reasoning in Humans: II. The Solution of the Problem and its Appearance in Consciousness," *Journal of Comparative Psychology*, Vol. XII (August, 1931), 181-182.

^34 Birch and Rabinowitz, op. cit., 125.

Maier two-string problem with no pretraining. Five experimental groups were also asked to solve the problems, each group given a different amount of training before the problem. The training took the form of giving subjects insights into the various uses of a critical object which (unknown to the subjects) would subsequently be included among items available to help solve the problem. When, after an unrelated exercise, subjects were exposed to the problem, "an almost perfect inverse relationship was found between group functional fixidness and the amount of varied pre-problem experience," thus facilitating problem solution. Thus training in diverse uses did attenuate group functional fixidness for one item, although no further problems were assigned to determine whether the training caused a general increase in spontaneous flexibility or redefinition.36

Studies by Maltzman and his associates indicate that solution of Maier's two-string problem is facilitated by presenting subjects with lists of uncommon uses for the various objects available to be used in solutions. Again, however, no evidence has been educed which would imply that a general tendency toward spontaneous flexibility and redefinition was developed in subjects.37 It would be valuable to determine whether general training in unusual uses would develop the ability of individuals to redefine critical objects in a variety of problem situations.

To summarize, experiments have led to the belief that functional fixidness appears to inhibit creative problem solving. This particular

36 Ibid., p. 350.

species of set or Einstellung readily develops in individuals. Although specific functional fixations can be modified, it is yet to be determined whether a general tendency toward spontaneous flexibility and redefinition can be readily developed through training.

Summary

We have encountered several studies which appear to substantiate the hypothesis that individuals can be trained to be more creative. Evidence strongly supports brainstorming as a training technique, while somewhat less certain results have been achieved with the "out-of-this-world" approach. Both of these are participative techniques. No evidence is yet forthcoming concerning the effectiveness of written and oral discourses on the nature of problem solving or rules and procedures for thinking creatively.

Experiments by psychologists indicate that originality, the tendency to generate uncommon and remote responses, can be developed by conditioning subjects to generate responses low in their response hierarchy. Perhaps new training techniques may be profitably adapted to training programs which utilize this principle. In addition, there are findings which indicate that specific functional fixations can be modified through exposure to varying uses exercises. It is yet to be determined whether such training produces a general tendency toward spontaneous flexibility or redefinition.
CHAPTER V

CREATIVE ENVIRONMENT

We have seen that the alert administrator finds available to him information providing insights into the creative process and means for facilitating the selection of creative individuals. Moreover, there are being developed and tested techniques designed to increase the creative propensities and abilities of individuals throughout organizations. As these insights grow, and as selection and training procedures are refined and validated, it would appear that the general level of creativity will climb within organizations applying such techniques.

There exists another factor, however, which helps to determine organizational creativity. This factor may be termed the climate or environment or atmosphere which exists within the organization. Students of creativity find that ideas, like living organisms, need a favorable climate if they are to occur, grow, and multiply. Likewise, the individuals with great powers to generate these ideas and a strong desire to do so may be further motivated by environmental elements, or stifled by them. To these environmental elements we now turn our attention, specifically emphasizing the attitudes and practices of administrators and group characteristics relevant to creativity.

It should be noted in advance that the creative environment
and the atmosphere conducive to mass production may be quite different places.¹ The factors set forth as leading to creativity may, in fact, impede routine productivity, as is discussed presently. Moreover, the reader may be impressed with the unlikelihood that there could exist within human organizations all the elements of the creative climate herein described. The creative climate should be regarded as a model in somewhat the same manner as the economist regards his model of pure competition. Each may rarely (if ever) exist, but each serves as a benchmark and, conceivably, a goal.

Managerial Attitudes and Behavior

One can hardly overemphasize the role of the manager as part of the creative environment. That his influence pervades the organization becomes manifest when it is recognized that he affects the selection, training, placement, and motivation of individuals with the organization. Thus he helps determine the traits of the persons who compose the group and the degree to which they tend to identify their own interests with the objectives of the organization. Through his budgeting activities he affects the physical environment, which may contribute to creativity. In the performance of his administrative functions the manager may himself be a source of valuable innovations. His attitudes and practices are, therefore, of vital consequence to organizational creativity.

¹Thus one student of creativity observes, "At any given point in its history, a company must decide, not whether it needs creativity (it does) but how much creativity it can afford." See Lydia Strong, Creativity in Industry: The Care and Feeding of New Ideas, (New York: American Management Association, Inc., 1958), p. 72.
An attitude may be defined as "a manner of acting, feeling, or thinking that shows one's disposition, opinion, etc.," or "the specific mental disposition toward an experience." Attitudes and behavior are closely intertwined, for one's behavior expresses one's attitudes, and one's attitudes are formulated from experiences arising out of his behavior. Let us examine some possible attitudes and practices of managers and their effects upon organizational creativity.

Sincere Desire for Creativity

In order to achieve membership in the exclusive Jockey Club in Paris, one must fulfill the principal criterion of conformity. In the words of the chairman of the membership committee, "People must really belong, you see. They must have acquired the same reflexes, the same way of looking at things so that we won't have to make an effort to understand them, nor they to understand us." There exists an air of satisfaction and comfort, and a desire to perpetuate current thought and behavior patterns. Change is anathema, tradition sacred. Management's task in this organization is to protect members from divergent views and original expression, to eliminate creativity.

Elements of the Jockey Club climate may be found even within organizations which purport to encourage creativity. A recent survey of 4,000 subscribers of the Harvard Business Review, for example, con-

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cludes that managers prefer subordinates who are systematic, precise, careful, orderly, painstaking, or punctual over those who are assured, capable, independent, tolerant, or courageous. When subscribers were asked to choose among presumably undesirable traits, it was found that bashful, retiring, or apathetic subordinates are preferred to argumentative, intolerant, or rebellious individuals. The preference among positive traits, then, is for subordinates who perform routine work well. As for negative traits, subordinates not likely to cause "trouble" are preferred even though they are not particularly productive. It appears, therefore, that dependability and high productivity at routine work are preferred to organizational creativity by a majority of administrators.

Further evidence of apathy toward creativity has been gathered by Raudsepp, who asked 105 authorities on organizational creativity to evaluate current practices designed to promote valuable innovation. He received answers similar to those below:

"The encouragement now given is so slight that creativeness now occurs only in those people who of themselves have to create, or are high in ambition." (Hugh P. McGee, Head of Special Applications Branch, U. S. Navy Underwater Sound Laboratory)

"In many cases, invention is not wanted. And in places where it is wanted, many obstacles to invention are set up, and they negate any inducement to invention." (Professor John E. Arnold, Stanford University)

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7Ibid., p. 6.
"Many creative people in technical work are discouraged because their creative contributions are not properly evaluated, are not given encouraging support, or are not greeted as important or necessary contributions." (P. R. Mason, Course Development Engineer, Creative Engineering Program, General Electric Company)

Thus we find that underlying apathy or hostility toward creativity often renders fruitless the efforts of potentially creative individuals who are overtly induced to innovate. Subtle or overt resistance to change sooner or later smothers tendencies to innovate, the innovator perhaps sensing that the true desire of administrators is for the comfort and certainty of routine.

Elemental to the achievement of organizational creativity, therefore, is a sincere desire for creativity by administrators at all levels. Such an attitude may be difficult to achieve in the face of the various underlying forces leading to resistance to change.\(^8\) The tone, of course, must be set at the top and communicated downward through words and deeds. Should subordinate managers understand that they are being evaluated and rewarded in terms of the creative contributions of their organizational units as well as for routine productivity, a great step is taken toward organizational creativity.

Facilitating Communications

As previously discussed, students of the creative process emphasize the significant role of a vast inventory of varied impressions within individual minds. It is further generally accepted that the chances of creative solutions occurring are enhanced when the individual's encounter with the problem is intense. Administrators concerned

\(^8\)Resistance to change was previously discussed on pages 34-35.
with creativity might well strive, then, to develop conditions likely to facilitate broad understanding among subordinates and intense encounters with organizational problems. Communications may play a strategic role here.

The administrator who realizes the creative role of great volumes of diverse knowledge encourages "horizontal" communications within the group and among groups, hoping to effect mutual enrichment of mental content. Too great a concern over maintaining the integrity of formal channels of communications greatly impedes such flows of ideas. Thus, while the formal communications network does serve a creative purpose, the exchange of information among various components of an organization is often encouraged where useful new combinations of ideas are sought. Further broadening of understanding is facilitated through encouraging subordinates to read widely, to travel, to attend meetings of related associations, etc.9

Effective vertical communications may also contribute to the creative environment. Flowing downward should be information clarifying objectives of the organization and relevant components thereof, as well as data deemed pertinent to problems obstructing goal achievement.10 Certainly inspiration and motivation by superiors may accelerate the creative process. The subordinate should be made to see

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the organizational significance of assignments and the close relationship between organizational success and personal success, thus increasing his absorption with organizational problems.

The secretive manager, concerned lest his subordinates know as much as he does, hardly fits into the creative environment. In sharp contrast is the leader with enough self-confidence and security to truly desire the success of his subordinates as individuals and groups, the manager who desires the development of his subordinates to their fullest potential, informing them and motivating them accordingly. Co-existent with this self-confidence should be sufficient confidence in the judgment and general proficiency of subordinates to permit them substantial discretion in their attempts to achieve assigned objectives.\(^1\)

Contributing to the effectiveness of downward communications is the upward flow of information. The manager must seek to understand the value systems of subordinates, as well as their personal and technical problems, if he is to determine how best to motivate them and provide them with useful data. He should be receptive to their notions concerning their own assignments, as well as other efforts of interest to them. It is suggested, in fact, that he request the reactions of subordinates to various directives (assignments, policies, instructions, etc.), and that he consult with subordinates on various matters of mutual concern.\(^2\)

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\(^{2}\)Ibid., p. 31.
The creative environment, then, is a permissive one, in which information flows freely in all directions. It is one in which individuals seek expression of others' individualities, in which each person is considered a source of potentially valuable information and opinions because of his unique position, interests, and/or background. Consensus in this climate does not stifle individuality, for it is not forced upon the individual. Rather, the individual affects others and the consensus.

Clearly for such an atmosphere there must be developed and communicated by administrators a true desire for creativity and a sincere respect for the individual. Such attitudes should be expressed in words and confirmed in deeds. Verbal encouragement of free communications rings untrue when expressed by the inscrutable, insensitive manager. Similarly, verbal communications of the desire for creativity lose their value lacking serious attempts to measure and reward creative performance.\(^\text{13}\)

**Freedom to Fail**

Innovation is often a risky process. For example, it is estimated that from 85 to 90 per cent of all new products fail.\(^\text{14}\) It is probable that a great proportion of the ideas for altering various

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\(^{13}\) In a study of three large industrial organizations, it was found that researchers believe the skills and abilities needed for success in their organizations differ from those required for creativity. Conflicts within individuals seem likely in such an environment, lessening the degree of creativity. See M. I. Stein, S. J. Heinze, and R. R. Rodgers, "Creativity and/or success," in C. W. Taylor (1957), *op. cit.*, p. 205.

theories, systems, and procedures are also found to be defective, sometimes only after great investment in time and other resources. Under these circumstances one might readily understand a reluctance among potentially creative people to promote vigorously significant departures from current thought and operation. The prospect of being associated with failure may be too unpleasant for the individual to chance. Not only may such failures jolt the ego, they may also be seen by the individual as jeopardizing his position in the organization. Thus many ideas of great merit are never expressed.\textsuperscript{15}

If organizational creativity is to be achieved and maintained, therefore, administrators must take steps to offset these forces leading to reticence. The manager should, of course, recognize the risks inherent in departures from the normal approach. At the same time, however, he should be aware of and emphasize the risks of remaining static in a dynamic situation. Surely some innovations will be costly mistakes. The real question is whether those innovations which are successful outweigh the total costs, including the errors.\textsuperscript{16}

Where success in an organization is believed by the individual to be closely related to his reputation for always being "right," the tendency to attempt novel approaches is weakened. Randall clearly depicts this danger:

\begin{quote}
Faced with a problem situation which should set his mind to work to develop the\textit{ best} possible solution, he instead must turn to a search for the\textit{ safe} solution. The drive to be right blocks out all creative process, for the element of risk
\end{quote}

\textsuperscript{15}Ardleigh, \textit{op. cit.}, p. 98.

\textsuperscript{16}E. R. Randall, \textit{op. cit.}, p. 126.
is apparent. Instead of a creative process the mind adopts the process of recall, attempting to find a proven rule from the past into which the new problem fits. If this combination is found and the fit is a good one, he may possibly expect to do as well as was done in the past, though certainly not much better. And, of course, if the environment has changed sufficiently, he may do much worse. But the important consideration is that he has successfully escaped the possibility of jeopardizing his future with unknown. He avoids the risk of being called unstable and the possessor of poor judgment.17

More likely to attempt creative solutions is the person who feels confident that his superiors consider him a valuable asset, whose original contributions outweigh his errors. In the extreme case, in fact, the individual would be accepted "as of unconditioned worth ... of worth in his own right and in his own unfolding, no matter what his current condition or behavior."18 Within such an atmosphere the individual may act freely and spontaneously, and thus creatively.

While it is true that few individuals are likely to be considered "of unconditioned worth" regardless of current behavior, the individual's long-run value to the organization should be emphasized. Certainly every practicable precaution should be taken to minimize losses due to errant innovations. Before great commitments are made, relevant data may be collected, rigorous logic applied, and hypotheses tested on a small scale. Assuming positive results, the substantial investment may then occur despite still existing unknowns and risks. While the initial ideator is probably vitally concerned with the success of "his baby," he should be made to see that his position and

17 Ibid.

reputation within the organization are not contingent upon this, or any other, single idea.\textsuperscript{19}

**Flexible Control**

As discussed previously, creativity involves the combination of impressions into new mental configurations. The most satisfying configurations may not (and often do not) occur as a direct result of conscious analysis, but rather as a result of the subconscious processes of association and dissociation. Partial insights gained after a period of insight may direct further conscious study, leading to new subconscious probings, and so on until a complex problem is solved.

The nature of these steps in the creative process suggests some administrative practices likely to be conducive to creativity. To begin with, it may be productive of valuable innovations to permit somewhat creative persons some freedom from routine activities so that such individuals may consciously gather and analyze information concerning the organization's objectives and problems.\textsuperscript{20} Although this practice may lead to a decrease in routine productivity, this loss may be more than offset by an increasing number and value of innovations. Whereas routine work ceases when the worker leaves the office or closes


\textsuperscript{20}Some research departments within business and government organizations permit researchers free time during the normal work week to pursue research of extreme personal interest. See Norman Kaplan, "The Relation of Creativity to Sociological Variables in Research Organizations" in D. W. Taylor, *op. cit.*, p. 244. Also S. Boutourline, *et al.*, *Individual Creativity and the Corporation*, (Boston: Institute of Contemporary Art, 1959), p. 163.
his homework-packed briefcase at home, creative work may progress 24 hours per day, every day of the year. Thus small investments in productive time may, assuming proper motivation, increase the total number of hours spent working upon organizational problems. Moreover, the type of work being done is probably more satisfying to the creative individual than is the routine work sacrificed.

A second, closely related, administrative lesson to be deduced from the creative process involves the type of activity conducive to creativity during "off-duty" time. It appears that a great proportion of valuable innovations explode into consciousness while the individual is engaged in activities which are unrelated to the problem, and which allow the mind to remain passive. It may be, then, that significant insights occur when the briefcase remains in the office, while the individual goes home to "relax." Similarly weekends and vacations away from work may be highly productive of creativity. To maximize the contributions of somewhat creative persons, therefore, perhaps they should be encouraged (at times, at least) to leave their routine work in the office at night, to partake of diverse activities and relax during weekends and vacations.21

Also relevant here is the problem of scheduling creativity. Since creativity often involves an interweaving of conscious and sub-

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21 R. Dreyfack, "How to Get Ideas from an Idea Man," Management Methods, Vol. ILV (June, 1960), 46. Also see Ardleigh, op. cit., p. 100. Interesting testimonials by top sales executives concerning their most creative moments may be found in "Where do Sales Execs Get Their Ideas," Sales Management, Vol. LXXXV (September, 1960), 95ff.
conscious processes, the timing of insights is difficult to forecast. Time, however, is often so important a factor, that managers may tend to establish firm deadlines for creative products.\textsuperscript{22} Such deadlines may serve to stimulate early and continuous efforts to produce. This very pressure may, nevertheless, prove hazardous, for the individual may seek primarily to meet the deadline instead of seeking the most satisfactory solution. Tensions fed by the approaching deadline may prevent the broad mental scanning among apparently unrelated impressions, limiting associations to those high in the associational hierarchy.\textsuperscript{23} Truly novel solutions may be subjectively rejected because of the time considered necessary for verification. Thus the use of firm deadlines is a questionable practice in the creative environment.\textsuperscript{24}

When considering setting a deadline, the administrator might do well to ask himself these questions: Is an answer really necessary within a specified time period? Is the problem of sufficient significance to permit an indefinite allocation of resources to its creative solution? Are not the inner motivations of the problem solvers

\textsuperscript{22}For example in firms under contract to develop missiles and space vehicles for the U. S. Government. See Francis Bello, "Industrial Research--Geniuses Welcome," \textit{Fortune}, Vol. LIII (January, 1956), 145.

\textsuperscript{23}Experiments indicate that responses to problems become more uncommon and associations more remote as the time permitted for solutions increases. P. R. Christensen, J. P. Guilford, and R. C. Wilson, "Relations of Creative Responses to Working Time and Instructions," \textit{Journal of Experimental Psychology}, LIII (February, 1957), 88.

\textsuperscript{24}This issue may soon be clarified by current studies of relationships between anxiety and creativity. See "Creativity," \textit{op. cit.}, p. 7.
sufficient to expedite achievement? What positive means are at my disposal to accelerate the creative process?

**Tolerating Irreverency**

For a substantial degree of creativity to exist within an organization, there must be a questioning attitude among its members. The existence and expression of such an attitude is often difficult to attain. Old, long-revered concepts and methods often command too much general acceptance, too much respect to be questioned, subjectively or openly. In fact, great creative acts at one point in time may, through their subsequent grasp upon individuals, retard further progress.

Spellbound by Aristotle's achievement in extending and categorizing human knowledge, subsequent generations made little progress in astronomy, biology, and logic. It is said that Aristotle's works were "worshipped rather than studied." Yet Aristotle was not always correct; nor had he advanced beyond the rudiments of various subjects where he was essentially right. Because doubts amounted to heresy and questions were tantamount to irreverency, the status quo lived a long and secure life.

Perhaps the Aristotle example is too extreme to apply to American organizations, especially those which overtly champion progress. Yet many such organizations also practice promotion from within, which

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26 As one historian puts it, "The Scriptures, the writings of Church Fathers, and Aristotle were placed virtually on the same plane and were considered unimpeachable authorities, citation from which was incontrovertible truth." C. E. Smith and L. M. Case, *A Short History of Western Civilization*, (Boston: D. C. Heath and Co., 1940), p. 333.
tends to perpetuate the ideals and practices previously accepted. Then there are the guiding hands of men who have previously achieved greatness for themselves and the organization. F. W. Woolworth, for instance, fought long and effectively to keep his company from discarding the ten cent price limit. For many years after his death, the Woolworth Company consistently lagged behind other variety chains in its price adjustments. Probably accounting for some of this conservatism is the fact that his successors were "inbred." Supplementing this long indoctrination was the possible thought that the initiative, vision, and judgement of F. W. Woolworth had built the organization from an idea into a great empire. How many men would be likely to dispute his judgement? How hard could one fight to change a practice so highly successful?

The creative organization, on the other hand, does not idolize the past; it utilizes the past. There should exist a belief that past practices (even eminently successful ones) can become obsolete, that the great ideas of great men may serve as bases for further advances, that even great men can be wrong. In such an environment the questioning attitude is considered normal.

**Rewarding Creativity**

If highly creative individuals are to be attracted to, and re-

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tained within, an organization, they must feel that their efforts will be well rewarded. Since rewards take many forms, however, the effective manager of creative people must attempt to discern which rewards are likely to be most desired by his specific subordinates. Generalizations concerning the relative effectiveness of various types of rewards appear to present more hazards than utility, for there exist no formal, comprehensive studies of the motives or objectives of creative people in general. Each individual, it appears, is a unique composite of age, education, wealth, health, ethnic derivation, and experience, all of which may affect his system of values and his specific objectives at a point in time.

Hierarchy of Needs. A brief examination of Maslow's hierarchy of needs clarifies the existence of individual differences and helps properly to emphasize the need for managerial sensitivity. Maslow believes the motivations of an individual to be determined by the degree of satisfaction of his "prepotent," or more basic, needs. Maslow's hierarchy of needs may be listed as follows, in order of prepotency:

1. Physiological needs (food, warmth, sex, etc.)
2. Safety-Security (concern for the future)
3. Love and Belongingness (affectionate relationships with people)
4. Esteem (self-respect and the respect of others)

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5. Self-Actualization (self-fulfillment, achievement of maximum potential)

6. Knowledge and Understanding

7. Aesthetic needs (desire for beauty, order, symmetry)

Thus only when an individual's current physiological needs are somewhat satisfied does he become primarily concerned about the future. Upon achieving a level of security, he becomes primarily concerned with attaining love and belongingness, and so on. It is not necessary for our purposes that Maslow's hierarchy of needs be accepted in full. (In fact, Maslow admits that the hierarchy appears only generally true, noting several exceptions and modifications.)

Such a model for human motivation does have great heuristic value, however. To utilize such a model, the manager must attempt to discern to what extent each subordinate's various needs are satisfied or unfilled. But what determines when a given individual feels secure? Such variations must be sensed by the administrator, it appears, if proper incentives are to be consistently applied. Managerial alertness and judgement are made even more important by the possibility that behavior can be falsely interpreted as aimed at gratifying a certain need. For instance, is an individual's demand for a salary increase motivated by a desire for the fulfillment of physiological needs, for a greater feeling of security, or for greater esteem? If, furthermore, behavior is determined by a combination of

\[31\] Ibid., pp. 98-100.
motivations, then the administrator's need for sensitivity and understanding is increased.\textsuperscript{32}

At present, therefore, no profound psychological theory can replace the observant administrator, aware of the complexity of his subordinates and the variety of incentives available to initiate and reinforce desired behavior. Included among these incentives might be financial rewards for specific ideas or salary increases based upon a record of high creativity, private and public recognition of valuable contributions, more responsible assignments, more free time for creative projects, various status symbols, promotions, etc.

\textbf{Insuring credit for ideas.} Since creative individuals have much to gain by being identified with their valuable contributions, administrators do well to provide mechanisms wherein such ideas are recorded and credited. Westinghouse Corporation, for example, utilizes for this purpose an "idea book," in which ideas are recorded, dated, and signed. Other large corporations utilize their patent offices to preserve the authorship of potentially patentable ideas, although this is often a complex task when several persons have contributed to the full development of an innovation. B. F. Goodrich Company, among others, has assigned to specific persons the task of preserving credit for ideas, in addition to helping innovators to fully develop their brain-children. The well-known suggestion system serves a similar purpose, \textsuperscript{32}

in addition to evaluating ideas.\(^{33}\)

The direct superior may play a strategic role in encouraging communication by subordinates of their innovations. Often the superior is in a position to shed insight on the subject in question, or he may be able to suggest sources of further information. He may also be in a better position to "sell" the innovation than is the innovator.\(^{34}\) If the innovator is seriously to consider discussing his novel ideas with his superior, the innovator should feel confident not only of his superior's desire for creativity and ability to help in some way; there must also exist confidence that such a discussion will not risk authorship. A reputation for honesty and true concern for the success of his subordinates is invaluable to the administrator here.

**Problem of promotions.** The question of promotions for creative people is receiving considerable attention, the basic issue concerning what to do about advancement when a highly creative specialist (scientist, copywriter, artist, professor, for example) reaches the top non-administrative position within the relevant hierarchy. Too often it has been found that the organizational value of a highly creative specialist is decreased when he is given administrative duties. As discussed earlier, he is often ill-suited to work calling for many

\(^{33}\)Information on methods of protecting the ideas of innovators was collected by graduate students in the Harvard School of Business, cited in S. Boutourline, \textit{et al.}, \textit{Individual Creativity and the Corporation}, (Boston: Institute of Contemporary Art, 1959), pp. 161-162.

\(^{34}\)Ibid., p. 152-153.
important human relationships. Moreover, administrative work typically involves great amounts of time spent dealing with details and routine activities, both of which often irritate the creative individual. The problem is intensified when such persons do not desire administrative positions, preferring to deal with matters utilizing their greatest competency. Thus advertising agencies offer brilliant artists and writers salary increments and more impressive titles, along with administrative responsibilities. Such persons often find that the greater the title, the less creative freedom they retain in their specialty. As a result, many leave agency employment to offer freelance services.

The prospect of promotion, nevertheless, is believed to be a great motivator, signifying more money, status, self-development opportunity, and possibly the gratification of other needs. In order to attain the benefits of promotional opportunities without the previously discussed disadvantages, some organizations are creating new, higher level non-administrative positions within specialized fields. Thus Ratheon Company recently created three new positions with the titles, "consulting scientist," "consulting engineer," and "science fellow;" Technical Operations, Incorporated simultaneously added the title of "corporate fellow;" and similar positions have been created


36Ibid.

37"A Scientist by any Other Name," Business Week, No. 1697 (March 10, 1962), 89-90.
by American Cyanamid Corporation.\(^{38}\)

At Raytheon, promotions to these positions are based upon the individual's education, experience, and standing in his field. Technical Operations, however, deemphasizes the formal factors of education and experience, placing greater stress upon imagination and creativity. At both organizations attainment of these positions means a true promotion, involving more money, freedom from deadlines and specific projects, distinguishing titles, higher spots in the organization chart, and closer contact with top management.\(^{39}\) Similar approaches are being considered in Civil Service research organizations;\(^{40}\) and such arrangements have long been accepted at major universities. Thus the "university fellow" at Harvard and Cambridge teaches no classes, presumably so that he may utilize his time more productively in research and writing.\(^{41}\)

**Group Dynamics**

Clearly, then, managerial attitudes and practices are important facets of the creative environment. Highly conducive to creativity are the sincere desire for creativity and the measures often used to achieve it: pervasive communications, tolerance of failure, flexible scheduling, tolerance of irreverency, and appropriate reward systems.

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\(^{38}\)Ardleigh, *op. cit.*, p. 98.

\(^{39}\)"A Scientist by any Other Name," *Loc. Cit.*


\(^{41}\)"A Scientist by any Other Name," *op. cit.*, p. 90.
Also of signal importance to creativity within an organization are the factors of group composition and interaction. While formal group relationships are to a great degree, determined by administrators, interactions within groups bring about the formation of informal organizations, attitudes, and motivation among individuals, all of which are parts of the environment affecting creativity. Let us now examine some ways in which the nature of groups helps determine the extent of valuable innovation within those groups.

Patterns of Conformity

Of considerable recent concern is an apparent tendency among individuals to conform to group beliefs, attitudes, patterns of behavior, and other norms.42 This tendency passively to accept externally imposed norms often forms a powerful deterrent to creative thought, for alternative conceptions are not seriously considered. Even should creative thought occur, expression of new conceptions is inhibited where the group appears adamantly committed to existing norms.

A number of studies provide rich insights into the phenomenon of conformity, as well as clues to the attainment of creativity within groups. Monumental among these studies are those performed by Solomon Asch,43 who constructed experimental situations in which individuals found their own perceptions disagreeing with those of an otherwise

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42This concern is eloquently expressed in W. H. Whyte, The Organization Man (Garden City, New York: Doubleday & Company, Inc., 1956), pp. 435-448.

unanimous majority. Asch found a clear "majority effect," i.e., a clear tendency for individuals to assume the majority position, even though that position was incorrect. Some individuals adopted the majority position on each question, while others did so at times, and a third group rendered responses completely independent of the majority. In discussions following experiments, subjects who responded independently expressed deep concern over their frequent disagreements with an otherwise unanimous majority. Some confessed rising doubts of their perceptive ability; others were tempted to agree with the group to avoid being regarded as absurd or inferior. Most stated a desire to agree with the group. Still others admitted that their judgements were inaccurate (which was untrue), while those of the group were correct. These subjects had, nevertheless, resisted the admitted tendency to concur with concensus.44

Among those who typically yielded to concensus, some appeared to have experienced a subconscious distortion of perception as a result of the group's erroneous pronouncements. Others perceived accurately, but then concluded that their judgements were wrong, in the face of opposing concensus. Such subjects cited the conviction and unanimity of preceding responses as reasons for doubting themselves. Finally, some conformers appear to have experienced an overwhelming need to be accepted as a normal part of the group. These subjects became relatively unconcerned with correctness and integrity, fearing primarily negative reflections upon themselves and exclusion from the group. Having perceived accurately and maintained their

44Ibid., pp. 468-472.
correct judgements subjectively, these individuals expressed conforming (and incorrect) judgements.\textsuperscript{45}

Thus Asch found that the opinions of unanimous opposition have considerable power to change the views and expressions of individual deviants, causing distortions in perception, judgement, and expression. Modifications of his basic experiment provide further enlightenment on conformity within groups. Even when the "objective discrepancies" were increased so that the majority was glaringly in error, there persisted a notable tendency to conform. Striking reductions in conformity occurred, however, when one other person within the group responded with correct answers, the number of errors dropping from 33 per cent to 13 per cent. No subject exceeded three errors in the seven "rigged" judgements, whereas some had erred on all seven when facing unanimous disagreement. Thus the support of one person reassured the independent and substantially liberated the dependent from the erroneous majority.\textsuperscript{46}

Similar studies by Berenda,\textsuperscript{47} with children as subjects, yield an even greater majority effect. Where 61 per cent of Asch's college subjects erred two times or less, 48 per cent of children between 10 and 13 years of age did as well, and only 36 per cent of those between 7 and 10. While only 12 per cent of the college group erred from 5 to 7 times, 32 per cent of the older children erred this often, and 42

\textsuperscript{45}Ibid., pp. 468-472.

\textsuperscript{46}Ibid., pp. 474-479.

per cent of the younger children. The tendency to conform, then, appears to decline with age.

Later tests by Crutchfield\textsuperscript{48} substantiate this hypothesis, finding that adult women (all in their early forties) tend to be more independent than college women. He also found a considerable range of "conformity scores" among subjects, as did Asch. Thus within a group of 50 men, several conformed to erroneous views on only 1 or 2 of 21 judgements, while others erred with the majority 17 times. These men were all highly successful in fields wherein leadership is one of the "salient expected qualifications." Crutchfield also found that college females tend to conform in experiments more than do college males, and that the tendency to conform varies inversely with age. As might be expected, nonconformers exhibited a pattern of traits found also in creative individuals: intelligence, dominance, independence, and self-confidence. Subjects who scored high on originality exams tended toward low scores in conformity. Finally, Crutchfield\textsuperscript{1} studies reveal that it is easier for an "authority" to increase conformity than to decrease it. When an experimenter said "correct" after subjects' concurrence with erroneous concensus, conformity rose as high as 90 per cent of responses. When he agreed with subjects deviating from spurious concensus, conformity dropped slightly.\textsuperscript{49}

Other factors underlying conformity include the individual's relationships with the group. Evidence reveals consistently that the


\textsuperscript{49}Ibid., p. 196.
higher the individual values membership in the group, the more likely he is to conform. It is not yet clear what effect group acceptance of the individual has on his degree of conformity. Jackson and Saltstein, among others, found that conformity is directly related to group acceptance. In contrast, Kelly and Shapiro conclude from their studies,

Among persons who place high value upon their membership in a group, those who are judged highly acceptable as co-workers were more likely to deviate from the norm than members who are not considered very acceptable. The latter authors admit, however, that their findings are unique, contradicting those of other studies. Evidence does consistently point to higher degrees of conformity by those who are of questionable acceptability to the group. Thus persons of minority ethnic derivation and other "outsiders" appear highly sensitive to group norms.

We find, accordingly, that within many individuals there exist strong forces leading toward conformity, forces so strong at times that conformity occurs even when the group is clearly mistaken. Let group unanimity be broken, however, and the tendency to conform with the majority plummets. Let some within the group be open minded


or of a different opinion, and others will find the strength to think new thoughts and express them.

Group makeup is also material to conformity. Apparently, females are more likely to conform than males. There seems to exist an inverse relationship between age and conformity, at least up to the early forties. Typically low conformers are individuals who are self-confident, intelligent, independent, and dominant, all traits of the creative person. Perhaps the group makeup can be manipulated, then, to increase group creativity and decrease conformity. For example, perhaps the injection of a few persons with nonconformity traits would help create an environment in which weaker individuals would contribute ideas of value. Too many nonconformers may, however, impede creativity within groups. Thus Cattell's studies indicate that groups "heavily laden" with traits of dominance and independence tend toward ineffectiveness in intellectual problem solving.54

The further finding that conformity is strengthened by a strong attraction to the group presents a challenge to the group as well as the administrator. How can knowledge of such a tendency be utilized to promote creativity? One answer is to have groups which desire and socially reward creative thinking. To conform, then, would mean generating and encouraging valuable innovation. Another possibility is frequent transfer of personnel among groups, or temporary groupings

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to lessen the probability of identification with one rigid group. Also, individuals may be encouraged to become active members of several groups simultaneously, including informal groups within the organization, and professional and social groups outside the organization. Finally, since one's attraction to a group is often an economic attraction, a degree of economic security would appear helpful in minimizing the extent of conformity.

If it is true, as indicated, that a sense of rejection or uncertainty of acceptance by the group encourages conformity, then an apparent answer is a group display of full acceptance of such individuals. It would seem, furthermore, that a sincere consideration of such members' viewpoints would help, as would an overt desire for unique ideas and creativity in general. An individual might then consider himself even more valuable to the group because of his uniqueness.

Importance of Disagreement

As is the case with group composition and attraction, certain interaction patterns within groups are found material to creativity. Torrance, for instance, concludes from his studies of aircrew effectiveness in Korean combat that high group effectiveness is character-


ized by a greater tolerance for disagreement. Those groups exhibiting a general tendency toward initial wide divergence of expressed judgment and broad participation in decision making are found to be more adaptive and more willing to take calculated risks. Emphasized is the value of expressed disagreement directed toward group goals, rather than toward other personalities within the group.

Ziller's studies lead to a similar conclusion. He finds that more accurate decisions derive from "heterogeneous group scales of judgement," or wide ranges of alternatives generated by members of the group. To assure candid expression, Ziller finds, it is best to elicit opinions from individuals in ascending order of rank or status, since there is a smaller likelihood of conformity by superiors than by subordinates. Not only does this procedure contribute to better decisions, but it also appears to promote greater understanding and acceptance of decisions by the group.57

Another study, by Maier and Solem, also emphasizes the need for full participation by members of a group if decisions are to be most productive. These experimenters find that in leaderless discussion groups, the vocal majority tends to discourage expression of minority views. Where a discussion leader helps to gain expression of divergent minority opinions, the likelihood of superior (and creative) decisions increases.58


Overview

Let us review briefly the highspots of our discussion of the environmental factors affecting creativity within organizations. Of signal importance is a sincere desire for creativity by administrators throughout the organization, with the tone set by the very top managers. In order to gratify this desire, pervasive communications should be encouraged to help motivate and "cross fertilize" the minds of potential creators. The risk inherent in innovation should be recognized and minimized through the application of logic and research. Innovators should feel that their value to the organization is not determined by the success or failure of any one idea, but rather by long-run creativity and productivity.

To increase the likelihood of truly creative solutions, schedules and deadlines should be flexible. It should be remembered that the creative process may be accelerated through encouraging changes of pace and relaxation for subordinates, and through relieving them of some routine work.

New and valuable ideas often challenge accepted and revered ones. The administrator, then, must beware of "worshipping" past ideas and persons. He must regard them as stepping stones toward still greater insights, and he must admit the possibility that currently accepted ideas and practices are becoming invalid or capable of improvement.

The manager should try to glean the value systems and problems of his subordinates if he is effectively to motivate them toward creative effort. He should have at his command and utilize a wide variety of incentives, and he should apply them according to his
insights into individual differences. Subordinates should be assured of receiving their due credit and appropriate rewards. Caution must be taken, however, to promote to administrative positions only those whose value to the organization is maximized by this action. It may be more beneficial to all concerned to create positions equal in status and other rewards to administrative positions, permitting the creative individual to make even greater contributions within his specialized field yet not involving administrative responsibilities.

Organization implies the existence of groups, and groups affect the behavior of their members. Group dynamics, then, forms a logical determinant of organizational creativity.

A number of studies testify to the tendency of individuals to conform to group norms. The tendency is strong when the potential deviate faces unanimous opposition, in which case the individual's cognition, judgement, or expression may be distorted toward the majority position. Conformity plummets, however, when the deviate finds even small support for his view.

Group composition and attraction affect conformity. Thus conformity appears inversely related to age and appears stronger in females than males. Individuals exhibiting traits associated with creativity are typically less likely to conform in groups. Those strongly attracted to groups tend to conform, as do persons who feel insecure of their position within groups. Evidence conflicts concerning conformity of individuals who are both highly attracted to groups and also highly accepted.

Also affecting creativity within groups are certain group attitudes and behavior. Group tolerance of goal-directed disagreement...
facilitates creativity, as does full group participation in solving problems. To increase the likelihood of candid participation, the views of members should be heard in ascending order of rank and status. Discussion leaders may facilitate creative decisions by assuring full airing of minority positions.

Thus the administrator may help create a creative climate through the cultivation within himself of attitudes conducive to creativity and practices facilitating it. He may manipulate group membership and encourage productive patterns of interaction to minimize conformity and to utilize uniqueness.
CHAPTER VI

OPERATIONAL TECHNIQUES

From the foregoing discussion it becomes clear that the achievement of organizational creativity presents a complex challenge to administrators. Potentially creative individuals must be selected and placed where their talents are most valuable. Training may help to develop the creative potentials of the organization's members who have varying degrees of the traits associated with creativity. Certainly an environment conducive to creativity can and should be cultivated. A considerable amount of study has provided the interested administrator with many insights into techniques and concepts which may guide him in these efforts. To the extent that such growing insights are gleaned and utilized by astute administrators, organizational creativity may flourish.

Still another facet of organizational creativity remains to be examined herein. While much emphasis has been allocated to the development of an organization generally able to innovate constructively, nothing has yet been said about the variety of techniques available for solving specific problems. Yet there exist a number of approaches which, when applied to complex problems, are said to facilitate creative solutions. These approaches, commonly termed "operational techniques," are of two basic types. We shall call the
first type "thought provokers," for this group of techniques prods the individual or group mind toward rigorous analysis as well as uncommon and remote associations. The second fundamental classification of operational techniques may be termed "conference methods," under which fall the various group approaches to creative solutions, including the much-publicized and controversial brainstorming. Emphasized in the second category is the mutual mental stimulation and "cross fertilization" said to occur in somewhat uninhibited group discussions.

Thought Provokers

A number of techniques are being used to prod minds toward creative thought about specific problems. For convenience, these may be classified as analytical techniques, forced relationship techniques, and checklists. Some admonitions appear useful before examination of specific operational techniques. Proponents of such procedures do not claim that these approaches provide in themselves fully developed creative solutions to problems. Rather these techniques help to generate large numbers of uncommon and remote ideas, ideas which might not occur to the unaided imagination. The production of large volumes of diverse ideas is frequently of great value when tackling a problem which may have a variety of acceptable solutions. After such techniques are applied, there still remains the often sizable task of evaluating ideas produced and modifying them toward practicality.¹

The various operational techniques have several other facets in common. The statement of the problem is, for example, of great concern. Judgement must be used to insure that the problem is not conceived too narrowly. The problem statement, "how to build a better mousetrap," might overly restrict thought if the true problem is "how to eliminate mice." Similarly, "how to get Johnny to eat his eggs" might be expanded to "how to insure that Johnny gets sufficient proteins." The problem may, in contrast, be stated too broadly. Thus, "how to market our new product" might be more readily manipulated if it were divided into sections dealing with packaging, promotion, channels of distribution, etc.

Two rules usually guide sessions in which operational techniques are used:

(1) All judgements or evaluations are eliminated from the idea-producing stage.

(2) All ideas, even the most impractical, are considered.

The first rule encourages freedom of thought and expression, and may serve a further purpose of conserving time through eliminating interruptions in the flow of ideas. Consideration of all ideas, even the seemingly impractical, may help to generate unusual solutions, perhaps through modification or combination with other ideas, or through forming a needed link in a propitious chain of associations.

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3 Ibid.
Thus the two rules cited are basic to the application of operational techniques by individuals as well as groups.4

Analytical Techniques

Logical, step-by-step approaches to the problem are involved in the analytical operational techniques. As depicted subsequently, these techniques attempt to combine basically logical structures with the freewheeling, positive rules cited above. Let us now examine the most widely used among these analytical techniques, including attribute listing, input-output analysis, morphological analysis, and the epistemological method.

Attribute Listing

Professor R. P. Crawford of the University of Nebraska is credited with developing the technique called attribute listing. This technique involves defining a critical object or idea in terms of its major characteristics or attributes. The possible changes for each characteristic are then ideated. Thus the common (nonmechanical) pencil is typically yellow, is framed of wood, writes with a black lead center, and has a rubber eraser at the top, among other characteristics (weight, shape, size, etc.). Changes may now be sought for each major attribute. Any number of colors and color combinations may be suggested; and the wood frame might be changed to metal, plastic, leather, rubber, etc., or it might be done away with altogether. New writing media may be suggested in place of lead. Thus one might write with an electrically

4C. S. Whiting, "Operational Techniques of Creative Thinking," op. cit., p. 25.
charged point on sensitive material, or the pencil might deposit a chemical which in time etches the message on metals, rock, etc. The eraser might consist of a chemical which dissolves errors, rather than rubbing them away, or of materials which recoat paper to cover errors.  

To increase the possibility of truly radical suggestions, the basic function of a product may be considered as an attribute. Then changes may be offered for performing the same function in different ways, or for utilizing the product to perform new functions. Attribute listing may be utilized, then, to vary the details of an object or an idea, or to generate sweeping, inclusive metamorphoses.  

Input-Output Analysis

A second analytical technique has been termed input-output analysis. This somewhat technical approach begins with a statement of a desired output or result. The next step is to examine various fundamental forms of energy which can, directly or indirectly, cause the desired output to occur. A good example of input-output analysis is provided by C. S. Whiting. Let us assume that the desired output is warning of the existence of a fire at a given location. The basic input, of course, is fire. The input fire, however, engenders several direct outputs: heat, light, smoke, a decrease in oxygen conc-

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6Ibid.

tent, etc. Each of these outputs may now be considered an input. For example, heat (input) expands certain materials and melts others (outputs). Differentiation in expansion rates (input) may be used to break an electrical circuit, as may the expansion of liquids or the melting of a highly volatile alloy such as Wood's metal (output). The electrical impulse (input) may then be used to trigger any of several warning devices.  

Whereas heat was the fundamental input used in our discussion, a similar progression may flow from the others. It is important that many outputs be sought from each basic input before each output is, in turn, considered as an input. There is a tendency to think all the way through from a given input to the desired output. Such thinking, it is believed, may ignore the less frequently recognized outputs of a given input and thus may fail to uncover unique solutions.  

As Whiting admits, input-output analysis usually calls for a high degree of technical training among its users. This technique also tends to become quite time consuming and thus expensive when the number of inputs and outputs mushrooms. It is practical, therefore, only when problems are of substantial concern.  

Morphological Analysis  

Developed by Dr. Fritz Zwicky of the California Institute of Technology, the technique called morphological analysis consists of

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defining the problem, then listing all possible solutions, and finally evaluating each alternative solution. The problem is defined in terms of its parameters or dimensions. Then a model is formulated which facilitates the statement and visualization of each possible combination.\textsuperscript{11}

For illustrative purposes, assume a hypothetical problem wherein a dairy is contemplating a change in its packaging of milk. Assume further that the dimensions of milk containers include only size, shape, and materials. The next step is to list the practical variations within each dimension. Thus milk, let us hypothesize, may be sold in sizes of four ounces, eight ounces, 12 ounces, pints, quarts, and half-gallons. Shapes of containers may be rectangular, cylindrical, conical, cubical, and spherical. Materials considered practical include cellophane, plastic, metal, paper, and glass. Assuming only these three parameters and the indicated variations within each, a large number of alternative solutions (150) becomes available. The model may be set up graphically, as exemplified in Chart 1. The analyst is now in a position to evaluate each cube. Some will be found quickly to be impractical, others already being used or previously considered. Other cubes may be found novel and practical. In our hypothetical dairy, for example, why not sell half-gallons of milk in cylindrical cans, or quarts in cone-shaped, reusable containers?

\textsuperscript{11}Ibid., pp. 63-66. See also B. B. Goldner, "Are You Flunking in Creative Thinking?" \textit{Sales Management}, Vol. LXXI (December 5, 1958), 33ff.
Chart 1. A Graphic Depiction of Hypothetically Practical Milk Container Dimensions and Intra-dimensional Variations

Chief among the limitations of morphological analysis is its unwieldiness when large numbers of dimensions and variations are involved. For example, a problem might have five parameters, each having ten possible variations. Graphic presentation becomes impractical and the number of alternative solutions ($10^5$ or 100,000) unmanageable. Since most problems do have many facets and numerous slight variations, this technique is of limited utility.\footnote{12}

**Epistemological Method**

B. S. Benson proposes an analytical technique which he calls the epistemological method.\footnote{13} After carefully defining the fundamental problem, the analyst lists all the fundamental approaches to possible solutions that he can imagine. Next, each category is divided into more specific sub-categories of solutions. These, in turn, are sub-divided until all of the detailed alternative solutions are visualized, i.e., all conceivable ways of implementing each fundamental approach are charted. Then the job of evaluation begins, aided by the limits to the solution previously determined.

As an example, Benson presents his approach to the "problem" of designing a better mouse trap. He "works back" to the "real problem" of exterminating mice and then seeks basic approaches for doing so. A mouse may be killed "mechanically, electrically, chemi-

\footnote{12}{In our dairy problem, for example, color could be added to the other dimensions, and numerous variations within dimensions could be considered.}

\footnote{13}{B. S. Benson, "Let's Toss This Idea Up...," *Fortune*, Vol. LVI (October, 1957), 146.}
cally, or by restricting its fuel supply." Each basic approach is now intensively probed to find specific methods for implementation. Then each implementation is related with criteria for effectiveness and relevant limits (cost, danger to human beings or pets, unpleasantness, etc.). The point is that through systematic analysis, all alternative solutions may be formulated and later objectively evaluated. Among these alternatives may well be some which are novel and useful.\textsuperscript{14}

**Forced Relationship Techniques**

Somewhat less structured than analytical techniques are forced relationship techniques. In the latter system, the thinker attempts to relate meaningfully two or more objects, which may at first glance appear closely or dimly related. Where items seem closely related, new relationships are sought; and where objects are apparently unrelated, any form of relationship is sought. In either instance, some highly original ideas may occur, of which a few may be creative. From the ensuing presentation of three rather widely used forced relationship techniques, the reader should grasp more firmly the nature of this approach and its creative possibilities.

**Focused Object Technique**

A highly useful forced relationship approach is the focused object technique, developed by C. S. Whiting. The first step is to present the idea or product or problem that is being considered. Next, attention is focused upon a seemingly unrelated element, typi-\textsuperscript{14}Ibid., p. 145.
cally something visible to the ideator(s), who must now begin the process of ideation by stating relationships between the two objects. More specifically, the thinking about the object of concern is to be affected by associating with it characteristics of the second object.15

For example, assume that the problem involves the redesign of chairs. The focused object chosen is, let us say, a light bulb. The flow of ideas might move as follows:

Chair--Lightbulb
Glass chair
Thinner chair
Bulb-shaped chair
Screw-plug construction
Electric chair
Electrically operated chair

Thus the attributes of the bulb (glass, thinness, screw-attachment, electrical operation) are associated with chairs, leading, possibly, to original design ideas.16

Thinking does not end, however, with the statement of first-level relationships. Extremely valuable ideas may now flow through the process of free association. The bulb shape might, for instance, trigger a pattern of associations similar to the following:

Bulb-shaped
Flower bulb
Flowers
Floral design for chairs
Flower scent
Scented chairs
Flower stems
Floral stem and leaf design legs

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15Whiting, Creative Thinking, op. cit., pp. 55-57.

16Ibid., p. 57.
Floral theme—rose chair and lily chair, etc.
Garden chairs
Combination garden and house chairs

From the bulb shape, then, ideas may flow to flower shapes, scents, and themes, as well as garden chairs. Similarly meandering idea progressions may derive from a number of the stated relationships, resulting in a large volume of design possibilities, some of which appear likely to be quite original.\(^\text{17}\)

**Listing Technique**

Somewhat more structured than the focused object technique is the listing technique. Here several objects are listed, the items typically belonging to a general category. Relationships are then sought between each object and each of the others in the list.

For example, consider the relationships among the following objects, as might a manufacturer of office furniture seeking new designs.

(1) Desk       (4) Filing cabinet
(2) Chair      (5) Bookcase
(3) Desk lamp

Forced relationships would first be sought for the desk and the chair, then the desk and lamp, the desk and filing cabinet, and so on. The same would be done with each item on the list. After initial (or first level) relationships have been stated, the process of free association might continue the flow of design ideas. Out of such a session might result ideas and sketches combining the elements

\(^\text{17}\)Ibid., p. 58.
practically, such as a filing cabinet with a built-in light that glows when a drawer is open, or bookshelves built on the sides of filing cabinets, or permanent but mobile bookends built into desks, to list some initial possibilities. There is no forecasting where free association will lead beyond here.18

**Catalog Technique**

Probably the earliest used among forced relationship techniques is the catalog technique. This consists simply of selecting two items at random from any source of printed information, such as catalogs and directories. Relationships between these randomly chosen items are then sought.

This technique is limited to situations in which ideas are being sought regardless of their subject content. Cartoonists or comedy script writers, seeking ideas for new plots or new relationships which might generate humor, might use this technique. An advertising copywriter or artist for a mail-order house might use this technique to help formulate promotional material about the institution or its products and services.19

**Checklists**

Still another operational technique for obtaining large numbers of diverse ideas about a problem is the use of checklists. These checklists generally serve to focus attention on a large number of facets of an object or idea, facets which might otherwise escape the

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analyst's attention. Space limits inclusion of the numerous checklists that have been created for the purpose of stimulating creative thought. Their nature and function may be adequately illustrated, however, through a presentation of two exemplary checklists: the general-purpose checklist promoted by Alex Osborn, and a limited-purpose checklist used by General Motors Corporation.

General-Purpose Checklists

To use Osborn's introduction, the following are "some of the kinds of self-interrogation that can lead to ideas." The list is condensed from four chapters of his Applied Imagination.20

1. **Put to other uses?** New ways to use as is? Other uses if modified?

2. **Adapt?** What else is like this? What other ideas does this suggest? Does the past offer parallel? What could I copy? Whom could I emulate?

3. **Modify?** New Twist? Change meaning, color, motion, sound, odor, form, shape? Other changes?


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Clearly such general checklists are likely to include questions or reminders which are irrelevant to the problem at hand. Some of these questions may focus the analyst's attention upon a significant consideration which he might otherwise have ignored.

**Limited-Purpose Checklists**

The goal of the specific-purpose checklist is also to broaden the problem solver's scope of thought, but to a lesser degree than the general-purpose checklist. As indicated below, limited-purpose checklists prod in areas most likely to be relevant to a specific problem. This relative narrowness of scope could, however, overly restrict ideation and thus impede creativity.

A good example of the limited-purpose checklist is that used by General Motors to improve production methods and procedures:

1. Can some machine be used to do a better or faster job?
2. Can the fixture now used be improved?
3. Can slides, conveyors, or stock handling be added or changed in position or sequence to improve the operation?
4. Can the quality of the part be improved by changing the sequence of the operation?
5. Can a special tool be used to combine the operation?

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21Ibid., pp. 317-318.
6. Can cheaper material be substituted satisfactorily for that now in use?

7. Can the material used be cut or trimmed differently for greater economy or efficiency?

8. Can the operation be made safer?

9. Can forms be eliminated?

10. Can established procedures be simplified?^22

**Appraisal of Thought Provokers**

Thus the administrator has a large variety of thought provokers available to him and his subordinates. He may see fit to expose his subordinates to such thinking aids and to encourage their use where they are deemed practical. Each of these devices has its strong points and its limitations. Thus analytical techniques appear helpful in formulating great volumes of alternative solutions, perhaps all of the possible solutions for a particular problem. Application of these techniques is often time-consuming, however, since many solutions are considered which are impractical or already commonly recognized. Others must be related with objective criteria to properly evaluate them. In some instances (input-output and morphological analysis, for example) the analyst needs a considerable amount of technical knowledge before he can productively utilize analytical techniques.

The various forced choice techniques appear to offer opportunities for truly original thinking. While heavy reliance upon association may produce novel ideas and remote relationships, such

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^22Crawford, *op. cit.*, pp. 81-82.
ideas may be more original than creative, that is, novel but not particularly useful.

Checklists serve primarily to focus the individual's attention upon specific facets of a problem which he might otherwise ignore. General-purpose checklists suffer the weakness of including irrelevant reminders, while limited-purpose checklists may limit the scope of thought and also include irrelevancies.

When considering using devices for provoking novel ideas, the administrator should be forewarned that there appear to exist no truly objective evidence of the general effectiveness of such techniques. There are reports of specific successes achieved through such techniques in isolated instances, but these seem insufficient bases for generalizations. It is suggested, therefore, that such techniques be judiciously applied, that they be selected after an evaluation of the situation and the personnel using them, and that such techniques be used to supplement other approaches to the solution of important, complex problems.

Conference Techniques

Within the past 15 years there has developed a number of techniques which purport to facilitate the creative solution of complex problems through assault by groups. The most popular and controversial are the several variations of Alex Osborn's brainstorming procedure. Apparently gaining in stature is another group technique called operational creativity, developed and practiced by William J. J. Gordon of the Arthur D. Little Company. Since the effectiveness of such techniques is clearly relevant to the achievement of organizational
creativity, let us now examine their natures, their utilities, and their limitations.

**Brainstorming**

Born in 1939, the brainstorming technique has found tremendous acceptance within many of the largest organizations in the United States. Numerous successes in helping to solve complex production, marketing, personnel, academic, and civic problems are attributed to this technique. Currently, however, there appears to be growing skepticism of this technique as a route to creativity. Let us first examine the essence of brainstorming. We may then better evaluate the evidence and the arguments of its proponents and its critics.

**Basic Rules and Assumptions**

The fundamental rules applied in brainstorming sessions were previously mentioned to permit understanding of brainstorming as a training technique. To refresh the memory, these rules, as stated by Osborn, are again presented, this time with considerable elaboration.

1. **Criticism is ruled out.** Adverse judgement of ideas must be withheld until later.

2. **"Freewheeling" is welcomed.** The wilder the idea, the better; it is easier to tame down than to think up.

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(3) **Quantity is wanted.** The greater the number of ideas, the more the likelihood of winners.

(4) **Combination and Improvement are sought.** In addition to contributing ideas of their own, participants should suggest how ideas of others may be turned into better ideas; or how two or more ideas can be joined into still another idea.24

Clearly the brainstorming session differs from the normal conference wherein much time and effort is consumed in evaluation and debate, as well as the eduction of hypotheses and proposals. Osborn and his followers believe that division of labor is a fruitful practice, that the mind should be encouraged to ideate and hypothesize first. Only after generating and expressing these positive ideas to the point of exhaustion (of topic and mind) should the process of evaluation begin.25

Proponents of brainstorming also place great value upon the mutual mental excitation and the "cross-fertilization" which occurs in a freewheeling, spontaneous, and permissive atmosphere. It is believed that enthusiasm is contagious, and that ideas springing from individuals may "trigger" ideas in the minds of other participants. Thus, conclude these proponents, individuals feeding upon the ideas of other individuals and inspired by the enthusiasm of the others, should generate a greater number of ideas than individuals working alone. Moreover, the diversity of backgrounds from which these ideas emerge plus the greater volume of ideas add up, it is said, to the


probability that more ideas of good quality will be produced by groups than individuals.26

**Detailed Procedures**

For analytical purposes it is necessary to look beyond the fundamental rules and assumptions used in brainstorming. To be more specific, the effectiveness of a brainstorming session may be determined by such factors as the size and composition of the group, the degree of pre-session consideration of the problem, the length of the session, and the leader's effectiveness. Thus when one evaluates "brainstorming" through counting the number of ideas produced and rating the quality of responses, one is often evaluating a given session, which may or may not be representative of brainstorming in general.

For example, men experienced as brainstorming leaders agree that the participants should number from 5 to 15. Yet there has been at least one session in which over 200 persons "participated." In 30 minutes, about 100 ideas were produced and expressed. Now 100 ideas recorded in 30 minutes is rather an imposing rate. Looked at in another way, however, the results are discouraging. Over a 30-minute period, each "participant" expressed an average of .5 ideas; about half the members produced nothing.27 Typically such large groups would be divided into several smaller groups, which would separately brainstorm the problem.

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Experience suggests also that the composition of groups be carefully planned. Osborn suggests, for instance, that the panel should be composed of about five regular and five guest members, combining thereby the advantages of experienced, proved brainstormers with the guests' freshness, variety, and perhaps backgrounds relevant to the problem. Where a problem deals with household items, style, or cosmetics, feminine participants are purposely included. It is furthermore generally agreed that all participants should hold approximately equal status or rank to maximize freedom of expression.

Previous discussion of the creative process emphasized the strategic role which incubation often plays in the creative process. Brainstorming leaders, accordingly, frequently "brief" the participants on the problem days in advance of the session. Under this practice the individual searches for ideas long before he attends the session. The ideas produced in the meeting are not solely the spontaneous, free-associational "spin-offs" of excited and cross-cultivated minds. Some of these ideas, at least, result from sober, solitary meditation and considerable incubation. It appears doubtful that a brainstorming group presented a problem and immediately requested to ideate alternative solutions can generate within 30 minutes the depth and diversity of ideas that could develop over two days (and two nights!) of conscious and subconscious thought.

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28 Ibid., 235.


Some leaders, on the other hand, prefer to give no advance notice of the problem. They cite the tendency of particular participants to begin judging their ideas before the session, thus violating a cardinal rule of brainstorming. Ideas may be discarded which might have stimulated valuable associative chains in the minds of other participants. Also, participants may become "egocentrically involved" with their own ideas and close their minds to other avenues of thought, perhaps even persuading others to think similarly. Lastly, it is said that advance disclosure causes loss of spontaneity in the session. Some leaders, wishing to gain the advantages of incubation without the just-mentioned disadvantages, practice partial disclosure, i.e., participants are briefed only on the general nature of the problem. Thus participants might be asked to think about packaging when the problem deals with ways to package a particular item.\(^{31}\)

Another factor affecting the productivity of brainstorming is the length of the session. Studies by the editors of *Industrial Marketing* magazine indicate that sessions should generally be continued about 45 minutes.\(^{32}\) Sales executives at General Electric typically continue their sessions for 30 to 50 minutes,\(^{33}\) while Whiting recommends 40 minutes to an hour as most effective.\(^{34}\) Mental fatigue appears to restrict ideation after about an hour. While sessions of 10 minutes or

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\(^{31}\) Whiting, *op. cit.*, pp. 84-86.


\(^{34}\) Whiting, *op. cit.*, p. 83.
less are not uncommon, authorities appear to agree that at least 20 minutes is necessary to get past superficial, familiar solutions, and to get the associational mechanisms in full gear.35

The panel leader also significantly affects the productivity of a brainstorming session. Some of the functions he performs indicate his signal role. Preceding the session, the leader typically formulates the problem statement, chooses the panel, and apprises the panel of the problem and perhaps the nature of brainstorming. During the session he again presents the problem, calls upon volunteering participants, discourages criticism, clarifies proposals, and offers his own ideas. He must be prepared to pull the session out of lulls in idea flow through suggestions of new idea avenues, or perhaps by inviting participants to "hitchhike" on a previously expressed idea. Small wonder authorities on brainstorming place great emphasis on the choice of alert, enthusiastic leaders.36

Last among the procedural aspects with which we are concerned is the post-session flow of ideas. Many leaders provide mechanisms whereby participants may offer ideas after the session is over, thereby permitting expression of thoughts which time and the enthusiasm of others prevented during the session. This procedure, moreover, frequently elicits excellent ideas, for the participant has had additional time to mull over the problem.37

35McMahon, loc. cit.

36Hodgson, op. cit., p. 39.

It is obvious from our brief discussion that brainstorming is far from a simple, standard device for attaining ideas. Thus when one attempts to evaluate "brainstorming," great care must be taken to describe the form of brainstorming being judged. The difference among sessions may be as meaningful as the similarities. Keeping this admonition in mind, let us cautiously seek evidence of the effectiveness of brainstorming.

**Brainstorming Evaluated**

The difficulty in evaluating brainstorming lies not only in its diverse nature. Compounding the problem is a lack of truly rigorous study in the area. The few relevant controlled experiments are indeed enlightening, but they are not sufficient in themselves to generalize about brainstorming. In the main, other statements concerning this technique discuss specific successes attributed to it, and a mass of more or less rational analysis of its basic assumptions and rules. To assure clarity of presentation, the arguments and evidence opposed to brainstorming are presented first; then the proponents' case appears; and finally some conclusions which appear to the writer to be warranted by the evidence.

**The Opposition Case.** The chief argument against brainstorming is provided by the findings of fairly recent studies conducted by psychologist D. W. Taylor and his associates at Yale University.\(^38\) The sub-

jects were 96 Yale juniors and seniors, who were taking a course in the Psychology of Personnel Administration. Forty-eight of these students were selected at random to participate in 12 experimental groups of four. The other 48 students worked on problems as individuals. Three problems were chosen from a group believed by Osborn to be suitable for brainstorming. All participants were oriented in brainstorming techniques. Then all of the groups and individuals were given 12 minutes in which to propose solutions or consequences for each problem. The experiment's purpose was to compare the number and quality of responses generated through group brainstorming with those proposed by individuals working alone.39

Taylor found that the average group did produce more ideas than did the average individual working alone; but when these individuals were placed at random into "nominal groups" of four and their ideas pooled, the performance of the average nominal group was found markedly superior to the 12 real groups in number of ideas, number of unique ideas, and quality of ideas. Taylor concludes that "to the extent that the results of the present experiment can be generalized, it must be concluded that group participation when using brainstorming inhibits creative thinking."40 He suggests two possible explanations for the apparent superiority of individual effort:

(1) The individual in a group feels less free of possible criticism by others than when working alone, even when such criticism is not expressed. This tends to inhibit expression of some ideas.

39 Ibid., 26-27.
40 Ibid., p. 43.
(2) Individuals in a group "appear more likely to pursue the same train of thought," to adapt the same set, than are individuals working independently.41

Thus those who oppose the "groupthink" and "togetherness" as approaches to problem solving find themselves with live ammunition with which to attack brainstorming. The "lonethink," they maintain, produces (per man hour) more ideas, more unique ideas, and better quality than does the group approach.42

Other criticisms are levied against brainstorming. Ideas produced tend to be superficial, it is said. Participants are trained to think haphazardly and nonlogically, trusting to association for ideas. Furthermore, no satisfactory way has been found to evaluate ideas produced during brainstorming sessions. Who should do the evaluating? The participants find it difficult to discard their own ideas. Technical men often lack the imagination to translate and combine freewheeling suggestions into tangible solutions. Some see the group as an attempt to escape individual responsibility and individual evaluation. Too much emphasis is afforded to quantity of ideas, not enough to quality. Finally, critics state, the brainstorming technique trains "hitchhikers" instead of the "self-starters" needed for creativity.43

41Ibid.

42Bristol and Benson, op. cit., 7-10. See also "In Defense of Lonethink," Sales Management, Vol. LXXXI (October 17; 1958), 40-41.

The **Affirmative Position**. The charges levied against brainstorming are sufficiently serious that administrators may think long before leaning upon brainstorming for creative solutions. Yet many large and successful organizations have used this technique for years. Case after case is cited of successful attacks upon problems which had defied ordinary forms of analysis. A probe into the arguments favoring brainstorming should help explain such successes.

First, in answer to the criticisms based upon the Yale study, brainstorming proponents might ask whether the generalizations based upon the findings are valid. Groups of four participated without the all-important leader; participants had no advanced notice of the topic; sessions lasted only 12 minutes, barely enough time to get started; and no ideas were elicited after the session was over. This certainly could not be considered typical of brainstorming sessions. Even if the conclusions were generally acceptable at face value, it must be recalled that all of the participants were following the basic rules of brainstorming. All were freewheeling, seeking quantities of ideas, postponing judgement, and attempting to "hitchhike" on previous ideas. Thus the basic rules of brainstorming were not being questioned; only the question of group versus individual brainstorming was at issue. That even this issue has been decided is certainly to be questioned.44

Brainstorming proponents are not without their own objective supporting evidence. In an experiment at the University of Buffalo, 32 members of a class in creative problem solving were divided into

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four equal groups. One group was given two problems to work, the first under brainstorming instructions\textsuperscript{45} stressing quantity of ideas, and the second under "nonbrainstorming" instructions\textsuperscript{46} emphasizing quality of ideas. The second group worked with the same set of problems, but this group received nonbrainstorming instructions for the first problem and brainstorming instructions for the second. The other two groups, however, worked the two problems in reverse sequence. Responses of all groups were then scored for quantity of ideas, uniqueness of ideas, and value of ideas. The rater was unaware of the ideas' origins.\textsuperscript{47}

The experimenters conclude that there occurred "significantly more good solutions ... under brainstorming instructions than under nonbrainstorming instructions."\textsuperscript{48} Thus the positive, freewheeling procedure, stressing quantity of ideas, also produced more good quality ideas than did a system stressing quality. It would appear, then, that the emphasis upon quantity in brainstorming may engender quality.

\textsuperscript{45}You are to list all ideas that come to your mind without judging them in any way. Forget about the quality of ideas entirely. We will count only quantity on this task. Express any idea that comes to your mind. As you go along, you may combine or modify any of the ideas which you have already listed, in order to produce additional ideas. Remember that quantity and freedom of expression without evaluation are the key points.

\textsuperscript{46}You are to list all the good ideas you can think up. Your score will be the total number of good ideas. Don't put down any idea unless you feel it is a good one. See S. J. Parnes and A. Meadow, "Effects of 'Brainstorming' Instructions on Creative Problem Solving by Trained and Untrained Subjects," \textit{Journal of Educational Psychology}, Vol. L (August, 1959), 171-173.


\textsuperscript{48}\textit{Ibid.}, p. 416.
A likely criticism of this experiment concerns the fact that all of the participants were members of a class wherein brainstorming was a prime training device. Participants might well be expected, then, to perform better under brainstorming instructions than would untrained subjects. To meet this criticism a new experiment was designed in which both trained and untrained subjects participated. Both trained and untrained groups produced a greater quantity of ideas and more good quality ideas under brainstorming instructions than under nonbrainstorming instructions, although trained subjects clearly excelled untrained subjects.\textsuperscript{49} The brainstorming way of thinking was thus confirmed as superior to the more conventional approach which generates an idea, evaluates it, accepts or rejects it, and then generates another idea. Yet this is the typical pattern of thought within individuals and within ordinary conferences.

In further defense of brainstorming, its proponents state that brainstorming is not considered a substitute for individual thought, but as a stimulant and supplement. They feel that much of the criticism is based upon limited understanding of this technique. Brainstorming is seen basically as a device for generating large numbers of diverse ideas about a problem. There is no attempt to develop complete solutions in such a session.\textsuperscript{50} The responsibility for tangible, practical

\textsuperscript{49}Parnes and Meadow, \textit{op. cit.}, 175-176.

\textsuperscript{50}Although rarely attempted, brainstorming may be utilized for several steps in problem solving, such as stating the problem, seeking ideas and alternative solutions, and stating possible consequences of each alternative. See Whiting, \textit{op. cit.}, p. 88.
solutions may still rest with individuals who utilize analytical methods and objective criteria for evaluating notions produced through brainstorming. Critics, then, either lack adequate perspective or they have been impressed with the misuse of the brainstorming technique.\footnote{R. H. McMahon, op. cit., 100-101.}

Brainstorming proponents question the statement that ideas produced are superficial, citing creative solutions provided by this technique. Even where superficial ideas are produced, these may stimulate more profound thought by subsequent evaluators. Answering the objection that brainstorming engenders haphazard, nonlogical thought, defenders state that this type of thought appears quite productive at the idea-formulating stage of the creative process. Courses in creative thinking often attempt to develop this very approach. Finally, say proponents, brainstorming is a most stimulating and enjoyable way to approach problems, as many participants testify.\footnote{S. Nicholson, "Group Creative Thinking," \textit{Management Record}, Vol. XVIII (July, 1956), 235.}

Indirect benefits appear also to accompany the brainstorming technique. General Electric sales executives believe that brainstorming with salesmen as the participants has built the confidence and enthusiasm of their sales organization. The technique has also been used to learn more about what problems exist, from the salesmen's point of view.\footnote{McMahon, op. cit., p. 97.} Others find that brainstorming widens the viewpoints...
of participants and provides "dramatic demonstrations" of the possibilities of creative thought. Through brainstorming sessions, the hidden creative talents of some participants have been discovered. Morale or esprit de corps is said to rise as a result of brainstorming. Supervisors are said to become more receptive to ideas of subordinates after participating in brainstorming sessions.

The Verdict. While evidence concerning the effectiveness of brainstorming appears to conflict, a pattern does emerge. The Yale study should cause serious doubt of the superiority of group brainstorming over individual brainstorming. It may well be that a pooling of the ideas of individual brainstormers will typically yield more and better ideas than would be the case where all the individuals participate in a group session. Certainly further experiments, testing the effects of varying group size, session time, advanced notice of problems, post session ideas, and effective leaders will clarify this issue. Such evidence as exists certainly favors the "lonethinkers."

On the other hand, brainstorming as a way of generating diverse ideas, hypotheses, and proposals, apparently does have considerable merit when compared to the more typical conference system. Evidence indicates that the brainstorming approach to problem-solving conferences may yield more ideas and more valuable ideas than the typical group approach, where ideation and judgement intertwine.

54 Nicholson, loc. cit.
55 McMahon, loc. cit.
No other claims are supported by rigorously gathered and reported evidence. However, if, as claimed, the brainstorming technique does raise morale and does have salutary effects upon general organizational communications and understanding, then the technique may be utilized by administrators to help develop a creative atmosphere, even though individual ideation might be seen as the most effective approach to a given problem. Nevertheless, it may be, as many have claimed, that creativity is more likely to proceed from the solitude of the individual mind than from the group mind.

Gordon Technique

Of lesser renown than brainstorming is a group approach to creativity designed and applied by W. J. J. Gordon of Arthur D. Little, Inc., industrial consultants. This technique, applied primarily to the development of new products, utilizes a permanent group composed of a leader and from four to six men of diverse backgrounds and fields of specialty. Typically the group meets in a sound-proof room that is equipped with three tape recorders, large note pads on all four walls and on easels, all to assure immediate recording of fleeting ideas. The floor serves as a large ash tray. Where practical, all attention diverters are eliminated.56

Commonly the group is not told of the specific problem at the beginning of the session. Rather the group is informed of the topic's general nature. Thus if a specific tool is to be created, the discussion will likely begin on the subject of tools in general. Discussion

of a problem concerning packaging of a new product might begin with ideas about packaging in general. Gordon believes that through this approach there is likely to occur intensive thought about the fundamentals, the universals, the principles which apply. When the group appears to have grasped the essentials of the general topic, the leader metes out a little more insight into the specific problem. By degrees, then, the group becomes apprised of the problem in detail.57

Through this approach of gradual problem disclosure, Gordon hopes to avoid quick, superficial solutions. Instead solutions are likely to be based upon broad consideration and upon the basic concepts underlying the precise problem. The technique, moreover, decreases the likelihood that group members will become egocentrically involved with specific solutions. This would be almost impossible early in the session, since the problem's precise nature is unknown.58

Unlike brainstorming, sessions often last three hours or longer. The technique's very nature implies the need for extended sessions and/or several sessions on a given problem. Fatigue-causing tension is frequently broken by the humorous comments which are natural occurrences during such discussions. Nor is fatigue considered solely a negative factor. Gordon finds that fatigue often causes participants to "swing for the fence," to think and express wild ideas which may be of great value.59

57 Ibid.


59 Gordon states that he has learned from experience that "the most exotic speculation may lead to the greatest practicality." Ibid.
Some of Gordon's procedures are similar to those used in brainstorming. Freewheeling, spontaneous expressions are invited. Criticism is discouraged, at least early in sessions, and participants are encouraged to build upon each other's ideas wherever useful.60

An important limitation of the Gordon technique is the extremely important role of the panel leader. Since the group is unaware of the precise problem, only the leader is able to visualize the value of ideas generated early in the session. He thus must be alert, imaginative, and highly intelligent. Even if he is all this, there still exists the probability that a fully informed group would see relationships that one man might be expected to miss. This technique also calls for well-trained, knowledgable participants, whereas the brainstorming technique may utilize novices. Finally, the Gordon approach, while probing deeply into the essence of a problem, does not typically yield the sheer volume of possible solutions that brainstorming does.61

Gordon's technique does have its variations. Thus Gordon finds through experience that a group which has used this technique over time successfully may be told the specific problem without harmful effect. Participants seem conditioned so that they immediately consider the basic and broad context of the problem. Thus the leader's role diminishes in importance. Also the "mature" group is permitted greater critical freedom as a part of the generally permissive atmosphere. It

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is felt that criticism does not affect the subsequent willingness of experienced participants to express ideas.\textsuperscript{62}

Gordon's technique has been adapted for use by the Kimberly-Clark Corporation. This firm has created a group of individuals with diverse backgrounds and given it freedom to investigate problems in any area it chooses and to challenge current practices in all company activities.\textsuperscript{63} The group has autonomous control over financial resources allocated to it, and it has its own research equipment. Members of the group have no duties other than participating in the group's efforts to create. In essence, the group is organizationally independent.\textsuperscript{64}

Such a group faces problems of deciding what projects to essay, how to overcome defensiveness of personnel affected by the group's investigations and suggestions, and how to maintain the highly valued individuality of its members. Probably the strategic difference between the basic Gordon technique and the adaptation of the Kimberly-Clark Corporation is that the Gordon group acts as consultants whose services are requested by firms. In the Kimberly-Clark situation, however, the group seeks to effectuate improvements and new approaches for departments whose personnel do not necessarily desire such analyses or changes. This group seeks problems and then tries to solve

\textsuperscript{62}Gordon, op. cit.


\textsuperscript{64}Ibid.
them, whereas the Gordon group is concerned solely with the latter. The Kimberly-Clark approach is admittedly a long-run experiment. Thus we must await further word concerning its effectiveness.65

Operational Techniques in Perspective

Administrators seriously concerned with organizational creativity will do well to consider utilizing the techniques described in this chapter. The very diversity of these techniques suggests that each manager should evaluate them in terms of applicability to his situation, i.e., the types of problems involved and the personnel and other resources available to solve them. It is hoped that the preceding discussion of operational techniques will aid the administrator in such efforts.

A further admonition appears of value at this point. The application of operational techniques in no way diminishes the need for an otherwise comprehensive program for achieving organizational creativity. The emphasis should still be directed upon obtaining highly creative individuals, developing the creative talents of individuals at various points on the continuum of creative ability, and maintaining an environment conducive to creativity. Operational techniques may then serve as highly productive tools for the generation of novel solutions for specific complex problems.

65Ibid., 20-22.
CHAPTER VII

SUMMARY AND CONCLUSIONS

Creativity, long a subject of curiosity and speculation, is at long last attracting considerable attention of psychologists, sociologists, administrators, and persons associated with the various other sciences, fine arts, and education. A number of studies are providing us with substantial and growing insights into factors which affect creativity within individuals and organizations. It is the purpose of this paper to examine the findings of such studies and to indicate how insights thereby gained may be applied to the achievement of creativity within organizations.

Since organizations are composed of individuals, a probing examination of the internal factors associated with individual creativity receives first priority. Of great value to administrators are insights into the creative process, the steps taken by individual minds in their generation of valuable innovations. Such knowledge provides clues to the traits of creative individuals, while forming a base from which to develop programs for developing the creative abilities of subordinates, providing an atmosphere conducive to creativity, and evaluating devices designed to aid individuals and groups to formulate creative solutions to specific, complex problems.
Creative Process

Descriptions of the creative process have become more comprehensive with time and study. Thus early writers described with awe the seemingly unexplainable inspirations of gifted individuals. Later students of the creative process recognized the essential role of sustained, intensive effort in the achievement of inspirations. With further investigation, insights into the creative process have grown until one can identify seven stages of mental functioning leading toward creativity: early preparation, encounter with the problem, conscious probing, incubation, illumination, verification, and communication. In the early preparation stage, the individual absorbs information of a general nature and data closely relevant to his field of specialization. These impressions, capable of moving in and out of idea configurations, are the raw materials of creativity.

Creativity is unlikely unless the individual becomes seriously concerned with the problem. This problem, moreover, must be of the type which permits wide imaginative play in grasping significant relationships and in generating alternative solutions. An intense encounter with a complex, relatively unstructured problem compels the mind toward novel solutions.

Having become aware of his problem, the individual consciously seeks data and insights to help him solve it. He thus augments his store of impressions with those closely related to the problem. Often the problem is conquered at this point. If the problem is highly complex and unstructured, however, it may not (and often does not) yield to conscious efforts. Through frustration or sheer exhaustion, the potential creator may "give up," at least temporarily. His sub-
conscious mind, triggered by the tension associated with the intense encounter, continues to work on the problem.

The preconscious, the deep well of highly plastic, mobile, accessible impressions, plays a key role, dissociating and associating, free from the restrictions of the conscious. Whether it is solely this freedom from reality and set which facilitates creation is not certain. It may be that other factors contributing to subconscious creativity are a rested mind, uninterrupted meditation, or simply the passage of time.

Whatever the mechanism in the "little black box" of the subconscious, creative ideas do frequently emerge from it, as numerous creators testify. Perhaps these sudden and unexpected illuminations provoke the aura of mystery and the divine myths associated with such sudden insights. It should be emphasized that great illuminations are typically the result of great volumes of diverse knowledge, intensive conscious study, and, frequently, much subconscious mentation.

Often such illuminations are followed by conscious attempts to test, judge, refine, and elaborate the creation. The last step in the process is gaining acceptance by those who decide upon and otherwise affect the application of new ideas. Here the creator often faces his greatest challenge: overcoming ignorance and resistance to change. He is often ill-suited to this task.

The stages of the creative process should be visualized, not as independent steps occurring in a particular sequence, but rather as threads interweaving to form a creative fabric. Thus conscious efforts lead to subconscious incubation, which results, possibly, in intermediary insights, which, in turn, channel new conscious efforts. All the while the creator's store of impressions expands and mixes.
Creative Mind

Further studies of individual creativity are yielding insights into the intellectual and personality traits associated with creativity, as well as methods for measuring the relevant traits. In contrast to previous beliefs, current theory holds that intelligence and creativity are not synonymous, although they are positively correlated. Other intellectual traits now believed generally important to creativity include:

(1) sensitivity to problems

(2) fluency of thinking: word fluency, associational fluency, expressional fluency, ideational fluency

(3) flexibility of thinking: spontaneous flexibility, adaptive flexibility

(4) originality

(5) redefinition

Tests for measuring the existence of these traits have been developed and somewhat validated. Such tests are being used for selection and placement purposes by several large industrial organizations.

Certain personality traits appear to differentiate the highly creative person from the general public. Thus the typical creative individual tends to be notably inner directed, sensitive to his own emotions, and autonomous in the sense that he formulates and lives by his unique objectives and standards. He is an independent thinker and thus often considered radical. Often his radical ideas reflect his unconcern with consensus rather than its rejection, although attitudes of defiance and rebellion are not uncommon. The creative person tends to feel self-confident and self-sufficient. He is inclined to dominate his environment, both people and things, although he is usually more
comfortable dealing with the latter. His behavior is often controlled and inhibited by the exacting standards and role images which he has evolved within himself.

The creative individual often appears to combine contradictory traits, including some identified with masculinity and some with femininity. He combines passion with rationality, introversion with self-assertion, fantasy with reality. It is believed that these apparent inconsistencies are manifestations of the well-integrated personality, able to reconcile the ambiguities within itself. This wholeness, combined with his drive to dominate, his intelligence and his propensity toward solitary contemplation, form a fertile field for the generation and growth of creative ideas.

The above generalizations about creative persons should not obscure differences among them. Those highly creative within the expressive arts are typically more tense, more plagued with guilt feelings, more emotionally sensitive, and more radical than creative scientists, although the latter are themselves differentiated from the general population by the last two traits. Personality traits also differentiate among segments of these general disciplines. Thus, for example, creative physicists tend to be more detached from people than are other creative scientists.

Studies indicate that with advancing age, there occurs a gradual decline in certain intellectual powers, including memory, perception, reasoning ability, and dexterity. Other studies find that creative productivity within a number of fields tends to decline after a peak is reached, typically somewhere between 25 and 40 years of age.
The decline is, however, gradual, and many remain highly creative at very advanced ages.

With such growing insights into the traits associated with creativity, one may expect that tests to measure these traits may also be developed. It is suggested that each organization determine the traits relevant to creativity within that organization, and that tests designed to measure these traits be adopted for selection and placement purposes. Among such tests currently available are the Cattell 16 Personality Factor Test, the Barron-Welsh Art Scale, various projective techniques, and the Guilford-type tests, including the A C Sparkplug test.

Training in Creativity

Administrators interested in achieving organizational creativity might well seek ways to develop the creative abilities of their subordinates. Various publications offer advice to individuals concerning procedures or rules which may increase creative abilities. Although such advice is often based upon insights into the creative process or traits associated with creativity, there is no evidence that individuals are prone to change their ways of thinking or their intellectual and personality traits as a result of such advice.

There is evidence, however, that some training techniques do increase creative ability. Thus brainstorming appears to train participants to generate large quantities of diverse ideas concerning problems and to express more good quality ideas. Trained subjects exhibit a significant increase in dominance, a trait intimately related with creative ability. Other training programs, combining
lectures, discussion, brainstorming, the "out-of-this-world" approach, and other techniques provide encouragement that the creative capacities of individuals can be increased. In all reported experiments there occurred an increase in the proclivity toward remote, uncommon, and high quality responses, although there also resulted a decrease in the quantity of responses where originality was emphasized. It is felt that the decrease in ideational fluency may be more than offset by the value of increased originality and quality of responses.

In addition to foregoing evidence, a series of laboratory experiments indicates that individuals can be trained to be more original (more likely to generate uncommon and remote responses) through developing in them a tendency to present ideas low in the response hierarchy. Rewards for original ideas strengthen the tendency to generate and articulate such ideas. The length of such training directly affects the degree of originality developed, up to some undefined point. Finally, training in originality has enduring effects, although the rate of deterioration remains undetermined. There exists no evidence, however, to indicate that training produces a general tendency toward spontaneous flexibility or redefinition, even though a specific functional fixation can be modified through exposure to varying uses exercises.

**Creative Environment**

Efforts to staff the organization with creative personnel should be coordinated with endeavors to provide an atmosphere conducive to creativity. Managers must evince a sincere desire for creativity. Pervasive communications should be encouraged to help motivate and
inform the minds of potential creators. Innovators should be made to feel that their value to the organization is not determined by the outcome of any single idea, but rather by long-run creativity and productivity.

To increase the likelihood of truly creative solutions, schedules and deadlines should be flexible. It should be remembered that the creative process may be accelerated through encouraging changes of pace and relaxation for subordinates, and through relieving them of some routine work.

The administrator must beware of "worshipping" past ideas and persons. He should regard them as stepping stones toward still greater insights, and he must admit the possibility that currently accepted ideas and practices are becoming invalid or capable of improvement.

The manager should try to glean the value systems and problems of his subordinates if he is to select the most effective of available incentives. Subordinates should feel assured of receiving due credit and appropriate rewards for creative efforts. Caution must be taken, however, to promote to administrative positions only those whose value to the organization is maximized by this action. It may be more beneficial to all concerned to create positions equal in status and other rewards to administrative positions, permitting the creative individual to make even greater contributions within his specialization, yet involving no administrative responsibilities.

Organization implies the existence of groups, and groups affect the behavior of their members. The group, then, forms a signal determinant of organizational creativity. A number of studies testify to
the tendency of individuals to conform to group norms. The tendency is strong when the potential deviate faces unanimous opposition, in which case the individual's cognition, judgement, or expression may be distorted toward the majority position. Conformity plummets, however, when the deviate finds even small support for his views.

Group composition and attraction also affect conformity. Thus conformity appears inversely related to age and appears stronger in females than males. Individuals exhibiting traits associated with creativity are typically less likely to conform in groups. Those strongly attracted to a group tend to conform, as do persons who feel insecure of their positions within the group. Evidence conflicts concerning conformity of individuals who are both highly attracted to groups and also highly accepted. It appears that conformity may be minimized through injecting some creative individuals into each group, by decreasing attraction to specific groups, and through enhancing acceptance of members by groups.

Also affecting creativity within groups are certain group attitudes and behavior. Group tolerance of goal-directed disagreement facilitates creativity, as does full participation in solving group problems. To increase the likelihood of candid participation, the views of members should be heard in ascending order of rank and status. Discussion leaders may engender group creativity by assuring full airing of minority positions.

Utilizing such knowledge, the administrator may help create a creative climate through the cultivation within himself of attitudes conducive to creativity and practices facilitating it. He may manipulate group membership, group attraction, and group attitudes; and he
may encourage productive patterns of interaction to minimize conformity and to utilize uniqueness.

Operational Techniques

While the fundamental requisites of organizational creativity are creative members operating within a creative environment, the administrator may find it worth his while to consider certain techniques which may be applied in solving specific problems. A variety of methods exist for provoking novel ideas about a topic. All of these techniques emphasize clear statement of the basic problem. They also typically involve deferment of evaluation and entertainment of all ideas, even those apparently impractical.

Among the prominent analytical techniques are attribute listing, input-output analysis, morphological analysis, and the epistemological method. These techniques generally appear helpful in formulating great volumes of alternate solutions, perhaps all of the possible solution to a given problem. Application of such techniques is often time-consuming, however, since many solutions are considered which are impractical or already commonly recognized. Others must be related with objective criteria to properly evaluate them. In some instances (input-output and morphological analysis, for example) the analyst needs a considerable amount of technical knowledge before he can productively utilize the techniques.

Various forced choice techniques (focused object, listing, and catalog) may well help generate original ideas. While heavy reliance upon the process of association may produce novel ideas and remote
relationships, such expressions may be more original than creative, that is, novel but not particularly useful.

Checklists serve primarily to focus the individual's attention upon facets of a problem which he might otherwise ignore. General-purpose checklists suffer the weakness of including irrelevant reminders, while limited purpose checklists may both limit the scope of thought and also include irrelevancies.

While there are reports of specific successes achieved by the use of thought provokers, there appears to exist no truly objective evidence of the general effectiveness of such devices. It is suggested, therefore, that such techniques be judiciously applied, that they be selected after an evaluation of the personnel to use them, and that these approaches be used to supplement other approaches to the solution of important, complex problems.

Problems may also be attacked by groups, as is the case in brainstorming and the Gordon technique. There is considerable controversy over the effectiveness of brainstorming. Its many variations and the availability of only scanty evidence make brainstorming difficult to evaluate. Such evidence as exists indicates that individual brainstorming may be superior to group brainstorming in the production of ideas and good quality ideas. On the other hand, brainstorming as a way of thinking by groups and by individuals appears superior to thought patterns wherein ideation and judgement intertwine.

A number of indirect effects attributed to group brainstorming by its users and proponents may be considered by the administrator evaluating this technique. It is claimed that brainstorming improves morale, and has salutory effects upon general organizational communica-
tions and understanding. If these be true, then group brainstorming might be used more as a climate builder than as an operational technique. As previously noted, group brainstorming may be an excellent device for developing the creative abilities and propensities of participants.

The Gordon technique applies some brainstorming rules, but utilizes a permanent panel. Apprised first of only the general field in which the problem lies, the panel is gradually informed of the details of the specific problem as the leader believes the fundamental and broad subject area is covered. Thus it is believed that the problem's essence is grasped, while early superficial solutions and egocentric involvements are avoided.

This technique bears watching. Gordon's own panel at the consulting firm of Arthur D. Little, Inc., has been sufficiently successful so that his technique has been adapted for experimental use by the Kimberly-Clark Corporation. The approach has great merit in that it encourages both intensive and extensive thought about a problem. The method suffers, however, from too much reliance upon the leader and the time needed to examine gradually all facets of the problem. Participants must be alert, of varying backgrounds, well-trained in their specialties, and verbally fluent. Clearly the maintenance of such a superior group of individuals involves considerable expense.

It will be enlightening to observe the long-term results of the Kimberly-Clark experiment, wherein the panel challenges current thinking and modes of operation within operating departments. Lessons learned here may be of great value to administrators interested in this
approach to creativity, for Kimberly-Clark is the first organization to apply the Gordon technique to its own operations.

An Integrated Program

We see that there exist a number of possible approaches to organizational creativity. An organization may work toward this goal through selecting individuals with great creative potential and placing them in challenging positions. Such persons and others with less creative potential may be trained so that they attain a high proportion of their potential creativity. An environment may be purposefully constructed that is conducive to the generation and expression of creative ideas. Furthermore, administrators and subordinates have available to them a variety of techniques for provoking novel ideas relevant to specific problems. Such techniques are supplemented by the existence of brainstorming in all its variations and the Gordon technique, methods believed by many to be superior to the typical conference approaches to the generation of valuable innovation.

Most likely of success in the achievement of organizational creativity is a comprehensive program in which efforts are made to build a creative environment within which work inherently creative individuals whose talents are well developed. Operational techniques may then be used to supplement these fundamental requisites.

The tools available for achieving organizational creativity are still crude and incompletely tested. While much has been learned about the creative individual over the past decade, much remains in the realm of hypothesis or (probably) the unknown. The same is true of the techniques for developing creative ability and various facets of the
creative environment. Perhaps in greatest need of further research are the various operational techniques presented in this study.

It is very easy to overemphasize how much is not known. The insights which are available are sufficient, it appears, to justify serious attempts by administrators to apply them toward the attainment of organizational creativity. There are traits which clearly differentiate creative persons from the general public, and tests which measure such traits with a considerable degree of reliability. There are techniques for developing creative ability which have been objectively evaluated and found effective. Administrators, educators, and sociologists have provided deep insights into the elements which may compose the creative environment. It is now the task of the administrator to apply such knowledge as is available so as to balance organizational creativity with the stable productivity also needed within the typical organization.

It seems, moreover, that the accumulation of knowledge relevant to creativity is accelerating. Studies of the subject are being conducted by federal, industrial, and educational institutions. The concerned administrator must be sure to absorb the findings of such studies so that he may reflect them in his program. His thinking must be as flexible as that of his creative subordinates.
SELECTED BIBLIOGRAPHY

Books


Periodicals


Ardleigh, J. D. "How to get Profits, not Problems from Creative People," Management Methods, XVII (1959), 91-98.


Benson, B. F. "Let's Toss This Idea Up...," Fortune, LVI (October, 1957), 145-146.


Goldner, B. B. "Are You Flunking in Creative Thinking?" *Sales Management*, LXXXI (December 5, 1958), 33ff.


"How to Develop Your Creative Talent," *Steel*, CXLV (December 28, 1959), 53.
"How to Keep New Ideas Coming," *Business Week*, No. 1364 (October 22, 1955), 112-118.


Kirchner, W. K. "Is Brainstorming Really Effective?" *Office Management and American Business*, XXI (June, 1960), 78-80.


Peterson, W. A. "Groups Don't Create: Individuals Do," Printers' Ink, CCLVII (October 26, 1956), 24-25.

Randall, F. R. "Stimulate Your Executives to Think Creatively," 

Management Methods, XX (July, 1961), 38-40.

__________. "Industrial Climate for Creativity," Management Review, 
XLVII (September, 1958), 4-8.

(August, 1959), 13ff.

__________. "Supervisor Determines Productivity of Creative People," 

Raven, J. C. "The Comparative Assessment of Intellectual Ability," 

Monthly, I (1900), 648-675.

Rogers, C. R. "Toward a Theory of Creativity," ETC: A Review of 

(1898), 113-144.

Shaw, M. E. "A Comparison of Individuals and Small Groups in the 
Rational Solution of Complex Problems," American Journal of 
Psychology, XLIV (1932), 491-504.

Speroff, B. J. "Brainstorming; Another Gimmick?" Personnel Journal 
XXXVII (July-August, 1958), 98-100.

Sprecher, T. B. "A Study of Engineers' Criteria for Creativity," 

Springbett, B. M., J. B. Dark, and J. Clarke. "An Approach to the 
Measurement of Creative Thinking," Canadian Journal of 

Taylor, D. W., P. C. Berry, and C. H. Block. "Does Group Participa-
tion When Using Brainstorming Facilitate or Inhibit Creative 
Thinking?" Administrative Science Quarterly, III (June, 1958), 
23-47.

"Teaching of Creative Thinking Added to Executive Training," 


"Where do Sales Executives Get Their Ideas," *Sales Management*, LXXXV (September, 1960), 95ff.


"Yale Study; Brainstorming Blocks Creativity," *Printers' Ink*, CCLXII (February 21, 1958), 64-65.


**Pamphlets**


Newspapers

Irwin Weinstock, the son of Mr. and Mrs. Harold Weinstock, was born in New York City on June 17, 1928. He graduated from Seward Park High School in February, 1946. After having spent four years in the United States Navy, he enrolled at the University of Washington in January, 1953. He received a Bachelor of Arts from that school in August, 1955.

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EXAMINATION AND THESIS REPORT

Candidate: Irwin Weinstock

Major Field: Business Administration

Title of Thesis: An Inquiry into Certain Human Determinants of Organizational Creativity

Approved:

[Signatures]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination:

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