ABSTRACT

A STUDY OF THE RELATIONSHIP OF A HOLISTIC CONCEPTION OF CREATIVITY TO INTELLIGENCE

by Webster R. Callaway

The Problem

This study explored the relationship between creativity, defined in terms of multidimensional personality attributes, and intelligence. A major sub-problem of this study involved a critical comparison of the structure-of-intellect-factor-analytic frame of reference with a more holistic conception of creativity.

Procedures

The data were obtained from 180 eleventh-grade students from four public schools of Lansing, Michigan. The criterion for inclusion in the study was a reading score on the California Reading Test of two or more years above grade level. The California Test of Mental Maturity was administered to assess verbal IQ. The Omnibus Personality Inventory was employed to obtain six scores on selected scales which are assumed to be positively associated with creativity. Intercorrelations were computed among the IQ and the six variables of the OPI.

High and low IQ groups were formed by eliminating those who had IQ's in the standard deviation between 115 and 130. There were 59 in the high group with a mean IQ of 137 and 60 in the low group with a mean IQ of 112. The high and low groups were then compared by means of t-tests for significant differences between mean scores on the OPI.

Findings

1. A positive relationship between each of the personality variables and IQ was found (r varied between .18 and .34).

2. The relationship between the personality variables and IQ was higher for the girls than for the boys (for girls r varied between .25 and .40; for boys between .12 and .29).

3. For all three groups, total and boys and girls considered separately, the personality variable most closely related to IQ was Originality, while the personality variable least related to IQ was Theoretical Orientation.

4. The high IQ group (mean IQ 137) was significantly higher (.05) than the low group (mean IQ 112) on each of the six creativity variables.

5. High IQ boys were significantly higher on the personality variables than low IQ boys with the exception of Theoretical Orientation. High IQ girls were significantly higher than the low IQ girls on all six personality variables.

Conclusions

The results of the theoretical and experimental studies indicate that the assessment of certain non-cognitive aspects of personality may be a valid alternative to the factor-analytic rationale for measuring creative potential. This approach to the understanding and measurement of creativity must be considered in relation to the structure-of-intellect approach which sees creativity as a strictly cognitive phenomenon. The distinguishing characteristics of holistic creativity testify to drastic differences between the two approaches to creativity. The magnitude of the differences suggest that they have very little in common.

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CHAPTER I

INTRODUCTION AND OVERVIEW

The Problem

The problem with which this study is concerned is the relationship between intelligence and a holistic conception of creativity. The qualification "holistic" is necessary because of a singular succession of events plus a basic cleavage in philosophy which obtains in creativity research. The catenation of events began in 1950 with the publication of Guilford's theory of creativity based on his "structure of intellect" and factor-analysis.[1] One of the significant results of Guilford's research was the development of "creativity" tests which, in conjunction with his philosophy, supplied the tools and rationale for the celebrated study of the relationship between intelligence and creativity by Getzels and Jackson in 1962.[2]

From the standpoint of the present study, the Getzels-Jackson investigation was the key episode in the

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[1] J. P. Guilford, "Creativity," The American Psychologist, V (September, 1950), 447-448.

[2] Jacob W. Getzels and Philip W. Jackson, Creativity and Intelligence (New York: John Wiley and Sons, 1962).

formation of the fashionable, but narrowly conceived, severely circumscribed frame-of-reference which now pervades much of creativity research. Be that as it may, this investigation proved to be a catalyst which generated much interest in the relationship between intelligence, as measured by IQ tests, and creativity, as measured by the new "creativity" tests.

The Getzels-Jackson study and the work which followed in the interest and excitement of its wake, especially that of Torrance,[3] has had such a tremendous impact upon the educational community that many have accepted the philosophy and instruments of this conception of creativity without question while remaining unaware of a thoroughly different way of looking at creativity. For instance, among those engaged in creativity research with adolescents, there has been an almost total and exclusive acceptance of this view. Unfortunately, whatever error this easy acceptance may contain will tend to be compounded by the ever growing nexus of relationships that will inevitably develop from the original conception.

The essence of the Guilford or structure-of-intellect model is the assumption that creativity is a combination of distinct cognitive abilities which can be adequately

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[3]E. Paul Torrance, Guiding Creative Talent (Englewood Cliffs, New Jersey: Prentice-Hall, 1962).

measured by short, simple, open-ended tests. The holistic position is in many ways a polar alternative to this view. Whereas the former focuses on isolated cognitive abilities, the latter directs attention to the value systems, which are manifest in terms of attitudes and interests, around which the personality is integrated. The rationale for a systematic investigation of the relationship between holistic creativity and IQ is based on the premise that intrapersonal, interpersonal, and personal-world relations are carried on in terms of persistent patterns of attitudes toward self, others and the world. These patterns of attitudes, by virtue of their persistent and consistent nature, are susceptible of description, measurement and prediction. Consequently, the relationship between these patterns of attitudes and IQ can be subjected to statistical analysis.

An attempt at clarification of the relationship between holistic creativity and IQ presents several unusual difficulties. There is the psychological barrier of two radically different approaches, the holistic and factor-analytic, bearing the same name, "creativity", only one of which, the factor-analytic, is usually associated with this relationship. The literature on this subject, at least that pertinent to the adolescent, is almost entirely of the factor-analytic variety. These and other factors have contributed to much confusion and lack of discrimination in the

dialogue on creativity and make it necessary to review both approaches so that pertinent contrasts will stand out clearly.

To summarize, the problem of elucidating the relationship between holistic creativity and IQ requires, first of all, a graphic delineation of the historical and theoretical development of both the holistic and the factor-analytic viewpoints in order to reveal the intrinsic differences which exist between them. After this is accomplished, a study of the attitude and interest patterns characteristic of holistic creativity and their relationship to IQ will be practicable.

Background and Overview

The vanguard of our society has sensed a new and desperate need for creative thinking. This is evidenced by the recent spate of books and articles on creativity and related topics. Arnold Toynbee sounds the alarm by underscoring the scarcity and therefore the vital necessity of actualizing the potential of society's most valuable possession.

> To give a fair chance to potential creativity is a matter of life and death for any society. This is all-important, because the outstanding creative ability of a fairly small percentage of the population is mankind's ultimate capital asset, and the only one with which Man has been endowed. . . . If society fails to make the most of this one human asset, or if, worse

> still, it perversely sets itself to stifle it, Man is throwing away his birthright.[4]

Gardner emphasizes the urgency of contemporary problems.

> The plain fact is that never in our history have we stood in such desperate need of men and women of intelligence, imagination and courage. The challenge is there--greater than any generation has ever faced.[5]

These discerning observations are not urgent entreaties to accelerate even more the tremendously rapid changes that are continually altering so many facets of our existence. The reason for their imperativeness must be found elsewhere. From ancient times man has understood that the progress of civilization depends on the occurrence of new ideas in the minds of individuals which are subsequently developed into useful theoretical and practical tools. Society advances by exploiting those innovations which it deems useful. But, since current events attest to the fact that progress in a material sense presents no particular problem, at least to the western world, we might reasonably ask: Why is the need for creativity greater now than ever before? Why the note of urgency? Perhaps it is because of the growing realization that the only way to conserve is by

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[4]Arnold Toynbee, "Is America Neglecting Her Creative Minority?" Widening Horizons in Creativity, ed by C. W. Taylor (New York: John Wiley and Sons, 1964), p. 4.

[5]John W. Gardner, Excellence (New York: Harper and Brothers, 1961), p. 153.

innovating.[6] Perceiving that creativity is necessary for conserving what is best in our society as well as being the main agency of its progress could amply account for the greatly increased interest in this subject.

The problem posed by the existence of two basically different conceptions of creativity may be seen as a particular instance of a more general problem. Western scientific thought can be roughly divided into two more or less conflicting approaches to the understanding of natural phenomena: the old dichotomy of "particles" versus "patterns." "Some center attention on the physical particles, others on the field-forces or relations that hold the particles together."[7] It is true that theoretical physics has attempted to bridge the gap with Bohr's concept of complementarity,[8] but the disunity of these two theoretical and philosophical orientations is discernible in almost all efforts toward scientific explanation.[9] Attempts to understand and explain creativity are no exception.

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[6]Peter Drucker, Landmarks of Tomorrow (New York: Harper and Brothers, 1959), Chaps. 1 and 2.

[7]Harold Rugg, Imagination (New York: Harper and Row, 1963), p. 312.

[8]Arthur Koestler, The Act of Creation (New York: Macmillan, 1964), p. 198.

[9]Rugg, op. cit., p. 312.

Of course, there are minor differences in the way these two orientations are expressed and differentiated in the separate subject areas. Translated in terms of creativity research, the "particle" or atomistic point of view is well represented by the factor-analytic philosophy[10] and the simple, short-answer, open-ended tests, designed to measure the intellectual components of creativity, which were derived from this philosophy.[11]

There seems to be no one best representative which is typical of the "pattern" or holistic viewpoint. However, there are three clusters of studies which, taken together, represent this philosophy quite well. First, are the biographers of great scientists and artists who were vitally interested in understanding the wellsprings of creativity in their subjects. For example, Wertheimer,[12] Loestler[13] and Lowes[14] who researched Einstein, Kepler and Coleridge

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[10] Yaoru Yamamoto, "'Creativity'--A Blind Man's Report on the Elephant," Journal of Counseling Psychology, XII, No. 4 (1965), 428-434.

[11] J. P. Guilford, "Progress in Discovery of Intellectual Factors," Widening Horizons in Creativity, ed. by C. W. Taylor (New York: John Wiley and Sons, 1964), pp. 261-297.

[12] Max Wertheimer, Productive Thinking (New York: Harper and Brothers, 1945).

[13] Arthur Koestler, The Sleepwalkers (New York: Macmillan, 1959).

[14] John Livingston Lowes, The Road to Xanadu, A Study in the Ways of the Imagination (Boston: Houghton Mifflin, 1927).

respectively. Second, are investigators like Ghiselin,[15] Roe[16] and MacKinnon[17] who have made intensive studies of groups of highly creative individuals in the arts and sciences. The third cluster consists of recent, scholarly investigations of creativity based on data from numerous separate disciplines. For example, the work of Rugg,[18] Selye[19] and Koestler.[20] In all of these studies there is the implicit assumption that creative activity is always emotive and connative as well as cognitive, and that "these are not three separate or separable species of functioning but three inseparable aspects of a single conscious activity."[21] The essence of the holistic position on creativity is captured by the eminent contemporary philosopher, Karl Jaspers:

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[15]Brewster Ghiselin, The Creative Process, A Mentor Pocket-book, MD 132 (New York: The New American Library, 1952).

[16]Anne Roe, The Making of a Scientist (New York: Dodd, Mead, 1953).

[17]Donald W. MacKinnon, "Personality Correlates of Creativity," paper presented at the Second Conference on Productive Thinking, National Educational Education Association, Washington, D.C., May 2-4, 1963. (Mimeographed.)

[18]Rugg, op. cit.

[19]Hans Selye, From Dream to Discovery (New York: McGraw-Hill, 1964).

[20]Koestler, The Act of Creation.

[21]Errol E. Harris, "Mind and Mechanical Models," Theories of the Mind, ed. by Jordan Scher (New York: The Free Press of Glencoe, 1962), p. 488.

> What actually happens . . . cannot be modified merely by an improvement in expert knowledge; only through man's being can it be decisively altered. Decisive is a man's inward attitude, the way in which he contemplates his world and grows aware of it, the essential value of his satisfactions--these things are the origin of what he does.[22]

The global and holistic conception of creativity implies that we must look first at the total personality. We must somehow understand the attitudes, values and motives which give rise to the creative disposition.[23] As Hartshorne says, "what we call thinking is the fashion in which human beings tend to carry out their evaluations."[24] Allport agrees:

> Personal values are the dominating force in life, and all of a person's activity is directed toward the realization of his values. And so the focus for understanding is the other's value orientation--or, we might say, his philosophy of life.[25]

Accordingly, the main method of inquiry has been by means of intensive personological studies of historical and contemporary individuals who have made noteworthy contributions to

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[22]Karl Jaspers, Man in the Modern Age, A Doubleday Anchor Book (Garden City, New York: Doubleday and Company, 1957), p. 175.

[23]Raymond B. Cattell, "The Personality and Motivation of the Researcher from Measurement of Contemporaries and from Biography," Scientific Creativity: Its Recognition and Development, ed. by Calvin W. Taylor and Frank Barron (New York: John Wiley and Sons, 1963), p. 131.

[24]Charles Hartshorne, "Mind as Memory and Creative Love," Theories of the Mind, ed. by Jordan Scher (New York: The Free Press of Glencoe, 1962), p. 442.

[25]Gordon W. Allport, Pattern and Growth in Personality (New York: Holt, Rinehart and Winston, 1961), p. 543.

civilization. Only the manifestly creative were examined because:

> When a variable is maximized, we are more likely to discover characteristics which are also present, though perhaps in hidden form, in the usual range of the variable. Furthermore, since creativity is at best hard to define, it is only at the extreme that we can be reasonably sure that we are talking about it.[26]

Ghiselin's book The Creative Process[27] is a good example of this method. Ghiselin ferreted out impressive accounts from the writings of thirty-eight well-known creative thinkers pertaining to their behavior and subjective mental states during various stages of the creative process. Although studies which include the self-reporting of mental states often introduce the hypothetical problem of subjectivity, McLeod argues that self-observation is the point at which the inquiry should begin.

> Introspection and retrospection may not give us secure criteria, but without the intuitions derived from direct experience our inquiry would be formal and barren. Just as the sensitive psychiatrist understands his patient in part through the memories of his own moments of irrationality, so the psychologist must seek for criteria of creativity in the memories of his own creative moments.[28]

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[26]Howard E. Gruber, Glenn Terrell and Michael Wertheimer (eds.), Contemporary Approaches to Creative Thinking (New York: Atherton Press, 1962), p. x.

[27]Ghiselin, op. cit.

[28]Robert B. McLeod, "Retrospect and Prospect," Contemporary Approaches to Creative Thinking, ed. by Howard E. Gruber et al. (New York: Atherton Press, 1962), p. 183.

Only by thoughtfully analyzing the introspections of great creative minds and by noting the similarities and differences in their own mental states that are perceptible during their more modest creative ventures, are investigators enabled to establish an intuitive base for inquiry into the creative process.

To summarize, the underlying assumption of the factor-analytic or atomistic philosophy is that creativity is essentially an intellectual ability, the components of which can be separated from their affective-conative background and adequately measured by short-answer tests.[29] Holistic psychologists asseverate that creativity research within the above frame of reference "is impoverished by a disregard for the complexity of original thought,"[30] and reserve the appelation "creativity" for unequivocal creative behavior in the "real" world. Personal factors not intellectual ones are crucial and the main point of testing lies in measuring those qualities which predispose an individual to use every aspect of his personality, not just his intellect, in creative ways. These are two radically different views of creativity. Perhaps the protagonists on each side are

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[29]J. P. Guilford, "Factors that Aid and Hinder Creativity," Readings in Professional Education, ed. by Aubrey Haan and Norman Haan (Boston: Allyn and Bacon, 1963), pp. 212-230.

[30]Liam Hudson, Contrary Imaginations: A Psychological Study of the Young Student (New York: Schocken Books, 1966), p. 51.

not talking about the same thing at all. In any event, it would be imprudent to indiscriminately transfer findings from one type of creativity research to the other.

Although this study was conceived and structured in terms of "patterns," both orientations will be reviewed so that pertinent contrasts can be made clear. This is particularly essential in discussing the relationship between intelligence and creativity as the present dialogue on this subject, especially since the Getzels-Jackson study in 1962,[31] is almost wholly atomistically oriented. The criteria for creativity used by Getzels and Jackson was performance on five Guilford-type tests. The investigators found little correlation between scores on these tests and IQ scores. They also found little correlation among the various creativity tests,[32] but the fact that the composite score on the creativity tests showed a low relationship to the IQ scores touched off a series of similar studies using comparable tests. Torrance, for instance, made a series of eight studies in diverse settings in an attempt to corroborate the findings of the Getzels-Jackson study.[33] Substantially the same results were found in six of the eight studies.

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[31]Getzels and Jackson, op. cit.

[32]Cyril Burt, "The Psychology of Creative Ability," British Journal of Educational Psychology, XXXII (November, 1962), 292-298.

[33]Torrance, op. cit.

As has already been implied, we must bear in mind that these tests are based upon assumptions about the nature of creativity that are far from being confirmed. Inasmuch as external validity was not a prerequisite in the development of these tests,[34] our acceptance of the results depends, in the final analysis, on our faith in Guilford's understanding of the nature and structure of creative abilities since they are ultimately based on his factor-analytic model of human intellect.[35]

Before we summarily relegate the attribute of intelligence to inferior status, perhaps we should look more carefully at the conception of the creative process which emerges from the studies of highly creative individuals. The creative process can be divided into two major phases: (1) the unconscious and preconscious "feeling" phase which provides the context for the illuminating flash of insight and (2) the conscious and logical reasoning phase which provides the basis for and the verification of the insight. Both are indispensable.[36] These two major phases are usually divided into the four familiar stages originally suggested by Wallas: preparation, incubation, illumination and

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[34]Guilford, "Progress in Discovery of Intellectual Factors," Widening Horizons in Creativity, p. 262.

[35]Yamamoto, op. cit.

[36]Rugg, op. cit., p. 290.

verification.[37] Every scientific discovery is preceded by a preparatory period of gathering and conscious exploration of facts and ideas which serves as a nucleus for the new contribution.[38] And after the idea is born in a flash of insight it must be examined and checked by conscious reasoning and logically planned experimentation.[39] In other words, the flash of insight is preceded and followed by the methods of conscious intelligence. Selye indirectly alludes to the crucial importance of intelligence at the birth of new ideas:

> Contrary to common opinion, Edward Jenner was far from being the first to inoculate people with cowpox to protect them against smallpox; William Harvey was not the first to recognize the circulation of the blood; Darwin was not the first to suggest evolution, and Pasteur was not the first to formulate the germ theory. Carbolic acid was used as a wound antiseptic before Lister's time. But these were the men who really developed these ideas to a point where they became useful.[40]

New ideas are useless unless they are received with the requisite intelligence to see their significance and develop them at least to the point where they can be communicated to others. "Even the most original idea," says Selye, "is worthless if we cannot grasp and fix its meaning in terms of conscious intellect."[41] Ideas not communicated

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[37] Graham Wallas, The Art of Thought (New York: Harcourt, Brace, 1926).

[38] Selye, op. cit., p. 57.

[39] Ibid., p. 61.

[40] Ibid., p. 92.

[41] Ibid., p. 67.

because of insufficient insight and development are obviously not viable and the creative process is aborted. An observation by Kneller is pertinent here.

> In other words, to realize his creative idea, he must master the means of expressing it. The painter, the poet, the dancer, the draughtsman, the teacher, indeed all who would create, must submit to the discipline of their craft.[42]

This last stage of development to the point of viability and usefulness is often an arduous application of intelligent effort.

> The last stage--verification, elaboration, consolidation--is by far the least spectacular, the most exacting, and occupies the longest periods of time both in the life of the individual and in the historical evolution of science. Copernicus picked up the ancient Pythagorean teaching of the sun as the centre of all planetary motions when he was a student in Renaissance Italy . . . and spent the rest of his life elaborating it into a system. Darwin hit on the idea of evolution by natural selection at the age of twenty-nine; the remaining forty-four years of his life were devoted to its corroboration and exposition.[43]

The level of intelligence needed is obviously related to the nature of the task. Kneller says that

> the degree of intelligence necessary for high creativity varies with the work to be performed. For the scientist, for example, a high IQ is generally more important than it is for a novelist or a painter.[44]

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[42]George F. Kneller, The Art and Science of Creativity (New York: Holt, Rinehart, and Winston, 1965), p. 51.

[43]Koestler, The Act of Creation, p. 225.

[44]Kneller, op. cit., p. 63.

Roe, for instance, found that her subjects, the sixty-four most eminently creative physical, biological, and social scientists in this country, were extraordinarily intelligent. The median score for this group on a verbal test of intelligence was approximately equivalent to an IQ of 166.[45] The creative scientists and philosophers studied by Cox were considered by a panel of psychologists to have had even higher levels of intelligence.[46] Terman believed that high general intelligence was necessary for significant contributions in almost any field.[47] Ward states that the cognitive essence of significant creative acts is high general intelligence with its "perceptual efficiency, adequacy in evolving and manipulating higher syntheses of ideas, and more complex and subtle inferences based upon such complex syntheses."[48]

The empirical evidence which has issued from recent studies and the inferences which logically follow would seem to indicate that intelligence is an inherent aspect of the creative process and that the level of intelligence needed

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[45]Roe, op. cit., p. 164.

[46]Catherine Cox (under direction of Lewis Terman), Genetic Studies of Genius: The Early Mental Traits of Three Hundred Geniuses, Vol. II (Stanford, California: The Stanford University Press, 1926).

[47]Lewis M. Terman, "The Discovery and Encouragement of Exceptional Talent," The American Psychologist, IX (June, 1954), p. 224.

[48]Virgil S. Ward, Educating the Gifted: An Axiomatic Approach (Columbus, Ohio: Charles E. Merrill Books, 1961), p. 32.

depends on the nature of the creative task. The intelligence required for the creation of an excellent soup or a beautifully creative tackle on the football field would patently be of a very different order from that needed to synthesize data from several separate disciplines into a novel and useful concept.

Taylor's classification of creativity into five levels ranging from the most simple to the most complex is helpful at this point.[49] The levels in order of complexity are: expressive, productive, inventive, innovative, and emergentive creativity. These classifications range in complexity and significance from the spontaneous, independent expression of children to the highest levels of creativity which alter the universe of meaning itself by introducing radically new and unfamiliar insights. Durr points out that this system of classification widens the range of behavior which we may consider as creative and also

> . . . provides a conceptual framework for evaluating creative products. Estimating the level at which a creative product may be classified most appropriately provides some basis for evaluating the probable importance of that product.[50]

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[49]Irving A. Taylor, "The Nature of the Creative Process," Creativity: An Examination of the Creative Process, A Report on the Third Communications Conference of the Art Directors Club of New York, ed. by Paul Smith (New York: Hastings House, 1959), pp. 54-61.

[50]William K. Durr, The Gifted Student (New York: Oxford University Press, 1964), p. 175.

Explicit recognition of vastly different levels of creativity is perhaps an important key to the diagnosis of the confusion that plagues research in this area. There is a wide-spread belief that tests which measure the simple skills and attributes of the lower levels of creativity will correlate well with the complex abilities and qualities which characterize the higher levels. Hudson states that there is no evidence for this belief.[51] And he points out how "naive it is to use tests which measure simple skills and expect them to correlate well with abilities . . . which are highly complex."[52]

The determining complexities and characteristics which distinguish the higher levels of creativity must be given the attention and study they deserve if we are to gain a clearer understanding of these levels of creativity.

One neglected aspect of the creative process is its duration. When we consider the time element involved in making creative contributions we are impressed by its importance in three of the four stages of the creative process. Except for the key central stage of illumination, time is a principal factor. It is usually acknowledged that the stages of preparation and verification often take their course over

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[51] Hudson, op. cit., p. 107.

[52] Ibid., p. 34.

long periods of time, but it is not generally appreciated that the stage of incubation also imposes inevitable demands with respect to time. "What is certain," says Kneller in discussing the relationship between the stages of preparation and incubation, "is that . . . he [creator] must be able to set his work aside in order to give his own ideas freedom to develop."[53] First-hand accounts consistently affirm the importance of giving the unconscious and preconscious levels of our unconscious-conscious mental continuum the time necessary to recombine, refashion, and bring into being new and better versions of the partially worked-over products of our conscious experience and effort. Loewi tells of an incubation period of seventeen years which ended when the design for an experiment which solved the problem came to him at three o'clock one morning.[54] Arthur Koestler quotes Walter Cannon's description of this experiment as "one of the neatest, simplest, and most definite experiments in the history of biology."[55] Rugg tells of the futility and frustration that Bertrand Russell experienced in trying to finish his creative work on mathematics, by conscious

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[53]Kneller, op. cit., p. 50.

[54]Otto Loewi, Perspectives in Biology and Medicine, Vol. IV, No. 1 (Chicago: University of Chicago Press, 1960), p. 19.

[55]Koestler, The Act of Creation, p. 205.

effort alone, until he discovered the necessity of "waiting for it to find its own subconscious development."[56]

The factor-analytic approach in effect by-passes the incubation stage, as well as the other three well-documented stages of the creative process, by focusing on the putative intellectual components of creative ability. Neither the insights of creative individuals nor the ecological analysis of creative behavior is deemed important by the atomists.

A growing realization that the differences between these two views are not superficial is represented by Yamamoto's penetrating insight.

> Why, after all these efforts, have we not reached any kind of concensus about the elephant we are feeling? My thesis is that the reason may be found in the basic philosophical differences among workers in this area, and not in mere over-abundance of different techniques and methods nor in the wide variation in the degree of sophistication among investigators. In other words, I submit here that the confused out-of-focus picture of the elephant drawn by the blind men is a result of not so much the restricted nature of their exploratory activities as of the radically different expectations with which explorations are initiated. Men might come to the same conclusion even if one touches the elephant's ears while another feels its tail--but not when the former started out with a clear intention of finding a rabbit and the latter a snake.[57]

Later in the same article we find this statement:

> . . . the present "confused abundance" in the study of creativity is a result of (1) the different points of departure in the definition of creativity, (2) the

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[56]Rugg, op. cit., p. 8.

[57]Yamamoto, op. cit., 428-429.

> differences in assumptions and presuppositions, and (3) the differences in research strategies among and within groups of workers of different orientations. . . . Each group has its unique assumptions, adopts its particular definitions, and employs its preferred techniques of inquiry. Each group has its own language, its peculiar way of speaking about the problem which is not readily understood by other groups of workers.[58]

Far-reaching implications follow as a consequence of recognizing the existence of widely disparate orientations toward creativity. As a case in point, on surveying the recent literature one becomes aware that most of the instruments used for the assessment of creativity have evolved from the factor-analytic methods of J. P. Guilford. This is especially true concerning studies in the public schools. These instruments, almost universally considered to be the "creativity tests" by those investigating this subject at the high school level and below, are simple, open-ended, short-answer tests designed to assess the intellectual factors supposedly most pertinent to the creative process. In order to justify the term "creativity test" two crucial criteria would seem to become apparent at this juncture: One, do the young subjects who make high scores on these tests tend to make creative contributions in the accepted sense as adults? Two, do highly creative adults, i.e., those who are unquestionably creative as scientists, writers, painters, architects, mathematicians, etc., score unusually well on these tests? The former can not be answered at this

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[58] Ibid., p. 432.

time because of the recent development of these tests, and there is scarcely a shred of support for the latter.[59] In view of our nebulous understanding of creativity and the as yet uncertain and confused status of our theoretical and practical tools we would do well to heed the advise of McLeod: ". . . in this particular field there should certainly be no premature freezing of methods and models."[60]

Although there are many reservations about Guilford's position, the impact of his theories, enhanced by their precise and concrete expression on thinking and teaching practice, led Yamamoto[61] to exclaim: "Reification of Guilford's factors appears to be an unfortunate but possibly inevitable by-product of such a forceful formulation." McNemar[62] in discussing this self-sufficient system, makes a strong argument for the importance of adducing evidence on the empirical validity of creativity tests based upon independent criteria. Cronbach[63] is more vivid in describing the factor-analytic approach as "a narcissistic program of studying . . . tests as an end in themselves."

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[59]Hudson, op. cit., p. 107.

[60]McLeod, op. cit., p. 209.

[61]Yamamoto, op. cit., p. 431.

[62]Quinn McNemar, "Lost: Our Intelligence? Why?" American Psychologist, XIX (1964), 879-880.

[63]Lee J. Cronbach, "The Two Disciplines of Scientific Psychology," Research in Personality, ed. by Martha Mednick and S. A. Mednick (New York: Holt, Rinehart and Winston, 1963), p. 9.

To paraphrase McLeod, there are obviously some disadvantages in imposing a minutely developed, more or less inflexible, structure of theory on phenomena before the phenomena have been really inspected.[64] Taylor's concept of several levels of creativity could be quite pertinent to this question. It is possible that the factor-analytic type test, while being completely inappropriate for the higher levels of creativity, may be fairly applicable to the lowest levels. In any event, the premature closure that obtains in some circles not only insures over-simplification but facilitates practical blunders in guiding the lives of children through spurious beliefs engendered in parents, teachers, and administrators. If we wish eventually to explain the phenomena of creativity at all levels, we must give each of them detailed examination.

Accepting the notion that we must accord the phenomena of creativity intensive study before delimiting and solidifying our frame of reference, how should we proceed? MacKinnon believes that we must begin our investigation of creativity with those individuals who are unmistakably creative in art, science, technology, and literature. His very thorough assessment work with highly creative writers, scientists, architects, painters, inventors, engineers, and

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[64] McLeod, op. cit., p. 182.

mathematics demonstrates that there are common characteristics across these fields which begin to give us the outline for the study of creativity. How do these common characteristics differ from the factors which were isolated by Guilford without reference to external criteria? The most obvious difference found is that personal rather than intellectual factors are crucial to creativity.[65] In other words, we do not find the most important differences in terms of intellectual equipment alone, but in the use individuals see fit to make of it. This does not mean, of course, that intelligence is not important, especially in heterogenous samples, but that, given an above-average level of intelligence, the area of motivation, values, and interests is more vital and pertinent if we are to understand creativity. Numerous important consequences follow from this basic observation and they will be explored later.

MacKinnon and his staff, at the Institute of Personality Assessment and Research, University of California, Berkeley, have, for over a decade, been gathering pertinent data through their unique and painstaking methods of evaluating the creative individual. They use many varieties of instruments and techniques in their appraisal, but not in their original selection. A very important difference in

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[65]Donald W. MacKinnon, "The Nature and Nurture of Creative Talent," The American Psychologist, XVII (1962), 484.

approach is noted here. Whereas MacKinnon rejected the use of tests in the selection process because he believed that it was first necessary to empirically isolate and validate, as far as possible, the pertinent characteristics, Guilford approached the problem in the opposite direction. Guilford made certain assumptions about the nature of creativity, invented a theoretical model, "the structure of intellect," based on these assumptions and then developed tests through factor-analysis to fit his model. MacKinnon sought to study creativity "only after it had been realized and found expression in clearly identifiable creative products--buildings designed by architects, mathematical proofs developed by mathematicians, and the published writings of poets and novelists."[66]

The creative subjects are usually selected from their respective specialized fields by nominations from a number of their respected colleagues. Also, one or two control groups, chosen in some appropriately random way, are usually included for study so that the differences between those who have made significant creative contributions and those who have not can be determined.

Roe's study of highly creative scientists[67] parallels and corroborates MacKinnon's conclusions. Roe selected

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[66]MacKinnon, "Personality Correlates of Creativity," p. 2. (Mimeographed.)

[67]Roe, op. cit.

her creative population in much the same manner as did MacKinnon, but instead of having them come to her she went to them. Over a period of four years she worked with the most eminent and creative biologists, physical scientists, social scientists, psychologists, and anthropologists in this country. Most of her information was obtained in a series of long personal interviews with each of the 64 subjects she studied. Roe concludes that the most obvious characteristic of the original thinker is his dedication to work.[68] "How do we account for such single-mindedness?" says Hudson, "Not I think, by invoking any quality of a purely cerebral nature: 'curiosity,' say, or 'inquisitiveness.' Some explanation of a more personal nature seems indispensable."[69]

One of the basic tenets of the holistic approach is that "psychological states do not organize themselves or lead independent existences. Their arrangement merely constitutes part of a larger arrangement--the personal life."[70] In other words, values, interests, and abilities within the framework of personality must be our central concern. This is recognized by Selye when he states that

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[68] Ibid., p. 49.

[69] Hudson, op. cit., pp. 139-140.

[70] Allport, op. cit., p. 553.

"research is a highly personal activity."[71] Also, Bloom "rather reluctantly" came to the view that "interests, motivation, and personality characteristics account for at least as large a portion of the variance in problem-solving and achievement measures" as cognitive skills and aptitudes.[72]

The basic premises of the holistic approach offer few problems; however, the question of measurement and prediction before significant creative products have been produced is a much disputed point. The difficulty of measuring creative potential is, supposedly, the main obstacle to the practical application of the holistic approach in predicting creativity in, for instance, the adolescent.

Taylor has shown that holistic-type tests are not only feasible, but highly practical. And, most significantly, the test he developed for his particular needs yielded better validities than any other psychological test scores.[73] This test, the Biographical Inventory was developed for NASA and has proven to be "possibly the best single

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[71]Selye, op. cit., p. 200.

[72]Benjamin S. Bloom, "Report on Creativity Research by the Examiner's Office of the University of Chicago," Scientific Creativity: Its Recognition and Development, ed. by Calvin W. Taylor and Frank Barron (New York: John Wiley and Sons, 1963), p. 253.

[73]Calvin W. Taylor and Robert L. Ellison, "Predicting Creative Performances from Multiple Measures," Widening Horizons in Creativity, ed. by C. W. Taylor (New York: John Wiley and Sons, 1964), p. 230.

creativity measure, perhaps because it is the most complex."[74] The Biographical Inventory measures a varied assortment of things about one's life history, including samples from the entire gamut of past experience.

> In a discussion of the biographical items in the Biographical Inventory, the term "biographical information" is in one sense a misnomer. The Biographical Inventory contains a wide variety of questions about childhood activities, experiences, sources of derived satisfactions and dissatisfactions, experiences, attitudes, value preferences, self-descriptions and evaluations, etc.[75]

It is important for the hypotheses of this paper that Taylor subsequently ascertained that creative and productive characteristics found for scientists on the job were also measurable in high school students in terms of an overall predictor of creative performance.[76] This latter step is crucial if we are to use this kind of instrument to measure the a priori creative potential of young people.

Several other instruments of the same general type have also proven to be effective in discriminating between creative and non-creative individuals. One of the best known is the Allport-Vernon-Lindzey Study of Values.[77] The

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[74] Ibid., p. 228.

[75] Ibid., p. 230.

[76] Ibid., p. 238.

[77] Gordon W. Allport, Philip E. Vernon, and Gardner Lindzey, Study of Values: A Scale for Measuring the Dominant Interests in Personality (Boston: Houghton-Mifflin Co., 1960).

classifications in this inventory are based on Edward Spranger's types of men which "defends the view that the personalities of men are best known through a study of their values or evaluative attitudes."[78] Characteristic profile patterns on this test were found by MacKinnon to distinguish highly creative from less creative in all of the groups he studied.[79]

Another instrument which was derived from the holistic universe of discourse is Cattell's Sixteen Personality Factor Inventory.[80] Although Cattell is rather strongly analytical in that he believes that human motivation and personality study should, and can, be on a quantitative, experimental, and mathematical basis, he avers that one must begin with the study of lives.

> . . . the biographical approach is a relatively loose exploratory method, yet absolutely essential initially for perspective and generating research ideas in investigating the personalities and processes in research. Indeed, one would rightly have little regard for theoretical generalizations and experimental investigations anywhere that do not take their origin from an immersion in the material itself--and no currently available material is yet as rich and complete as that which historical records give us.[81]

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[78] Ibid., p. 3.

[79] Donald W. MacKinnon, "The Creativity of Architects," Widening Horizons in Creativity, ed. by C. W. Taylor (New York: John Wiley and Sons, 1964).

[80] Raymond B. Cattell, The Scientific Analysis of Personality (Baltimore: Penguin Books, 1965), p. 69.

[81] Cattell, "The Personality and Motivation of the Researcher from Measurement of Contemporaries and from Biography," Scientific Creativity, p. 124.

Over a period of years the people at the Center for the Study of Higher Education in Berkeley have developed the multiform instrument which is used in the present study. It is based on premises corresponding to those which led to the instruments mentioned above. This instrument, the Omnibus Personality Inventory, is a modified composite of many separate tests and was constructed by Paul Heist and Phoebe Williams in 1957.[82] Like the three tests above, the OPI measures motivation to learn, openness to psychological growth, and predisposition to creative behavior rather than psychopathology.

Most work with the OPI has been done with college students and adults, but Drews has used it extensively in her work with bright junior high and high school students with whom it has discriminated well between those judged creative and less creative by other criteria.[83] It is her conclusion that the OPI is a valuable instrument of appraisal for this age level, especially when used with the more able

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[82]Paul A. Heist and Phoebe A. Williams, The Omnibus Personality Inventory (Berkeley, California: Center for the Study of Higher Education, University of California, 1957).

[83]Elizabeth M. Drews, The Creative Intellectual Style in Gifted Adolescents: Motivation to Learn, Report I in a series of three; Final Report of the Cooperative Research Program, E-2, U. S. Office of Education, "A Study of Non-Intellectual Factors in Superior (Average, and Slow) High School Students" (East Lansing, Michigan: Office of Research and Publications, Michigan State University, 1964).

students. This study is an outgrowth of her use of this inventory in her comprehensive investigations of the creative intellectual disposition in adolescents.[84]

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[84] Ibid.

CHAPTER II

THEORETICAL BACKGROUND AND REVIEW OF LITERATURE WITHIN THE ATOMISTIC UNIVERSE OF DISCOURSE

Conceptual Framework

As we indicated in the last chapter, the issues that have divided the atomists and the holists have been around for a long time. Speaking of psychologists generally, Sanford says that the atomists in their desire to establish themselves as representatives of "true science" have inappropriately adopted the more superficial characteristics of the physical sciences.

> The discipline is still much concerned to establish itself as a science, but the psychologists' naive conception of science has led them to adopt the more superficial characteristics of the physical sciences. This has made it difficult for them to study genuine human problems, since quantification, precision of measurement, elegance of experimental design, and general laws are so much more difficult to achieve once one goes beyond simple part processes.[1]

And McLeod adds:

> What is important for us as psychologists to recognize is that at the time when psychology was beginning to be a science the conception of science was essentially

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[1] Nevitt Sanford, "Will Psychologists Study Human Problems?" The American Psychologist, XX, No. 3 (March, 1965), 193.

> Newtonian. Science in its essence was the reduction of the complex to the simple, of quality to quantity, and the quantification of cause-effect relations in such a way that they can provide a basis for prediction.[2]

Since the atomists are convinced that the higher, more complex processes of behavior cannot be analyzed, they have reduced the problem to simple, isolated process--a "psychology-without-a-person"--so that they may approximate the standards of precision attained in the physical sciences.[3] Another observation by McLeod is apposite:

> Psychology, as a science, has understandably been overpowered by the achievements of its elder brother. All too frequently, however, psychologists seem to have assumed that because a method has proved fruitful in physics it is therefore universally applicable. The method that psychology has borrowed from Newton is that of reductive analysis. Today we have the almost amusing picture of a psychology that is still trying to pattern itself after nineteenth century physics, while the physicists of today have long since left the nineteenth century behind. If psychology is to imitate the physical sciences, which is not such a bad idea, it should imitate not the methods and the constructs of a particular era but the openness to facts and the willingness to challenge assumptions that have been the hallmarks of science in the modern world.[4]

Although McLeod states that he is biased toward the scientific experimental approach, nevertheless, he has some reservations about reducing the creativity problem to existing molds.

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[2] McLeod, op. cit., p. 198.

[3] Sanford, op. cit., p. 193.

[4] McLeod, op. cit., p. 198.

> I should like to argue that experimental psychology is not yet ready to assimilate all the phenomena of creativity. . . . My misgivings are about premature attempts, limited by available methods, to squeeze the intangibles of behavior into the existing molds. . . . All we need to do, they suggest, is drastically simplify the psychological problem to the point at which existing methods can be made to work. . . . The danger . . . is that in reducing our problem to convenient dimensions we may unwittingly trim away the very dimensions which make it interesting and challenging.[5]

However, despite the weaknesses that might be conjoined with their position, it was the advocates of the atomistic structure-of-intellect approach who were the chief catalytic agents in the remarkable upsurge of interest in creativity. A cursory adumbration of the train of events which ultimately led to this view of creativity should shed light on the sources of its development as well as clarify, to some extent, the particular characteristics of the creativity tests to which it gave rise.

To fully appreciate the interest generated by the creativity tests of Guilford, Getzels-Jackson, and Torrance, one must remember the long reign of the conception of intelligence which is generally considered to have begun with Galton. Galton, after showing that men of great reputation and distinction came from a relatively small group of families, concluded that genius is inherited and therefore

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[5] Ibid., p. 180.

fixed.[6] This belief led him to the next logical step of attempting to measure the inherited differences which were most pertinent in the differentiation of various levels of intellectual ability.[7] Galton devised many tests of simple sensory and motor functions and, for the price of three pence, over 9,000 persons took the tests before it was realized that there was little relationship among the various tests or between the tests and other estimates of intelligence.[8]

About 25 years later, a scale was developed by Binet and Simon, utilizing "more complex psychological functions," which did show a significant relationship to independent estimates of intelligence.[9] Binet deplored the belief in fixed intelligence,[10] but his instrument was eventually conjoined with Galton's belief in fixed intelligence through the influence, among others, of Cattell, Goddard, and

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[6]Francis Galton, Hereditary Genius: An Inquiry into Its Laws and Consequences, A Meridian Book M134 (Cleveland, Ohio: World Publishing Company, 1962).

[7]Francis Galton, Inquiries into Human Faculty and Its Development (London: Macmillan, 1883).

[8]J. McVickers Hunt, Intelligence and Experience (New York: The Ronald Press, 1961), p. 12.

[9]Ibid., pp. 12-13.

[10]Alfred Binet, Les Idees Modernes sur les Enfants (Paris: Ernest Flamarion, 1909), pp. 54-55, quoted in J. McVickers Hunt, Intelligence and Experience (New York: The Ronald Press, 1961), p. 13.

particularly, Terman.[11] Later, stimulated by the rediscovery of Mendel's principles of genetics, this combination was buttressed by the belief in predetermined development, primarily through the teaching of Hall at Clark University and the influence of his students, among whom were most of the men associated with the early development of intelligence tests.[12] This concept of the nature of intelligence dominated this area of psychometrics until recent times and is still quite influential in educational thinking.[13]

The investigators who held this view maintained that the newly developed intelligence tests did, in fact, measure innately fixed intelligence.[14] Miles, a close collaborator with Terman for several years, reported that Terman had a boundless faith in intelligence tests and that he had challenged educators and psychologists:

> . . . to produce, if they can, another concept as effective as the IQ for delimiting of a group of talent to include the most successful students, the best achievers in the academic world, and as he believed, in the world of human relationships and human endeavor generally.[15]

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[11] Hunt, op. cit., pp. 12-16.

[12] Ibid., p. 43.

[13] Ibid., p. 7.

[14] Cyril Burt et al., How the Mind Works (New York: Appleton-Century-Crofts, 1934), pp. 28-29.

[15] Catherine Cox Miles, "Crucial Factors in the Life History of Talent," Talent and Education, ed. by E. Paul Torrance (Minneapolis: University of Minnesota Press, 1960), p. 51.

With such faith in the IQ metric it is easy to see why this score remained for many years as the only criterion for judging levels of mental ability and overall giftedness. Gallagher, in discussing the perennial veneration of the IQ says:

> A valid IQ score was generally considered to measure practically all that was of importance in cognitive development. Creative abilities, productive thinking, and problem solving were all assumed to be more or less synonymous with IQ test performance . . . while this idea was rarely stated in such bald form, the practical applications of the idea are all around us.[16]

We can see that there were good reasons for enlarging the concept of mental ability. It had become painfully obvious to many that the IQ metric had come to be a hindrance to a more comprehensive understanding of the capacity of the human mind. The inadequate concept of intelligence implicit in the IQ score was thus the main source of motivation for Guilford's innovations.

When Guilford, in his presidential address to the American Psychological Association in 1950, took up the cudgels to break through these inadequate, constricting conceptions of mental ability and giftedness, he found that many were ready for a change. The following excerpt from this address reveals his thinking.

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[16]James J. Gallagher, "Productive Thinking," Review of Child Development Research, ed. by Hoffman and Hoffman (New York: Russell Sage Foundation, 1964), p. 350.

> Examination of the content of intelligence tests reveals very little that is of an obviously creative nature.
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> . . . . . .
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> If the correlations between intelligence test scores and many types of creative performance are only moderate or low, and I predict that such correlations will be found, it is because the primary abilities represented in those tests are not all important for creative behavior. It is also because some of the primary abilities important for creative behavior are not represented in the test at all. . . . In other words, we must look well beyond the boundaries of the IQ if we are to fathom the domain of creativity.[17]

This address is usually cited as the main stimulus to a new interest in creativity. From Guilford's point of view, it was not only a break away from a deficient method of measuring cognitive abilities, but was also a signal to turn from what he considered to be an outmoded approach to creativity. To Guilford, this address signaled a significant advance in methodology as the exploratory, anecdotal, holistic type of investigations by such workers as Roe and MacKinnon were now, supposedly, to be displaced by the important business of hypothesis testing.[18] This stance is characteristic of the atomists whose "basic complaint against holistic theory is that it does not lend itself to testing by empirical methods."[19] Guilford felt that these studies with

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[17]Guilford, op. cit., pp. 447-448.

[18]J. P. Guilford, "Creativity: Yesterday, Today, Tomorrow," The Journal of Creative Behavior, I, No. 1 (January, 1967), 7.

[19]Sanford, op. cit., p. 196.

their "psychoanalytic theoretical bias" which "emphasized motivational and temperamental characteristics" could now be superseded by the scientific application of multivariate methods of factor analysis.[20] In terms of constructing measuring instruments, "the initial factor analysis started with a prior hypothesis as to what distinctions were to be expected among abilities that should be relevant to creative performance."[21]

Guilford has recently summarized his salient assumptions and the outstanding features of his methods of inquiry thusly:

> Rejecting the prevailing doctrine that intelligence is a single, monolithic ability, and also the view that creative talents are something outside the realm of intelligence, the studies began with the assumption that there are several, perhaps many, distinguishable abilities involved. It was also assumed that creative talents are not confined to a favored few individuals, but are probably widely distributed to different degrees throughout the population. Creative talents could therefore be investigated without being restricted to observation of the gifted few. . . .
>
> Within a setting of exploration of other hypothesized intellectual abilities, a general theory of intelligence and its components known as the "structure of intellect" was developed. . . .
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> Briefly, the abilities believed to be most relevant for creative thinking are in two categories. One category is "divergent-production" (DP) abilities. DP

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[20] Guilford, "Creativity: Yesterday, Today, Tomorrow," The Journal of Creative Behavior, p. 7.

[21] J. P. Guilford, "Creativity: Yesterday, Today, Tomorrow," The Journal of Creative Behavior, I, No. 1 (January, 1967), 7, citing R. C. Wilson et al., "A Factor-Analytic Study of Creative-Thinking Abilities," Psychometrika, XIX (1954), 297-311.

> abilities pertain to generation of ideas, as in solving a problem, where variety is important. Some DP abilities have been characterized as kinds of fluency, some as kinds of flexibility, and others as elaboration abilities. The varieties of abilities within the DP category depend upon the kind of information with which the person is dealing. This circumstance strongly suggests that creative talents depend upon the media in which the person is working--for example, whether he deals with lines and colors, sounds, or words, as in the various arts.
>
> The other potential source of creative talents is in the category of "transformation" abilities, which pertain to revising what one experiences or knows, thereby producing new forms and patterns. Readiness to be flexible is a general characteristic of this group of talents, where flexibility leads to reinterpretations and reorganizations. Again, the variety of transformation abilities depends upon the kind of information or media with which creators deal.
>
> An important advantage of analyzing creative disposition in terms of abilities is that kinds of abilities also imply kinds of mental functions. Having taken this logical step, we are ready to talk about the processes of creative thinking, as such. Discovery of the intellectual factors or abilities answers the question what; applying these answers to operations that the individual performs answers questions of how. Thus, the study of how a creative thinker operates is opened to us, for we have the concepts that we need--the handles that we can grasp in further research efforts.[22]

Guilford affirms here that he considers creativity to be within the realm of intelligence and is to be found in the two categories of "divergent-production" abilities and "transformation" abilities. His primary objective was to expand the concept of intellectual talent to include cretive potential by increasing the number of factors to be

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[22]Guilford, "Creativity: Yesterday, Today, Tomorrow," The Journal of Creative Behavior, pp. 7-8.

considered. So, as he sees it, creativity is an aspect of intelligence, but creativity tests only partially overlap what is measured by IQ tests because the latter measure only a few of the total number of factors in the structure of intellect.

One may find little to criticize in the rationale, but where does it actually lead its proponents in terms of developing a practical instrument? And how is that instrument to be used in hypothesis testing when "prior hypothesis" making, based on "what should be very important," and factor analysis must take the place of reference to external criteria?[23] The instruments which evolved are:

> . . . based upon assumptions about and knowledge of the nature and structure of creative abilities; therefore, our test items should be representative of these abilities to be valid. So far as the factor-analytic model of creative thinking abilities satisfactorily explains those high on these traits and those low on them, and so far as our items are representative samples of basic traits, our instruments should serve as good assessment. These two fundamental conditions, and hence, content validity of our tests, are more or less assumed at present rather than proven.[24]

Even without raising the question of discernment and appropriateness, the basic assumptions concerning the nature of creative abilities can not be passed over lightly when we

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[23]Guilford, "Progress in Discovery of Intellectual Factors," Widening Horizons in Creativity, p. 262.

[24]Kaoru Yamamoto, "Creative Thinking: Some Thoughts on Research," Exceptional Children, XXX (May, 1964), 406.

realize that their operational efficacy, within the factor-analytic schema, must be transitory. It would seem that their function is to serve merely as a temporary bridge in the initial stages of developing what will become the de facto criteria--the creativity tests themselves. The use of creativity tests as the real criteria is facilitated and perpetuated because there is no provision to check the validity of the assumptions from which they are derived against external criteria. Taylor and Holland point out the logical necessity of relevant external criteria and the danger of substituting tests as the sole criterion:

> It is elementary, but of fundamental importance, to note that the use of predictors assumes that we have some explicit, relevant, external criterion for recognizing the creative performance that we hope to predict with personal and situational variables. Tests of creative ability, often used as criteria of creativity because they appear to be valid measures of the processes tested, are at best preliminary and inadequate criteria; if we rely on them extensively, we may overlook our chief criterion: adult creative performance.[25]

Another determining circumstance which should not be passed over lightly is the implicit assumption that children who make high scores on the Guilford-type tests will eventually, as adults, tend to make creative contributions which are socially useful:

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[25]Calvin W. Taylor and John Holland, "Predictors of Creative Performance," Creativity: Progress and Potential, ed. by C. W. Taylor (New York: McGraw-Hill, 1964), p. 16.

> In judging adult creativity, we usually resort to a social criterion, and the evaluation of newness is based on the concept of new to our society or at least new to the group doing the evaluation. In evaluating creativity in children, on the other hand, an individual criterion is more customarily adopted in which major emphasis is placed on the newness of an idea or object to the individual child who produced it. It is merely on an assumption that we are basing our efforts to cultivate creativity in children, an assumption that activities promoting self-expression in children will eventually produce adults who will be regarded creative in the social sense of the term. This assumption has not, however, been examined empirically by longitudinal studies.[26]

We must face the problem of "two sets of criteria (individual and social)" which "do not always agree with each other."[27] Since factor-analytic creativity tests are based on individual criteria rather than the social criteria of adult performance, judgment must remain suspended as to whether a high level of competence according to the former leads to the same according to the latter.

A look at Taylor's five levels of creativity, as described by Durr, accentuates and clarifies the differences between what is probably measured by the Guilford-type tests and what they are implicitly implied to measure:

> The first level is expressive creativity, exemplified in children's spontaneous drawings and involving "independent expression where skills, originality, and the quality of the product are unimportant."[28] The

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[26]Yamamoto, "Creative Thinking: Some Thoughts on Research," Exceptional Children, pp. 404-405.

[27]Ibid., p. 404.

[28]Taylor, op. cit., p. 55.

> second level, productive creativity, differs from expressive creativity in heightened realism, objectivity, and completeness. Although its product may not be stylistically distinctive, it involves a more mature mastery of the environment. The third level is inventive creativity, which entails new ways of looking at old things. It involves new applications of basic ideas rather than new basic ideas and is exemplified in most inventions. The fourth level, innovative creativity, requires an understanding of basic principles and involves a significant modification of them. Taylor exemplifies it in the modifications by Jung and Adler of Freud's basic principles. The fifth level is emergentive creativity, which involves entirely new principles or assumptions. It characterizes the work of such men as Einstein, Freud, and Picasso.[29]

It should be pointed out that Taylor himself is somewhat ambiguous concerning the relationships between the levels indicated. He is inclined to believe, for instance, that expressive creativity, the kind on which factor analysis primarily depends for hypothesis testing, is "the foundation upon which more creative talents develop":

> Actually, advanced levels of creativity involve a great deal of control, proficiency and mastery which probably cannot be achieved without first having successful experience in expressive creations. The more spontaneous and independent children are allowed to be, the more creative they may become later on.[30]

However, the use of the words "probably" and "may" indicates that he is aware of the, as yet, presumptive and unconfirmed nature of this relationship. And later in the same article, he further softens his stand by relegating this question, among others, to "further research":

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[29]Durr, op. cit., p. 175.

[30]Taylor, op. cit., p. 55.

> There are several important questions here which can be answered only through research. Assuming that definitions of creativity fall into these five psycholinguistic categories, to what extent or how reliably can actual creative products of individuals be thus identified? What are the major psychological characteristics of behavior at each level? Do highly creative persons proceed through these levels in sequence or is it possible to omit or jump phases? The latter seems probable since basic innovations may be made without technical proficiency in a field.[31]

A sample of test questions from both the Minnesota Tests of Creative Thinking,[32] which are primarily for children of elementary age, and also from the test which Getzels and Jackson adapted for use in their study of high school youth[33] should well illustrate the type of questions that are relied upon to evaluate creative ability within the atomistic orientation. It is important to note that the descriptions are paraphrased summaries of the accounts presented in the works cited.

One form of the Minnesota tests consists of four tasks, two of which require verbal responses while the other two require the children to put their ideas into drawings, sketches, or figures.[34] Each of the four tasks is scored

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[31] Ibid., p. 61.

[32] E. Paul Torrance and Ram Gupta, "Programmed Experiences in Creative Thinking," Bureau of Educational Research, University of Minnesota, Minneapolis, 1964, pp. 121-128. (Mimeographed.)

[33] Getzels and Jackson, op. cit., pp. 198-208.

[34] Torrance and Gupta, op. cit., p. 121.

according to four categories: fluency, flexibility, originality, and elaboration.

Task one, Figure Completion, consists of ten simple, more or less incomplete, configurations which the children are to incorporate in a more complete object or picture which they must imagine and sketch. A title must be improvised for each sketch.

Task two, Circles, is to determine how many different objects or pictures can be made from a series of 36 circles, in ten minutes, by placing marks inside and outside the circles in any way they may wish. The children are encouraged to be as original as possible and to complete as many as they can. They also are asked to make up titles for each object.

Task three, Product Improvement, shows a sketch of a stuffed toy dog. The children are asked to think of the cleverest, most unusual ways to change this toy so that they could have more fun playing with it.

Task four, Unusual Uses (tin cans), calls for the listing of as many interesting and unusual uses of empty tin cans as can be remembered and imagined.

Getzels and Jackson used five creativity tests in their study of creativity and intelligence.

> The tests in the creative battery involved facility in dealing with verbal and numerical symbol systems and object-space relationships. One instrument called for varied associations to stimulus words; another called for the ability to structure quickly an incomplete or distorted perceptual stimulus; another required the

> ability to see numerous different problems in a single set of numerical data; still another required remote, or clever, or original responses to complex verbal situations.[35]

The Word Association Test presents the student with five common objects (bricks, pencils, paper clips, toothpicks, sheet of paper) and asks him to respond with as many different uses as he can for each object. This test apparently measures the ability to shift frames of reference and to see the environment in an original manner. In scoring, each response is given two scores: the number of different uses suggested; and the number of uncommon uses suggested. There are no time limits but most students finish in about 15 minutes.

The Hidden Shapes test consists of simple geometric figures each of which is followed by several complex figures. The objective is to identify the complex figures in which the simple figure has been somewhat camouflaged by additional elaboration. The test appears to test the ability to perceive essentials quickly. The time limit is 3 1/2 minutes and, as it is a part of Cattell's Objective-Analytic Test Battery,[36] it is scored according to the manual which accompanies this test.

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[35] Getzels and Jackson, op. cit., p. 198.

[36] Raymond B. Cattell, Objective-Analytic Test Battery (Champaign, Illinois: Institute for Personality and Ability Testing, 1956).

The Fables Test consists of four fables whose last lines are missing. The subject is to supply a moralistic, a humorous, and a sad ending for each fable. The criteria of appropriateness and relatedness is used in the scoring of each ending. The test is open-ended and thus allows for originality.

The Make-Up Problems Test consists of four complex paragraphs. The student is supposed to use the information given to make up as many math problems as he can. The student does not have to solve the problems. Each problem is scored for the number of elements and operations contained in it. An element was considered to mean any piece of numerical information; the term operation was considered to mean any of the four elementary computational procedures. This test has no time limits but requires about 30 minutes to complete.

Wallach and Kogan think that they have made a distinct improvement on the testing conditions presented above.[37] They believe that when children are asked to perform creatively under the above test conditions the results will not be valid. By stimulating game conditions and doing away with time limits, they have developed methods of obtaining a creativity score under conditions where the subject does not

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[37]Michael A. Wallach and Nathan Kogan, Modes of Thinking in Young Children: A Study of the Creativity-Intelligence Distinction (New York: Holt, Rinehart and Winston, 1965), pp. 17-24.

know he is being tested. The results show, according to the authors, a greater differentiation between IQ and creativity than those obtained under orthodox test conditions. While the frame of reference remains essentially the structure-of-intellect model, the level of product obtained should be somewhat higher under these conditions--perhaps many would be judged at the "productive" level. Under orthodox conditions the time limits would seem to preclude, except on rare occasions, any product higher than the "expressive" level.

In any event, the products to be produced in taking Torrance's and Getzels-Jackson's tests would appear to be mostly minor examples of Taylor's expressive level of creativity. Occasionally a response might be classified as productive creativity, but the value of the products of these tests, even if taken by highly able and creative adults, would obviously seldom have any social significance. The value must, as noted previously, depend on the correlation between the processes measured in these tests of individual creativity and the processes involved in social creativity.[38] At present, this relationship is simply assumed, and few attempts have been made to bridge the gap by comparing creative with noncreative individuals on their relative abilities to perform well on the Guilford-type

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[38]Yamamoto, "Creative Thinking: Some Thoughts on Research," Exceptional Children, pp. 404-405.

tests. The results from the few attempts made are interesting and quite suggestive.

Elliott reports that Guilford's factor-analyzed tests are quite effective in identifying those who perform creatively in public relations and advertising.[39] Elliott realizes that there are some pertinent differences between creativity in the arts and sciences and in this aspect of the field of business:

> Most business executives are concerned less with the creative genius of an Einstein or a Michelangelo than with creativeness as demonstrated in the day-to-day production of useful new ideas. From a businessman's viewpoint, creativity can be defined as the capacity to produce fresh, original, and valuable ideas on a continuous basis.[40]

This definition, when applied in the area of public relations and advertising, has different connotations from those which apply to scientific work. One of the participants in the conference at which Elliott gave this report responded that:

> These highly verbal, quick-response "creativity" aptitude tests appear to have much more promise in discriminating between levels of creativity in the communications areas of public relations and advertising work than they do in scientific research work.[41]

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[39] John M. Elliott, "Measuring Creative Abilities in Public Relations and in Advertising Work," Widening Horizons in Creativity, ed. by C. W. Taylor (New York: John Wiley and Sons, 1964), pp. 396-400.

[40] Ibid., p. 397.

[41] Ibid., p. 400.

It should also be kept in mind that the level of creativity demonstrated by the "day-to-day" production of "fresh, original, and valuable ideas" would probably be limited to the "productive" or second level of Taylor's scale.

In this same vein, Wallace found that productive saleswomen scored significantly higher on a battery of creative thinking tasks than their less productive peers.[42]

Another attempt, with different results, was made by Hudson. "We need," says Hudson, "to examine much more carefully the nature of the task which an open-ended test presents."[43] Hudson made a pilot study of technical inventiveness and creativity as determined by factor-analytic tests, and found that there was almost no connection between the two.

> It is a simple matter, therefore, to contrast the scores of boys who show an inventive flair for such work, with those of boys whose efforts are prosaic. Although this study was conducted on a very small sample it does little to cement the connection between open-ended tests and technical inventiveness.
> . . . . . .
> The differences in test score between these two groups were slight.[44]

In this particular case, there is little or no relationship between the lowest two levels of Taylor's hierarchy;

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[42] H. R. Wallace, "Creative Thinking: A Factor in Sales Productivity," Vocational Guidance Quarterly (1961), pp. 223-226.

[43] Hudson, op. cit., p. 46.

[44] Ibid., pp. 47-48.

that is, between the "expressive" level prescribed by the Guilford-type tests and the "productive" level of technical ability demonstrated by the high school-age subjects.

He further suggests that:

> There is no guarantee that a boy whose life centers on logical computers, say, or aeromodelling, will think this . . . questioning [questions on a Guilford-type test] interesting. It may be that his mind focuses only on the topic he finds absorbing. If this is so, we can only hope to measure his capabilities by setting problems within his sphere of interest. The only way in which we can judge the abilities of a boy who is interested solely in logical computers is to judge how well his computers compute.[45]

He goes on to say that if we allow that such specificity of interest exists:

> We must envisage a spectrum of individuals, ranging from those who can apply their full energy to any task, to those who can apply themselves only when their special interests are aroused. . . . Research on adults suggests that the ability to channel one's interests, even obsessively, may be a condition for producing original work. . . . It may be, therefore, that the ability to turn one's hand to any task is not necessarily an unalloyed advantage. Instead of describing such people as "brilliant all-rounders," perhaps we should view them instead as intellectually "labile," or even as "promiscuous."[46]

Hudson reminds us that:

> Most of the results upon which the generalizations of mental testers rest, are based on school children: the age at which intellectual promiscuity is at its most pronounced.[47]

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[45] Ibid., pp. 48-49.

[46] Ibid., p. 49.

[47] Ibid., pp. 49-50.

Hildreth also poses a relevant question concerning interests, the pre-selection of problems, and the measurement of creativity:

> Are tests that start with something already manufactured, which a child is asked to improve upon, a true measure of creativity? In tests of this kind the child has no chance to think up his own problems and to work out original solutions. The ready-made product may not be congenial to the child's interest or in line with his imaginings. Furthermore, these tests do not necessarily measure the kind of creative behavior that a student might exhibit in the laboratory, or a field trip, or in the normal setting.[48]

Perhaps we should examine more carefully the assumption that we can take the interest and emotional commitment of our subjects for granted.

In another study, Chorness found no differences between awarded and non-awarded groups of civilian employees in the Air Force incentives program in performance on the transformation-abilities portion of the Guilford battery.[49]

As a keystone to the question of the relevance of the factor-analysis tests to the higher levels of creativity we refer to Guilford himself.[50] In 1957, Guilford selected

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[48]Gertrude H. Hildreth, Introduction to the Gifted (New York: McGraw-Hill, 1966), p. 458.

[49]Maury H. Chorness, "An Interim Report on Creativity Research," Scientific Creativity: Its Recognition and Development, ed. by Calvin W. Taylor and Frank Barron (New York: John Wiley and Sons, 1963), pp. 278-298.

[50]J. P. Guilford, "Intellectual Resources and Their Values as Seen by Scientists," Scientific Creativity: Its Recognition and Development, ed. by Calvin W. Taylor and Frank Barron (New York: John Wiley and Sons, 1963), pp. 101-118.

28 of the 46 factors then included in the structure of the intellect model and asked a group of 35 creative scientists and technologists to give their opinions as to the relative values of these ability factors in their work. The subjects ranked the factors in order of their rated value in creative work. It is certainly interesting, and perhaps significant, that the evaluations of these creative workers do not agree with Guilford's theoretical formulations and expectations. For example:

> We had expected somewhat higher ratings for factors in the divergent-thinking category, which we have generally regarded as most closely related to creative-thinking potentialities. This category, however, falls slightly behind that of convergent thinking.[51]

A number of workers have presented strong arguments against Guilford's basic assumption that divergent production, as he defines it, is the main ingredient in creative behavior. One of the most telling is an article by Kuhn.[52] While Kuhn agrees with Guilford that education has often emphasized convergent thinking at the expense of divergent thinking, he says it is equally erroneous to ignore the fact that "rigorous training in convergent thought has been intrinsic to the sciences almost from their origin":[53]

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[51] Ibid., p. 112.

[52] Thomas S. Kuhn, "The Essential Tension: Tradition and Innovation in Scientific Research," Scientific Creativity: Its Recognition and Development, ed. by Calvin W. Taylor and Frank Barron (New York: John Wiley and Sons, 1963), pp. 341-354.

[53] Ibid., p. 344.

> I do not at all doubt that this description of "divergent thinking" and the concomitant search for those able to do it are entirely proper. Some divergence characterizes all scientific work, and gigantic divergences lie at the core of the most significant episodes in scientific development. But my own experience in scientific research and my reading of the history of sciences lead me to wonder whether flexibility and open-mindedness have not been too exclusively emphasized as the characteristics requisite for basic research. I shall therefore suggest . . . that something like "convergent thinking" is just as essential to scientific advance as is divergent. Since these two modes of thought are inevitably in conflict, it will follow that the ability to support tension that can occasionally become almost unbearable is one of the prime requisites for the very best sort of scientific research.[54]

The chief point that Kuhn makes is that while scientists need the divergent characteristics, the need for convergent thinking is equally essential. He points out that:

> Normal research, even the best of it, is a highly convergent activity based firmly upon a settled consensus acquired from scientific education and reinforced by subsequent life in the profession. . . . Revolutionary shifts of a scientific tradition are relatively rare, and extended periods of convergent research are the necessary preliminary to them. As I shall indicate below, only investigations firmly rooted in the contemporary scientific tradition are likely to break that tradition and give rise to a new one. That is why I speak of an "essential tension" implicit in scientific research. . . . Very often the successful scientist must simultaneously display the characteristics of the traditionalist and of the iconoclast.[55]

Kuhn's statement that "only investigations firmly rooted in the contemporary scientific tradition are likely to break that tradition and give rise to a new one" is

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[54] Ibid., p. 342.

[55] Ibid., p. 343.

corroborated in a most interesting way by an observation which Hutchins made while discussing the authors of the Great Books.[56] Confirmatory evidence from the lives and work of the writers who shaped the Western Mind in all the main areas of knowledge--the great seminal thinkers of our civilization--is highly significant. Hutchins notes that each of the 74 extraordinary men among this topmost echelon of creative minds, was firmly rooted in what had gone before in the Great Conversation. Their introduction of novelty and departure from the old was apparently dependent on their being thoroughly conversant with the ingredients of the contemporary tradition:

> Except for Homer, the authors of great books who come later in the course of the Great Conversation enter into it themselves as a result of reading the earlier authors. Thus, Plato is a reader of the Homeric poems and of the tragedies and comedies; and Aristotle is a reader of all of these and Plato, too. Dante and Montaigne are readers of most of the Greek and Roman books, not only the poetry and history, but the science and philosophy as well. John Stuart Mill, Karl Marx, William James, and Sigmund Freud are readers of almost all the books in this set.[57]

Probably the least justified assumption of all is that creativity can be essentially specified within the cognitive realm. Hudson, after discussing the work of Cox, Roe, and MacKinnon, states that:

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[56]Robert M. Hutchins, The Great Conversation, Vol. I: Syntopicon and Great Books of the Western World, ed. by Robert M. Hutchins; Mortimer J. Adler, assoc ed. (Chicago: Encyclopedia Britannica, 1952).

[57]Ibid., pp. 78-79.

> The whole point of testing, in other words, lies in measuring those qualities which predispose a man to follow a particular bent. Some of these may be a matter of intellectual ability; but, in all probability, the majority do lie--as Cox, Roe, and MacKinnon suggest--within the sphere of personality.[58]

This statement, as we shall see in the next chapter, is supported by virtually all of the anecdotal and biographical material that has been accumulated by the painstaking research efforts of such investigators as Koestler and Rugg.

The foregoing effort to illumine, from both points of view, the fundamental features of the atomistic conceptual framework should provide the orienting matrix for the critical review of research on the problem which follows.

Significant Research and Critical Reviews

Although the pioneer contributions of Guilford prepared the way, it was the Getzels-Jackson study that opened the floodgates to speculation about the relationship between intelligence and creativity:

> Even the monumental work of J. P. Guilford ahd his laboratory at the University of Southern California remained almost totally neglected by educators until Getzels and Jackson showed that highly creative adolescents achieved as well as their highly intelligent peers, in spite of the fact that their average intelligence quotient was 23 points lower.[59]

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[58] Hudson, op. cit., p. 109.

[59] E. Paul Torrance, Review of Creativity and Intelligence, by Jacob W. Getzels and Philip W. Jackson, The School Review, LXXI (Spring, 1963), 112.

Getzels and Jackson examined the relationship between creativity and intelligence using Guilford-type tests in a project involving 449 adolescents who attended a private high school in the Chicago area. Out of this relatively large number, 54 subjects were arbitrarily chosen for study--28 were "highly intelligent" and 26 were "highly creative." The "highly intelligent" subjects were defined as those who scored in the top 20 per cent of the sample population on a conventional IQ test, but not in the top 20 per cent on the creativity battery. The "highly creative" group consisted of those students who were in the top 20 per cent on measures of creativity, but not in the top 20 per cent on IQ scores.[60]

It is a cardinal point that those who scored in the top 20 per cent in both groups were not included in the study:

> It should be noted that we did not include in our experimental groups those children who were high in both creativity and intelligence, and there were many such people. . . . Those individuals who excelled in both areas are the objects of further investigation still in progress.[61]

For unexplained reasons, Getzels and Jackson have not reported their findings concerning this third group.

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[60]Getzels and Jackson, op. cit., pp. 23-25.

[61]Jacob W. Getzels and Philip W. Jackson, "The Meaning of 'Giftedness,'" Education, LXXXII (April, 1962), 462.

The mean IQ of the "highly creative" group was 127, the mean IQ of the "highly intelligent" group was 150, and the mean IQ of the total sample was 132.[62] The rather wide margin of difference between the average IQ's of these two groups plus the fact that their average achievement was substantially the same was the probable key to the unusual amount of attention given to this study:

> The achievement test performance of the high IQ students is significantly above that of the population from which they were drawn. In view of the traditional positive relationship between IQ and school performance, this finding is not at all surprising. But what now about the high creativity group? We observe that they too are significantly superior to the school population, and this is quite surprising, for they are below the school average in IQ. It will be recalled that students in the top 20 per cent in IQ were by definition excluded from this group. Indeed, despite the 23-point difference in mean IQ between the high Creatives and the high IQ's, the achievement scores of the school population are equally superior to the achievement scores of the school population as a whole. It seems evident that the cognitive abilities assessed by our creativity instruments account for a significant portion of the variance in school achievement.[63]

This surprising finding motivated Torrance to attempt a replication. Torrance and his staff constructed the "Minnesota Tests of Creative Thinking,"[64] which they adapted from Guilford's tests, and used them with eight

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[62] Getzels and Jackson, Creativity and Intelligence, p. 24.

[63] Ibid., pp. 23-24.

[64] Minnesota Tests of Creative Thinking (Bureau of Educational Research, University of Minnesota, Minneapolis, 1962).

different samples. It should be emphasized that these are not the same tests as were used in the Getzels-Jackson study, but they were of the same kind. Torrance summarized the findings concerning the relationship between IQ and creativity in the sample populations studied:

> It is of interest to note the amount of overlap between the groups identified as gifted (in upper 20 per cent of their group) by the two kinds of measures. In most of the groups studied, about 70 per cent of the most creative would have been eliminated if we were selecting a "gifted" group on the basis of the intelligence test of Miller Analogies. The two exceptions are Elementary School D, using the California Mental Maturities, and in High School A, using the Lorge-Thorndike. In these two schools, there is a stronger tendency than in the others for the highly creatives also to be highly intelligent. This phenomenon may be due in part to the nature of the distribution of talent in these two schools or to the nature of the measures of intellectual talent used.[65]

Of the eight partial replications of the Getzels-Jackson study, different results were obtained in only two schools. Torrance noted that the average IQ in both these schools was lower than in any of the other groups studied and he surmised "on the best evidence available" that these students were taught primarily by authority.[66] Thus, he stated the following:

> These observations suggested that the phenomena Getzels and Jackson report may occur only in schools where students are taught in such a way that they have a chance to use their creative-thinking abilities in

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[65]Torrance, Guiding Creative Talent, p. 59.

[66]Torrance, Review of Creativity and Intelligence, p. 113.

> acquiring traditional educational skills or where the average intelligence quotient in the entire school is rather high.[67]

Vera Miller, in one of the few endeavors to effect external validation, attempted to correlate ratings on creative writing, drama, and music with two sub-tests of the Getzels-Jackson creativity battery.[68] The two sub-tests were Uses for Things and Word Associations. The subjects were 166 children who attained an IQ of 120 or higher on the Wechsler Intelligence Scale for Children (WISC). She summarized the findings as follows:

> It appears from the data we have gathered on writing, drama, music, symbolic thinking, uses for things, and word association, that there is some correlation between intelligence and giftedness in all areas examined, but that not all bright children have talent, and results do not preclude the presence of such talent in youngsters of lesser intellectual ability. On the other hand, some bright children have talent in several lines of endeavor. Creativity is not necessarily associated with the highest intelligence, but artistic products of highest value probably are usually associated with unusual intellectual gifts.[69]

The very low correlation of .09 which was obtained between creative writing products and the two sub-tests of the Getzels-Jackson creativity battery does little to bind the connections necessary for validity. This led her to

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[67] Ibid., p. 115.

[68] Vera V. Miller, "Creativity and Intelligence in the Arts," Education, LXXXII (April, 1962).

[69] Ibid., p. 495.

declare: "one might expect that Getzels-Jackson and Writing would show a higher correlation than other areas of creativity since both deal with verbal material, but this does not seem to be true."[70]

Dreyer reviewed Getzels' and Jackson's study in a rather favorable manner.[71] However, he agreed with many others that the group of students high on both "creativity" and "intelligence" should have been included in the report.

> A final note which is really more a function of my desires rather than the authors' failings. They have done what they set out to do, namely to differentiate adolescents manifesting certain cognitive or social characteristics to a high degree, but not its concomitant. They have obviously felt that for purposes of clearly demonstrating their point, only the two groups of high IQ and high Creative . . . were to be studied. It seems to me that they could have so easily included a third group in their selection procedure--a group which is in some ways more interesting than these other groups in having a high degree of both variables--a group high in IQ and high in Creativity. . . . The point I am making is that perhaps those high IQ and high Creative adolescents not included for study by Getzels and Jackson would present findings strikingly different from the other two groups.[72]

Coffman also was concerned for those students who scored high on both IQ and creativity.

> One wishes, however, that the various tables comparing responses of the extreme groups with each other and

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[70] Ibid., p. 494.

[71] Albert S. Dreyer, Review of Creativity and Intelligence, by Jacob W. Getzels and Philip W. Jackson, Harvard Educational Review, XXXII, No. 4 (Fall, 1962), 502-506.

[72] Ibid., p. 506.

> with the total group also reported results for subgroups high on two or more measures. As one reads, it becomes clear that these subjects have not been ignored. . . . In fact, one develops the impression that some of the most convincing "creative" responses are made by individuals who scored high on both IQ and creativity.[73]

In Great Britain, Burt questioned Getzels' and Jackson's reliance on a single IQ test.[74] As the test was not the same for every subject, he pointed out that low reliability could be expected. Burt also brought up the question of low correlations among the various sub-tests of the creativity battery and noted that they were not much higher than the correlations between IQ and creativity.

> Unlike the intelligence tests, those used for testing "creativity" were devised and applied specially in the course of the research; and, instead of just one test, five were used. . . . Each of the tests of creativity correlates positively with the test of intelligence, two of them to the extent of 0.37 or 0.38. The authors themselves describe these figures as "fairly low," and would evidently have us believe that their results fully confirm Guilford's prediction. But the correlations of the various tests of creativity among themselves are not much higher; moreover, as we have seen, the reliability of the intelligence test must have been rather low, and the children tested were themselves by no means a complete or random sample of the general population.[75]

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[73] William E. Coffman, "Convergent and Divergent Excellence," Contemporary Psychology, VIII (March, 1963), 126.

[74] Burt, op. cit., pp. 292-298.

[75] Ibid., p. 295.

DeMille and Merrifield were extremely negative in their appraisal of the Getzels-Jackson study.[76] They were especially critical of the selection of creativity tests:

> The creativity measure was a summated score from a somewhat redundant and not entirely appropriate collection of five tests representing a very limited array of factors of creative thinking. The descriptions of the test items as well as the test intercorrelations indicate that verbal meaning, the chief component of most IQ measures, was an important factor in every test. . . . Three of Getzels' and Jackson's creativity tests were substantially correlated with their IQ measure, suggesting that the selection of creativity tests was not a very good one, especially for their purposes.[77]

They were also critical of the experimental design:

> Throughout the book the reader encounters questionable clinical interpretations, incongruous theoretical statements, and gratuitous research conditions. . . . Minor errors, ambiguities, and inconsistencies in test and tables are frequent enough to cause the reader to question the care with which the study was done. . . .[78]

Thorndike depreciates the trend among many researchers to assert, on the dubious basis of correlations ranging from near zero to .40 between conventional intelligence tests and creativity measures, that "creativity" is different and distinct from the type of abstract intelligence that is measured by our established intelligence and scholastic

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[76] Richard deMille and Philip Merrifield, Review of Creativity and Intelligence, by Jacob W. Getzels and Philip W. Jackson, in Educational and Psychological Measurement, XII (Winter, 1962), 803-808.

[77] Ibid., p. 804.

[78] Ibid., pp. 807-808.

aptitude tests.[79] He has this to say about the Getzels-Jackson study and the research of Torrance:

> The low correlation among "creativity" tests has received little attention from those who have worked with them. Thus, though Getzels and Jackson are emphatic in pointing out the low correlations of their tests with IQ, they say nothing about the equally low correlations among the "creativity" tests themselves. And though Torrance has expressed commendable concern about reliable scoring for individual tests in his battery, he has provided only a minimum of information about the extent to which the different tests measure a common function. At the present time, the tests are offered to the public only as research tools, and this is certainly as it should be. However, if we are to comprehend the research done with the tests, or the nature of the groups selected by some combination of them, it is imperative that we get a better understanding of what the different tests that are offered to us as "creativity tests" actually measure, and of the degree of equivalence among different tests and test batteries. If, as now seems to be the case, the different subtests show quite low intercorrelations, and show even these in part because they all involve a little g, then we are ill advised to pool the subtests into a common total with a common name, either in our treatment of the results or in our thinking about the field. . . . We should be most circumspect in using such a global and value-laden term as "creative."[80]

He concludes by urging educators to be extremely hesitant about applying the term "creative" to children who are selected on the basis of current creativity measures.[81]

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[79] Robert L. Thorndike, "The Measurement of Creativity," Teachers College Record, LXIV (February, 1963), 422-424.

[80] Ibid., p. 424.

[81] Ibid.

Guilford noted that the creativity tests used by Getzels-Jackson and Torrance contain certain limitations.

> In the structure-of-intellect model, there are 24 expected divergent-production abilities, of which 16 are now supported by factor-analytic information. There are 20 expected transformation abilities, of which eight are known. Since four factors are in common to the two categories, where they intersect in the model, the total expected is 40, and the number known is 22. How many of these abilities are represented in the Getzels and Jackson battery of five tests?
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> As nearly as one can tell from inspection of the tests, which the authors fortunately present in full in their recent book, I should say that four of the divergent-production abilities are represented and three of the transformation abilities, one being in common to the two operation categories. Four of the five tests involve verbal or semantic information or content and one involves figural content.
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> The aspect of creativity that dominates the battery, therefore deals with verbal information.[82]

Stephens added some interesting information concerning the Getzels-Jackson report.[83] He obtained the following information by letter concerning the size of the "overlap" group, which consisted of high scorers on both measures: "Forty-three students scored in the top 20 per cent on both

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[82] J. P. Guilford, "Potentiality for Creativity," The Gifted Child Quarterly, VII, No. 3 (Autumn, 1962), 87-90.

[83] Thomas M. Stephens, "An Analysis of Creative Thinking Tasks as Measures of Academic Potential with Special Reference to the Work of Getzels and Jackson," Pathways to Progress, ed. by Thomas M. Stephens and Arthur R. Gibson, A Research Monograph from Ohio's Program for the Gifted Child (Columbus, Ohio: Superintendent of Public Instruction, 1963), pp. 132-140.

measures. For this reason, they were not included in the study."[84] Stevens himself said:

> Forty-three students were excluded from the study because they were in the top 20 per cent on both measures. In other words, more students were high on both measures than are contained in either of the two experimental groups. It appears that measures of creative thinking and tests of intelligence overlap. They probably measure many of the same cognitive abilities. The researchers were interested in the exceptions, but little emphasis was given to this fact.[85]

Summary

How are we to evaluate the factor-analytic studies of Getzels-Jackson and subsequent workers concerning the relationship between intelligence and creativity? It should be clear that in this chapter these studies have been considered on two very different levels. In the first section the basic assumptions were questioned; in the second section the evaluations and criticisms were from within the universe of discourse represented by the studies themselves, at least they were not focused on the basic assumptions of the factor-analytic frame of reference per se.

With the possible exceptions of Miller and Thorndike, all of the critical reviewers of the studies by Getzels-Jackson and Torrance tacitly assented to the general principles of their approach to creativity although they may

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[84]Letter from P. W. Jackson, dated May 11, 1962, cited by Stephens, Pathways to Progress, p. 139.

[85]Stephens, op. cit., p. 138.

have been very negative concerning other aspects of the studies. Many of the reviewers do not, of course, accept the conclusions reached in these studies, but if, as is hypothesized in the present work, the major premises of the factor-analytic methodology have completely missed the heart of the creativity problem, criticisms from within this methodology lose much of their potency.

All of this is not to say that the investigation by Getzels-Jackson, Torrance, and others have not increased our understanding of other problems in vitally important ways. For instance, they quite dramatically demonstrated the predictive and explanatory inadequacy of the IQ metric, which, as we remember, was perhaps the main motivation for the development of the structure-of-intellect viewpoint. In discussing Getzels' and Jackson's work, Hudson said:

> The crucial fact, it emerges from Getzels' and Jackson's work and my own, is that a knowledge of a boy's IQ is of little help <u>if you are faced with a formful of clever boys</u>. The boy with the lowest IQ in the form is almost as likely to get the top marks as the boy with the highest. It is this simple, but disruptive, implication that English critics of Getzels and Jackson have overlooked. They land, claws extended, on a technical red herring.[86]

This is very interesting and deserves further elaboration; however, the purpose of this particular investigation is to direct attention to the inadequacies of the factor-analytic

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[86]Hudson, <u>op. cit.</u>, p. 108.

philosophy and methodology in amplifying our understanding of creativity and its relationship to intelligence, and to present evidence of what we hypothesize to be a more valid and appropriate alternative.

While we have presented evaluations from within the factor-analytic universe of discourse, it should be understood that from the point of view of this investigation, the intention is to bring into sharp focus serious questions concerning the basic assumptions of the approach itself--and therefore any conclusions which have emerged from this approach concerning the relationship between intelligence and creativity.

CHAPTER III

THEORETICAL BACKGROUND AND REVIEW OF LITERATURE WITHIN THE HOLISTIC UNIVERSE OF DISCOURSE

Conceptual Framework

Considerable evidence is emerging which signifies that the total personality must be considered if we are to talk meaningfully about the creative individual. It is clear that what a person perceives, remembers, and thinks about is intimately related to his interests, his values, and--a recent theoretical addition--the plans he makes in relation to his interests and values.[1] The central theme of this chapter is that creative behavior always involves an integration of the affective, the cognitive, and the conative, and that an adequate conception of creativity can not be articulated without discerning in what manner the cognitive, the affective, and the conative unite in producing the creative act. This three-fold integration forms the nucleus of the conceptual framework of holistic creativity.

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[1] G. A. Miller, E. Galanter, and K. H. Pribram, Plans and the Structure of Behavior (New York: Holt, 1960).

Although, as Allport says, there is a consensus which extends from Plato to the present regarding these three "major faculties,"[2] the manner in which these faculties blend and interact in behavior may obviously be explored in a variety of ways. For the purpose of developing the conceptual framework, the general aspects of each faculty will be reviewed with explicit reference to its importance in, and implications for, a deeper understanding of creativity. Following this tripartite presentation, the remainder of the chapter will be devoted to a more comprehensive and detailed review of the inferentially and experimentally derived personality correlates of creative productivity. For this purpose, personality characteristics will be discussed under headings which have a specific relevance to ongoing research in holistic creativity. That is, in succeeding sections the holistic literature will be reviewed in terms of the specific personality characteristics which, at this time, are considered most significant in creativity research.

It should be pointed out that the close integration of the affective, cognitive, and conative, which is assumed in creative behavior, strongly implies consistent patterns of relationship among these faculties. For instance, if

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[2]Allport, Pattern and Growth in Personality, pp. 258-259.

cognition, which theoretically is essentially congruent with the concept of intelligence, is integrated closely with the other two aspects of affectivity and conation, we could well expect to find that certain patterns of interests, preferences, values, plans, and aspirations would be correlated with certain levels of cognitive ability. Even though our measuring instruments, the traditional IQ tests, are deficient in many respects, it is not unreasonable to expect interesting and heuristic insights from such hypothesized correlations. These correlations would not have to hold throughout the entire range of IQ to represent significant relationships. Demonstration, for example, that particular personality patterns, with experimentally established relevancy for creative behavior, are seldom observed below certain levels of IQ and correlate reasonably well with higher levels of IQ would be a finding of considerable consequence in the current debate on the relationship of intelligence to creativity--as well as more extensive problems.

Many workers in the past have recognized the necessity of being attentive to, and striving to understand, the interaction between the rational and irrational, or as May would argue, between the rational and the suprarational,[3] in

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[3]Rollo May, "The Nature of Creativity," Creativity and Its Cultivation, ed. by H. H. Anderson (New York: Harper and Row, 1959), p. 64.

human behavior. This is another way of saying that we must look at the total personality. And the available evidence places no constraints on our consideration in terms of Taylor's levels of creativity.[4] Personality factors are important for creativity at all levels, and also, somewhat surprisingly, for ordinary problem-solving, academic achievement, and productivity.

Hilgard, in his investigation of Dunker's idea of "functional fixation" and problem solving in general, came to the conclusion that "personality studies opened up more useful leads than the learning studies."[5] He also found that "personality variables were important, even in the solution of simple laboratory-type problems that seemed almost purely "cognitive."[6] Bloom, in his studies at the examiner's office of the University of Chicago, has noted the great importance of personality factors at the level of problem solving. "Through our effort to understand problem solving," Bloom says, "we have come to recognize some of the ways in which personality influences problem solving as well as the entire learning process."[7] He continues:

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[4]Irving Taylor, op. cit.

[5]Ernest R. Hilgard, "Creativity and Problem-Solving," Creativity and Its Cultivation, ed. by H. H. Anderson (New York: Harper and Row, 1959), p. 169.

[6]Ibid., p. 169.

[7]Bloom, op. cit., p. 251.

> Our research on selection of students and prediction of academic achievement [has] convinced us that cognitive skills and aptitudes can account for only a portion of the variance in measures of problem solving or achievement. Rather reluctantly we have come to the view that interests, motivation, and personality characteristics account for at least as large a portion of the variance in problem-solving and achievement measures.[8]

The results of this research on problem solving led Bloom and his staff to study the "problem-solving skills and other characteristics of very creative individuals." They discovered that personality factors similar to those found by Roe were characteristic of the highly creatives and that there were no distinguishing differences in terms of aptitudes, problem-solving abilities, or perceptual-cognitive habits between the creatives and noncreatives.[9]

McDougall believed that in "every complete mental or psycho-physical process" we can distinguish a psycho-physical disposition consisting of three parts or phases; namely, the cognitive, the affective, and the conative.[10] Ghiselen, a holistically oriented contemporary worker, states essentially the same view:

> I believe that looking at it [creativity] as essentially a single action may be more fruitful than some other approaches have been. It may be conceived

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[8] Ibid., pp. 252-253.

[9] Ibid., p. 253.

[10] William McDougall, An Introduction to Social Psychology, A University Paperback, No. 6 (New York: Barnes and Noble, 1960), p. 333.

> of as an exercise of the configurative powers of the whole psyche, involving all its substance, the play of its entire energy.[11]

Allport in the same vein says:

> It would, of course, be more convenient if we could slice personality into its major faculties. From Plato onward, writers have tried to do so, and have even agreed that the major faculties are three in number: thinking, doing (willing), and feeling; sometimes these are called cognition, conation, affection.
> . . . . . .
> These systems are a blend of desiring-doing-willing-thinking-feeling. It is artificial to distinguish one aspect from another. . . . Difficult as it may be, we shall have to find a way to talk about thinking and cognition as parts of a single personal style where thinking and knowing are blended with emotions, wishes, orientations.[12]

As proposed above, we consider these three inseparable phases or aspects of the activity of the conscious-unconscious continuum as forming the heart of the holistic conceptual framework. We shall endeavor to substantiate the relevancy of this position by an examination of the evidence pertaining to each phase, and the vital relationship of each phase to the other two phases making up the psychic central core which causally conditions and gives direction to creative behavior.

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[11]Brewster Ghiselin, "The Creative Process and Its Relation to the Identification of Creative Talent," Scientific Creativity: Its Recognition and Development, ed. by Calvin W. Taylor and Frank Barron (New York: John Wiley and Sons, 1963), pp. 363.

[12]Allport, Pattern and Growth in Personality, pp. 258-259.

What evidence do we have concerning the necessity of considering the affective in creativity?

Rugg says that feeling is indispensable "to the complete act of thought" in creative inquiry.[13] More specifically, he states that, "while there is only one basic human act of response, it is governed by two different orientations: the feeling mood of discovering and the logical mood of verifying."[14] Obviously, this "feeling mood" is for Rugg a crucially important affective state because it serves as the origin of useful new insights.

There are many different aspects of affectivity. The phenomenon of "encounter" with its characteristic physical manifestations during creative experience is held by May and other existentialistically oriented workers to be an essential prerequisite for useful creative productivity.[15] A very similar idea is developed with painstaking care by Koestler under the heading of "participatory" or "self-transcending" emotions.[16] Murphy speaks of the necessity of cathexis upon subject matter and methods of learning.[17]

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[13]Rugg, op. cit., p. 272.

[14]Ibid., p. 290.

[15]Rollo May, op. cit., pp. 58-68.

[16]Koestler, The Act of Creation, pp. 271-284.

[17]Gardner Murphy, Freeing Intelligence Through Teaching (New York: Harper and Row, 1961), p. 59.

Whitehead said, "there can be no mental development without interest"[18] and "no comprehension apart from romance."[19]

Yakovlev, a physiologist, discussing creative behavior and the brain states: "emotional energy is the matrix and source of all human achievement through which man frees energy from matter."[20] Rugg avows: "to me, feeling is the very foundation of the act of response. It sets the meaning of the act. It is the matrix in which all coming to know takes place."[21] Coleridge agrees in a letter to a friend: "deep thinking is attainable only by a man of deep feeling."[22] Perhaps Helvetius, in his Treatise on Man, put it best: "a man without passions is incapable of that degree of attention to which a superior judgment is annexed: a

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[18]Alfred North Whitehead, The Aims of Education, A Mentor Pocketbook, M 41 (New York: The New American Library, 1949), p. 42.

[19]Ibid., p. 44.

[20]Paul I. Yakovlev, "Motility, Behavior and the Brain: Stereodynamic Organization and Neural Coordinates of Behavior," Journal of Nervous Mental Diseases, No. 107, 1948, pp. 313-335.

[21]Rugg, op. cit., p. 269.

[22]Samuel Taylor Coleridge, from a letter to Thomas Poole, March 23, 1801, quoted in I. E. Richards, Coleridge on Imagination (New York: Norton, 1950), p. 16.

superiority that is perhaps less the effect of an extraordinary effort than an habitual attention."[23]

Aristotle believed that "men were first led to . . . study . . . as indeed they are today, by wonder."[24] And Einstein struck the same chord when he wrote that whoever lacks the capacity to wonder, "whoever remains unmoved, whoever cannot contemplate or know the deep shudder of the soul in enchantment, might just as well be dead for he has already closed his eyes upon life."[25]

The ways in which affectivity is vitally important to creativity are many, but we have chosen one facet, because of its particular importance in this investigation, for a closer examination than the others. That is the facet of esthetics or appreciation of beauty.

First, we must distinguish between hedonist esthetics with its emphasis on sensory gratification and esthetic satisfaction. Koestler says that the difference derives from the hierarchic organization of the nervous system.

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[23]C. A. Helvetius, Oeuvres completes (Paris: Didot, 1795-1796), quoted in Jerome S. Bruner, "The Conditions of Creativity," Contemporary Approaches to Creative Thinking, ed by Howard E. Gruber et al. (New York: Atherton Press, 1962), p. 13.

[24]B. Farrington, Greek Science (London: A Pelican Book, 1953), pp. 130-131.

[25]K. Seelig, Albert Einstein (Zurich: Europa Verlag, 1954), p. 44.

Hedonistic esthetics pertains to "tastes and distastes directly affecting the senses"; while the esthetic satisfaction we wish to emphasize pertains to the "pleasure-unpleasure tone of complex emotional states mediated by the autonomous nervous system." "What matters is to distinguish between the aesthetic experience--or the experience of beauty if you like--on the one hand, and sensory gratification on the other."[26]

Paul Dirac, who shared the Nobel Prize for physics with Erwin Schrodinger in 1933 is outspoken on the decisive importance of the affective in creative production in physics. In relating how Schrodinger discovered his famous wave equation of the electron, he said that "Schrodinger got his equation by pure thought looking for some beautiful generalization . . . and not by keeping close to the experimental developments of the subject."[27] Then, after arriving at an equation and discovering that the results did not agree with the experiment, because it was not known at the time that the electron has a spin, he was greatly disappointed and published instead of his original formula, an imperfect approximation. Only later, by taking the electron's spin

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[26]Koestler, The Act of Creation, p. 385.

[27]Paul Dirac, "The Evolution of the Physicists' Picture of Nature," Scientific American, CCVIII, No. 5 (May, 1963), 45-53.

into account was the original equation proved correct.

Dirac concludes:

> I think there is a moral to this story, namely that it is more important to have beauty in one's equations than to have them fit experiment. If Schrodinger had been more confident of his work, he could have published it some months earlier, and he could have published a more accurate equation. . . . It seems that if one is working from the point of view of getting beauty in one's equations, and if one has really a sound insight, one is on a sure line of progress.[28]

In this particular instance, an affective state was more instrumental than deduction based on experimental data in pointing the way to new insights.

Poincare wrote that "the feeling of mathematical beauty" was what guided him in his unconscious gropings toward the "happy combinations" which yield new discoveries.

> It may be surprising to see emotional sensibility invoked apropos of mathematical demonstrations which, it would seem, can interest only the intellect. This would be to forget the feeling of mathematical beauty, of the harmony of numbers and forms, of geometric elegance. This is a true esthetic feeling that all real mathematicians know, and surely it belongs to emotional sensibility.[29]

Hadamard responds to the above quote thusly:

> That an affective element is an essential part in every discovery or invention is only too evident, and has been insisted upon by several thinkers; indeed, it is clear that no significant discovery or invention can take place without the <u>will</u> of finding. But with

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[28] <u>Ibid</u>., p. 47.

[29] Jacques Hadamard, <u>The Psychology of Invention in the Mathematical Field</u> (New York: Dover, 1954), p. 31.

> Poincare, we see something else, the intervention of the sense of beauty playing its part as an indispensable means of finding. We have reached the double conclusion: that invention is choice [and] that this choice is imperatively governed by the sense of scientific beauty.[30]

Santayana submits that, "for the existence of good in any form it is not merely consciousness but emotional consciousness that is needed. Observation will not do, appreciation is required. . . . In appreciation, in preference, lies the root and essence of all excellence."[31] "Beauty is the first test; there is no permanent place in the world for ugly mathematics," wrote Hardy in his book, A Mathematician's Apology.[32] Max Planck, the father of the quantum theory, said that the pioneer scientist needed "a vivid intuitive imagination for new ideas not generated by deduction, but by artistically creative imagination."[33] Sessions, the American composer and critic, in discussing the work of Beethoven, averred that "inspiration then, is the impulse which sets creation in movement; it is also the energy which keeps it going."[34] Wertheimer, who gained insight into Einstein's

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[30] Ibid., p. 31.

[31] George Santayana, The Sense of Beauty (New York: Dover, 1955), p. 13.

[32] G. H. Hardy, A Mathematician's Apology (London: Cambridge University Press, 1940), quoted in Arthur Koestler, The Act of Creation (New York: Macmillan, 1964), p. 329.

[33] Koestler, The Act of Creation, p. 147.

[34] Roger Sessions, quoted in Augusto Centano, The Intent of the Artist (Princeton, New Jersey: Princeton University Press, 1941), p. 27.

creative productivity during a series of conversations with him in Zurich in 1916, reports that Einstein said he was driven by a deep feeling that he was moving in the right direction and not because of logical deductions derived from axioms.[35]

Rugg, in considering creative discovery in science and art said:

> Both experiences are dominated by a common esthetic quality of feeling. Both Cezanne and Einstein were stimulated by natural phenomena: Cezanne by landscape, sky and earth; Einstein by light and its velocity and by movement--the motion of objects on the earth's surface, of planets and stars, of our universe and perhaps other universes.
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> . . . . . .
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> In Einstein, as in Cezanne, the process was one of feeling rather than of verbalized thinking; a feeling that he was on the right track, long before the problem could be defined. In this respect also is revealed the common esthetic mood governing the work of both scientist and artist. At this point both men worked as intuitive artists.[36]

Polanyi, a physicist turned social scientist, asseverates:

> The mind is attracted by beautiful problems, promising beautiful solutions; it is fascinated by the clues to a beautiful discovery and pursues untiringly the prospects of a beautiful invention. In fact, we hear beauty more often mentioned today by scientists and engineers than by critics of art and literature.
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> . . . . . .
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> Even physics, though based on observation, relies heavily on a sense of intellectual beauty. No one who is unresponsive to such beauty can hope to make an

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[35] Wertheimer, op. cit., pp. 176-177.

[36] Rugg, op. cit., pp. 31-32.

> important discovery in mathematical physics, or even to gain a proper understanding of its existing theories. . . . Pure mathematics presents us with a vast intellectual structure, built up altogether for the sake of enjoying it as a dwelling place of our understanding. It has no other purpose; whoever does not love and admire mathematics for its own internal splendors, knows nothing whatever about it.[37]

There is less necessity to justify the cognitive phase in creativity since this is the aspect which is usually abstracted out for scrutiny--often to the prejudicial exclusion of the other two aspects of creativity. However, as is apparent from the title of this investigation, the relationship between cognition and the other two aspects of behavior is of central importance in this study. It is our hypothesis that an acceptable view of cognition, especially when considering the subject of creativity, must include an affective-conative background. Allport gives us the central nature of this relationship:

> What we find in real people, then, is a <u>personalistic</u> patterning of intelligence, closely meshed with interests, traits, and outlook on life. . . . But however finely we subdivide intellectual functions we never reach the personal pattern. In general, psychology has scarcely touched the riddle of the personal organization of intelligence. . . . Of only one thing we can be sure: <u>intelligence moves in channels that correspond fairly closely to interests</u>, though which is cause and which effect we cannot clearly say.[38]

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[37]Michael Polanyi, <u>The Study of Man</u>, A Phoenix Book, P 128 (Chicago: University of Chicago Press, 1958), pp. 37-39.

[38]Allport, <u>Pattern and Growth in Personality</u>, pp. 66-67.

Cognition--or intelligence--is seen as belonging mainly to the conscious end of the unconscious-conscious continuum. Here abstraction, judgment and logical analysis hold sway. Newly born ideas rising from the unconscious must be subjected to its scrutiny if they are to have any chance of becoming socially useful.[39] Self-expression divorced from analytic intelligence is unsatisfactory because it remains incomplete.[40] Henle concurs: "The creative solution is not merely an expression of the individual, but must do justice to the requirements of the problem before him--requirements which the crazy solution ignores."[41] So does Selye:

> Genius must not only be able to dream, but also to articulate those dreams. In science, this process of articulation, this work of translation into logically and experimentally verifiable terms, requires talent, skill, and infinite attention to detail.[42]

Creative solutions, in the final analysis, are not to be evaluated by a psychological analysis of "novelty" or "divergence" but by a logical analysis in terms of the requirements set by the problems themselves. The fact that creative solutions are always novel and divergent, at least

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[39]Selye, op. cit., p. 224.

[40]Kneller, op. cit., pp. 56 and 58.

[41]Mary Henle, "The Birth and Death of Ideas," Contemporary Approaches to Creative Thinking, ed by Howard E. Gruber et al. (New York: Atherton Press, 1962), p. 34.

[42]Selye, op. cit., p. 67.

to the extent of producing "effective surprise," is secondary to the fact that they are always appropriate.[43] Hudson believes that "novelty" and "divergence," as defined by Guilford and his followers, may actually be facilitated by a lack of commitment to creative solution rather than the converse, as is now assumed by factor-analytic theoreticians.[44] However, even if commitment is present, validity depends ultimately, of course, upon the logical requirements of the situation, not the production of novelty.

> [There is a] gulf between searching and finding, between the intention and the accomplished fact. Every brainworker has had insights, luminous at the time, which turn out to be mistaken. The validity of an insight depends, in other words, on factors connected not with psychology but with logic.[45]

We are concerned with the task of describing the distinguishing personality attributes of those who are noted for their valid insights, and with the relationship between these attributes and the specific attribute of cognitive ability or intelligence. We are not concerned with the study of novelty or divergence per se.

What evidence do we have concerning the necessity of considering the conative in creativity?

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[43] Jerome S. Bruner, "The Conditions of Creativity," Contemporary Approaches to Creative Thinking, ed. by Howard E. Gruber et al. (New York: Atherton Press, 1962), p. 4.

[44] Hudson, op. cit., pp. 44, 49-50, 56-57.

[45] Ibid., p. 151.

American psychologists have, until recently, tended to turn a blind eye on the logical gap between the image, as delineated by cognitive psychologists, and individual action.[46] However, in 1960 there was an interesting attempt to fill this vacuum. Miller, Galanter, and Pribram argued cogently that the plans one makes to carry out the implication of his image, or, to use an equivalent phrase, his value system, is a pervasively important factor in human behavior.

> It is so obvious that knowing is for the sake of doing and that doing is rooted in valuing--but how? How in the name of all that is psychological should we put the mind, the heart, and the body together? Does a Plan supply the pattern for that essential connection of knowledge, evaluation, and action? Certainly any psychology that provides less--that allows a reflex being to behave at random, or leaves it lost in thought or overwhelmed by blind passion--can never be completely satisfactory.[47]

The authors develop the thesis that one of the chief functions of plans is to serve as an essential element in "willing."

> What we call an "effort of will" seems in large measure a kind of emphatic inner speech. Much, probably most, of our planning goes on in terms of words. When we make a special effort the inner speech gets louder, more dominating. This inner shouting is not some irrelevant epiphenomenon; in a very real sense it <u>is</u> the Plan that is running our information-processing equipment. As psychologists we should listen to it more carefully.[48]

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[46] Miller, Galanter, and Pribram, <u>op. cit.</u>, p. 2.

[47] <u>Ibid.</u>, p. 71.

[48] <u>Ibid.</u>

Few investigators have given attention to this vacuum between knowledge, or belief, and action because of their reluctance to deal with the difficult problem of human purposiveness or will.[49] Nevertheless, there are exceptions. Cantril submitted this statement on the subject:

> It becomes increasingly clear that we must include in our consideration the purposive behavior of the organism of which mind is an aspect. Otherwise we isolate mind as a complicated machine engaged in coding, sorting, predicting, generating. For all these processes cannot go on and cannot be evaluated outside the context of what all this elaborate activity is <u>for</u> anyway.[50]

Also, Allport, while reviewing the requirements for an adequate theory of motivation asserts that the dynamic force of planning and intention must be ascribed to the cognitive process. He further declares:

> Although there is no doubt that men greedily seek to know the meaning of their present experiences and of their existence as a whole, we should not sharply separate such cognitive motives from those that are traditionally called conative or affective. More typically we find that people are trying to do something in which their wants and their plans readily cooperate. Instead of being related as master and servant, the desire and the reason fuse into a single motive that we may call the "intention."
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> <u>Intention</u> is a much-neglected form of motivation, but one of central importance for the understanding of personality. It enables us to overcome the opposing of motive and thought.[51]

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[49] <u>Ibid</u>., p. 11.

[50] Hadley Cantril, "A Transactional Inquiry Concerning Mind," <u>Theories of the Mind</u>, ed. by Jordan Scher (New York: The Free Press of Glencoe, 1962), p. 339.

[51] Allport, <u>Pattern and Growth in Personality</u>, pp. 22-23.

Although in the past many warily stayed clear of the idea of purpose, recent developments have obviated many of the logical difficulties, and in addition have underscored the crucial necessity of investigating purposive behavior. One of the most significant developments is the giant strides made in improving the information processing capacity and conceptualizing the essential features of the new communication machines. This deeper comprehension of what machines can do has led to an awareness that they are capable of behaving purposively.[52] As early as 1943, such tough-minded mathematicians as Wiener, Rosenblueth, and Bigelow staked their reputations behind the assertion that machines with servo-mechanisms, or negative feedback, were teleological mechanisms.[53] Wiener, in his book, The Human Use of Human Beings, elaborates his argument that some of the newer communication machines as well as humans are capable of purposive performance.

> It is my thesis that the physical functioning of the living individual and the operation of some of the newer communication machines are precisely parallel in their analogous attempts to control entropy through feedback. Both of them have sensory receptors as one stage of their cycle of operation: that is, in both of them there exists a special apparatus for collecting information from the outer world at low energy levels, and for making it available in the operation of the individual or of the machine. In both cases these external messages

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[52] Miller, Galanter, and Pribram, op. cit., p. 42.

[53] Arturo Rosenblueth, Norbert Wiener, and Julian Bigelow, "Behavior, Purpose, and Teleology," Philosophy of Science, X (1943), 18-24.

> are not taken neat but through the internal transforming powers of the apparatus, whether it be alive or dead. The information is then turned into a new form available for the further stages of performance. In both the animal and the machine this performance is made to be effective on the outer world. In both of them, their performed action on the outer world, and not merely their intended action, is reported back to the central regulatory apparatus.[54]

Actually, several psychologists and workers in other fields had described servo-mechanisms many times over the years, though the language used was somewhat different and less precise than that above. Dewey, for example, in describing what he called a "reflex arc" gave detailed descriptions of servo-mechanisms.[55] Dennis reviewed the history of "circular reflexes" from 1749 to 1954.[56] And Cannon's descriptions of the homeostatic mechanisms were well known in the 1930's.[57] Selye says that despite all the invectives heaped on teleology, one must "constantly examine teleologic motives in the objects of creation" for "only by doing this can science progress from the mere accumulation of unintelligible facts to what we call understanding."[58]

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[54]Norbert Wiener, A Doubleday Anchor Book, A 34 (Garden City, New York: Doubleday, 1954), pp. 26-27.

[55]John Dewey, "The Reflex Arc Concept in Psychology," Psychological Review, III (1896), 357-370.

[56]Wayne Dennis, "A Note on the Circular Response Hypothesis," Psychological Review, LXI (1954), 334-338.

[57]Walter B. Cannon, Bodily Changes in Pain, Hunger, Fear and Rage (2nd ed.; New York: D. Appleton and Co., 1929).

[58]Selye, op. cit., p. 294.

Although it was censurable to openly admit belief in teleology, the idea was there all along, and "once a teleological mechanism could be built out of metal and glass, psychologists recognized that it was scientifically respectable to admit they had known it all along."[59] Of course, there is no suggestion that the principle of negative feedback renders a complete account of purposive human behavior. It lacks the conscious processes of desire and cognition--the felt tension, longing, unease, and distress--which are concomitants of consciousness.[60]

In the preceding pages we have discussed the compelling need of giving thoughtful attention to each of the three "major faculties" of human personality in any serious investigation of creativity. We have also organized a compendius conceptual framework of holistic creativity around these major faculties which will now be reorganized into subdivisions which will facilitate a more complete and detailed review of the literature.

The section headings for the remainder of this chapter will include six characteristics measured by the OPI, which taken together were chosen to serve as one of the measuring instruments of this study, combined with certain

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[59]Miller, Galanter, and Pribram, op. cit., p. 43.

[60]Harris, op. cit., p. 472.

pertinent attributes of the highly creative adult as reported by McKinnon in his paper, "Personality Correlates of Creativity."[61]

The organization of the remainder of this chapter will be focused on two major objectives: first, to show clearly the importance of certain personality characteristics, including intelligence, for creativity; second, to clarify and accentuate the evidence for a positive relationship between eight of these characteristics and the remaining one, intelligence.

Intelligence

The socially useful creative act is a complex process which must at many points be brought under conscious discipline, control, and intelligence. Golovin furnishes us with an overall view of the demands made upon the creative individual in terms of these traits and abilities:

> The work preparatory to the creative effort, or to the labor of subsequent reworking and validation, requires self-discipline and management. Generally speaking, at least in science, discovery and invention take place at the frontiers of knowledge and technique. However, comprehension of what is involved at the frontiers is impossible without thorough training in relevant areas up to these frontiers, and the requisite understanding cannot be attained without major concentration of the creator's energies, interests, and time. Also, the "clue" is often vague and involves only a

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[61] MacKinnon, "Personality Correlates of Creativity," (Mimeographed.)

> minor portion of the contents which must eventually be integrated into the finished solution. Relatively prodigious efforts may thus often be required to make the "clue" or "insight" more pertinent, to justify it, to draw all fruitful and necessary conclusions from it, and to relate it properly to the broader context of the field in which the work is being done.[62]

The creative act requires preparation which necessitates "a copious and ordered information; a well-defined storehouse of imagery to guarantee rightness and freedom of association, and of ordered key concepts to guarantee organization of thought."[63] The creative act also requires that any vagueness in the "clue" or "insight" must be eliminated by adding to and filling out the original contents so that it can be justified as a pertinent conceptual tool. Henle aptly describes this process:

> Welcoming a new idea is, of course, much more than not forgetting it. It involves first of all formulating it. Words are brought forth to cloak the idea, one and another tried on for fit. . . . The idea needs to be worked out with all the sagacity and critical ability one possesses. What does it mean? It does not always present itself ready to use. The idea needs to be tested; in this testing it must be subjected to the same scrutiny to which we might subject the idea of an opponent. . . . Not only must the idea itself be examined, but it must find its place in our system of ideas. This often means revising others in the light of it.[64]

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[62] N. E. Golovin, "The Creative Person in Science," Scientific Creativity: Its Recognition and Development, ed. by Calvin W. Taylor and Frank Barron (New York: John Wiley and Sons, 1963), p. 18.

[63] Rugg, op. cit., p. 311.

[64] Henle, op. cit., p. 42.

The creative act requires that "all fruitful and necessary conclusions be drawn from" the clue or insight and that it must be related properly "to the broader context of the field in which the work is being done." The deductive-inductive nature of drawing conclusions obviously makes great demands on intelligence, and proper location in a broader context requires knowledge and understanding that can only come through the efficient use of considerable intellectual ability.

The necessary preparation, the careful formulation, and the drawing of pertinent conclusions all demand conscious intelligence in proportion to the complexity of the creative task to be performed.[65]

Clues are seldom clear enough, when they first appear in consciousness, to be of much use and must be carefully elaborated and "meticulously analyzed according to a well conceived plan."[66] Very often the creative act consists of a series of such clues, each of which must be consciously elaborated before the next clue can appear. In other words, one must evaluate the clues he produces. Selye's two words, "analyzed" and "plan" would appear to be important clues in the effort to understand the relationship between creativity and intelligence.

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[65]Kneller, op. cit., p. 63.

[66]Selye, op. cit., p. 224.

Analysis is a logical reasoning act which requires separating something into its constituent elements so that the effect of each element can be distinguished separately and understood in relation to the whole. Analysis demands the ability to abstract out the basic components of a clue and to reason precisely concerning each one's effect on the situation and on the interrelations among the components. Since the ability to reason and form abstractions are major factors in intelligence, it is surely incumbent to recognize intelligence as a prerequisite for analysis.

The planning function is not only closely related to the conative, as was indicated in the preceding section, but is also closely associated with verbal intelligence. Vygotsky's theories concerning egocentric speech and inner speech, which is egocentric speech that has become covert,[67] give us a partial foundation for understanding why this is so. Over 35 years ago he pointed out how egocentric speech in preschool children, and inner speech in older children, show a "sudden increase when the child faces difficulties which demand consciousness and reflection."[68] Miller notes coincidence of an increase in inner speech with the process of problem-solving in human behavior and states that this is

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[67]Lev Semenovich Vygotsky, Thought and Language (New York: Published jointly by the M.I.T. Press and John Wiley and Sons, 1962), pp. 18, 46.

[68]Ibid., p. 133.

the planning function in action.[69] That is, this is the way in which the individual puts a plan into operation to process information and thereby reach some appropriate solution.

Bruner, who acknowledges Vygotsky's contributions, also notes that Mead[70] had a similar theory concerning the function of inner speech.[71] Bruner states in another work that inner speech is actually what makes intelligence operative by making conscious thought processes and, hence, education possible.[72]

If we accept these statements regarding the intimate relationship between inner speech, or planning, and the conscious thought processes, or intelligence, as being tenable, we will not be surprised at this quote by Miller: "We have every reason to believe that man's verbal abilities are very intimately related to his planning abilities."[73]

Since creativity in the realm of ideas must always depend upon conscious elaboration at some point, it is

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[69]Miller, Galanter, and Pribram, op. cit., pp. 105, 111.

[70]George H. Mead, Mind, Self, and Society (Chicago: University of Chicago Press, 1934).

[71]Jerome S. Bruner, Toward a Theory of Instruction (Cambridge, Massachusetts: The Belknap Press of Harvard University Press, 1966), p. 19.

[72]Jerome S. Bruner, On Knowing: Essays for the Left Hand (Cambridge, Massachusetts: The Belknap Press of Harvard University Press, 1963), pp. 116-117.

[73]Miller, Galanter, and Pribram, op. cit., p. 38.

almost inconceivable that significant creative advance would ever be in evidence in the absence of a good measure of intelligence. Newell, Shaw, and Simon have made this particular point: "There is little doubt that virtually all the persons who have made major creative advances in science and technology in historic times have possessed very great general problem-solving powers."[74] Underhill, in discussing the importance of preparation, discipline, and intelligence says:

> It is true that he (the creator) sometimes seems to spring abruptly to the heights, to be caught into ecstasy without previous preparation: as a poet may startle the world by a sudden masterpiece. But unless they be backed by discipline, these sudden and isolated flashes of inspiration will not long avail for the production of great works.[75]

Rugg's concept of "conceptual synthesis" extends our understanding of the place of intelligence in creativity.

> The solution of an unknown . . . depends upon two conditions. First, it depends on the assembling in one place, which means in one organism, of all the key concepts of the known data that might conceivably bear upon it. . . . Second, to facilitate the firing process, the flash of discovery waits on the optimal organization and integration of such concepts. Thus the scattered materials must not only be gathered; they must be formed.[76]

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[74]Allen Newell, J. C. Shaw, and Herbert A. Simon, "The Processes of Creative Thinking," Contemporary Approaches to Creative Thinking, ed.by Howard E. Gruber et al. (New York: Atherton Press, 1962), p. 66.

[75]Evelyn Underhill, Mysticism: A Study in the Nature and Development of Man's Spiritual Consciousness (12th ed.; New York: Dutton, 1930), p. 299.

[76]Rugg, op. cit., p. xix.

How does one assemble and organize optimally the key concepts of any area of knowledge without a substantial level of intelligence?

Bruner reminds us that it takes preparation to discern what is trivial improbability and what is effective surprise. "Surprise is the privilege only of prepared minds—minds with structured expectancies and interests."[77] The factor-analysts, it is remembered, use only the criteria of improbability in determining levels of originality.[78] Rugg backs Bruner with this statement: "A generation of research has established the further fact that no situation is ever perceived except within an orienting preparatory attitude."[79]

Koestler's theory regarding matrices of skill and thought is a most interesting amplification of this idea. His theory is essentially that the creative act is a joining of two independent orienting preparatory attitudes or skills which he labels matrices. For this joining of two independent matrices Koestler coined the term "biosociative act." Association, says Koestler, is the exercise of a habit, whereas bisociation is a "reshuffling and restructuring of of skills."[80] "The term 'bisociation' is meant to point to

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[77]Bruner, "The Conditions of Creativity," p. 4.

[78]Getzels and Jackson, Creativity and Intelligence, p. 201.

[79]Rugg, op. cit., p. 303.

[80]Koestler, The Act of Creation, p. 647.

the independent, autonomous character of the matrices which are brought into contact in the creative act, whereas associative thought operates among members of a single pre-existing matrix."[81]

Although the coalescence of two matrices in the creative act is seen by Koestler as guided mostly by the subconscious,[82] he emphasizes that this fusion is greatly facilitated by thorough familiarity with each matrix. To quote Koestler: "The more familiar and well exercised each of the matrices, the more likely it is that [the person] will solve the problem and, other things being equal, the less it will depend on the helping hand of chance."[83]

Koestler adds the point that the more complex the skill or understanding representing the matrix, "the more alternative variations it offers for adaptable strategies."[84] Therefore, to the extent that creativity depends on flexibility of strategies, it must depend on complexity of matrices, which in turn depends to a large extent on intelligence. This same idea is implicit in our rationale concerning the value of a "liberal education" which supposedly frees us by increasing the complexities of our matrices--in

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[81] Ibid., p. 656.

[82] Ibid., pp. 658-659.

[83] Ibid., p. 575.

[84] Ibid., p. 551.

other words, by increasing knowledge and understanding.[85] Creativity is thus limited by an individual's matrices of skill and thought, which is partly a function of intellectual ability.

A germane concept is that of heuristics. Although this concept combines the intuitive with the consciously logical aspects of mentation, it definitely involves processes that demand intelligence. The concept of heuristics has recently attracted increased attention because of its theoretical importance to problem-solving and creativity. A heuristic is a short-cut means of leaping across a logical gap.[86] These leaps are necessary because systematic plans are often inefficient or impossible.

> People do not always use systematic Plans for searching because . . . systematic plans can be dull and inefficient. The alternative is to be unsystematic--in a clever way. If we try to short-cut the systematic Plan . . . the Plan we follow is said to be "heuristic."[87]
> . . . . . .
> It is fairly obvious that without a little discernment and selection among the alternatives we are willing to consider, we will not live long enough to solve anything. A heuristic is a way of exercising discernment--but it always runs the risk that the solution will be

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[85]Hyman G. Rickover, Education and Freedom (New York: Dutton, 1959), pp. 26-27; and Mortimer J. Adler and Peter Wolff, A General Introduction to the Great Books and to a Liberal Education (Chicago: Encyclopaedia Britannica, 1959), pp. v-vi.

[86]Michael Polanyi, Personal Knowledge, A Harper Torchbook, TB 1158 (New York: Harper and Row, 1962) p. 125.

[87]Miller, Galanter, and Pribram, op. cit., p. 160.

> discarded inadvertently along with the millions of apparently useless combinations.[88]

Newell, Shaw, and Simon considered the set of possible alternatives in mathematical logic of one chapter of Whitehead and Russell's Principia Mathematica[89] and calculated that if a systematic plan had been used it would have taken the fastest electronic computers hundreds of thousands of years to come up with the appropriate answers.[90] Obviously, Whitehead and Russell worked heuristically in writing their creative magnum opus.

Polya's four phases of the heuristic process can be called upon to help clarify the place of intelligence in heuristic thinking.

> First, we must understand the problem. We have to see clearly what the data are, what conditions are imposed, and what the unknown thing is that we are searching for.
>
> Second, we must devise a plan that will guide the solution and connect the data to the unknown.
>
> Third, we must carry out our plan of the solution, checking each step as we go.
>
> Fourth, we should look back at the completed solution, reviewing, checking, discussing, perhaps even improving it.[91]

All except the second phase represents primarily the work of conscious intelligence. And although the second phase must

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[88] Ibid., p. 168.

[89] Alfred North Whitehead and Bertrand Russell, Principia Mathematica, 3 vols. (New York: Macmillan, 1925-1927).

[90] Miller, Galanter, and Pribram, op. cit., p. 168.

[91] G. Polya, How to Solve It (Princeton: Princeton University Press, 1945), p. 8.

depend to some extent on intuition, we see again the central importance of plans and remember that the ability to plan is probably intimately related to verbal intelligence.[92]

"Without a good supply of heuristic methods no artist could create, no scientist could discover, no technician could invent."[93] While a good supply of heuristics is certainly not wholly dependent on intelligence, it assuredly presupposes at least a moderatley high level of intellectual ability.

Selye furnishes a final example concerning the vital importance of intelligence as an integral part of creativity, which beautifully illustrates the practical maxim that it is not the one who sees something first that is creative, but the one who first makes the appropriate connections between two independent matrices. He tells about the discovery of insulin and how a physiologist, E. Gley, found insulin 17 years before Banting, who is credited with the discovery, published his findings in 1922. Gley had found insulin, he had performed some experiments similar to the ones later used by Banting, then he had described the new substance in a private communication and deposited it in a sealed envelope with the Societe de Biologie de Paris in 1905. Only after Banting's publication did Gley give permission to open

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[92] Miller, Galanter, and Pribram, op. cit., p. 38.

[93] Ibid., p. 183.

the letter and thus support his claim that he saw insulin first. Gley subsequently received little credit and, at an international symposium on diabetes, bitterly, but vainly, protested what he considered to be this great injustice to his discovery.[94]

Selye uses this story to vividly make his point:

> Obviously, Gley did not recognize the importance of what he saw; otherwise he would not have been satisfied to deposit his findings under seal. In fact, it would have been criminal to do so had he realized he would thereby have become responsible for the deaths of the thousands who succumbed from diabetes for want of insulin during the intervening years. None of Gley's subsequent work was comparable in importance to the discovery of insulin. Why had he put the subject aside, if not because he failed to understand its significance? It is easy to deposit private communications about things we are not sure of, then unseal them if and when somebody else proves that we were on the right track. To my mind, Gley not only failed to discover insulin but he also proved that he could not do so. Although he saw it by chance, he still did not discover it.[95]

In other words, there is an essential difference between seeing and discovering. "It is not to see something first," says Selye, "but to establish solid connections between the previously known and the hitherto unknown that constitutes the essence of scientific discovery."[96]

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[94] Selye, op. cit., p. 91.

[95] Ibid., p. 91.

[96] Ibid., p. 89.

Originality

Originality is unlike the other personality characteristics to be considered in the fact that it is almost synonymous with creativity itself. Many workers would subsume most or all of the distinguishing attributes of the creative process under the term "originality."[97] Others would prefer to say that originality is the most salient characteristic of creativity.[98] In any case, originality demands attention, not because it needs justification as an important correlate of creativity, but because enlightenment is acutely needed concerning its etiology and nature.

Originality, like the more inclusive concept, creativity, is almost impossible to study directly because it combines the operations of the unconscious and conscious in ways which our present modes of investigation have, to this point at least, found quite impenetrable. While most workers would probably not accept Jung's dictum that "the creative act will forever elude the human understanding,"[99] a frontal assault on originality cannot be made at this time. However, there are indirect but hopefully valid ways of gaining insight into the causes and nature of originality. Especially pertinent to the present study are the recent

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[97]Hudson, op. cit., p. 100.

[98]Selye, op. cit., p. 31.

[99]Quoted in Rugg, op. cit., p. 3.

findings concerning certain motivational stances toward, and personalistic styles of processing, natural phenomena as correlates of socially useful original behavior.

Holistic investigations of the creative process reveal that certain personality patterns are characteristic of individuals noted for their originality. Koestler, Kuhn, and Barron, among others, have called attention to the balance between opposites that is so typical of, and which appears to be necessary for, the processes that eventuate in original production. Theoretical and empirical considerations concerning this vital balance will serve as the basic framework for the following discussion of originality.

Original acts, according to Koestler, depend on a "sublime balance" between the self-assertive and the self-transcending tendencies.[100] Kuhn, as we observed previously, speaks of the "essential tension" between the convergent and divergent modes of thinking, which he regards as a prerequisite for original advances.[101] And Barron has attempted to understand this essential tension in terms of a number of dualities, such as "intellect and intuition, the conscious and the unconscious," and others.[102]

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[100]Koestler, The Act of Creation, p. 679.

[101]Kuhn, op. cit., p. 343.

[102]Frank Barron, "The Relationship of Ego Diffusion to Creative Perception," Widening Horizons in Creativity, ed. by C. W. Taylor (New York: John Wiley and Sons, 1964), p. 81.

Koestler has developed his idea far more completely than the other two, anchoring it conceptually in biology as well as psychology. His theoretical model includes all aspects of human creativity from the comic through science to art. In explaining his model, he first analyzes humor by showing that the pattern underlying all humor is bisociative; that is, a situation is perceived in two habitually incompatible associative contexts. "This causes an abrupt transfer of the train of thought from one matrix to another governed by a different logic," which results in laughter.[103] The emotions involved are "those of the self-assertive, aggressive-defensive type, which are based on the sympathico-adrenal system and tend to beget bodily activity."[104]

Next, he analyzes the motivational drive of the scientist which he sees as a blend of the self-asserting and self-transcending tendencies: "it is a blend in which both tendencies are sublimated and balance each other."[105] Koestler shows how this kind of behavior is already foreshadowed in the exploratory behavior of clever animals such as Kohler's chimpanzee, Sultan.[106] Here again the situation

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[103]Koestler, The Act of Creation, p. 95.

[104]Ibid., p. 95.

[105]Ibid., p. 266.

[106]Wolfgang Kohler, The Mentality of Apes (Baltimore: A Pelican Book, 1957).

is perceived, with the resulting insight, when two independent, and heretofore seemingly incompatible matrices, are brought together. However, instead of a "collision" of the matrices producing laughter, there is a "fusion" which profitably ties together elements which previously had been considered independent.[107]

According to Koestler, "ambition, greed, vanity [which are aspects of the self-asserting emotions] can enter the service of creativity only through indirect channels; and the self-transcending emotions must undergo a similar process of sublimation."[108] The blend of which Koestler speaks is perhaps best depicted by this quote:

> The most conspicuous feature in the character of Galileo and the cause of his tragic downfall was vanity--not the boisterous and naive vanity of Tycho, but a hypersensitivity to criticism combined with sarcastic contempt for others: a fatal blend of genius plus arrogance minus humility. There seems to be not a trace here of mysticism, of "oceanic feeling"; in contrast to Copernicus, Tycho, and Kepler, even to Newton and Descartes who came after him, Galileo is wholly and frighteningly modern in his consistently mechanistic philosophy. . . . Where, then, in Galileo's personality is the sublime balance between self-asserting and self-transcending motives which I suggested as the true scientist's hallmark? I believe it to be easily demonstrable in his writings on those subjects on which his true greatness rests: the first discoveries with the telescope, the foundations of mechanics, and of a truly experimental science. Where the balance is absent--during the tragic years 1613-33, filled with poisonous polemics, spurious priority claims, and

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[107] Koestler, The Act of Creation, p. 45.

[108] Ibid., p. 267.

> impassioned propaganda for a misleadingly oversimplified Copernican system--in that sad middle period of his life Galileo made no significant contribution either to astronomy or to mechanics. One might even say that he temporarily ceased to be a scientist--precisely because he was entirely dominated by self-asserting motives. The opposite kind of imbalance is noticeable in Kepler's periods of depression, when he entirely lost himself in mystic speculation, astrology, and number-lore. In both these diametrically opposed characters, unsublimated residues of opposite kind temporarily dominated the field, upsetting the equilibrium and leading to scientific sterility.[109]

The originality of the artist is more dependent upon the participatory or self-transcending emotions "which are mediated by physiological processes of a different type, and tend to discharge not in laughter but in tears."[110] Whereas the self-assertive emotions operate through the adrenal-sympathico system, the participatory emotions operate through the parasympathetic system:

> In the main, its function is to counteract and to complement sympathico-adrenal excitation: to lower blood-pressure and pulse-rate, neutralize excesses of blood-sugar and acidity, to facilitate digestion and the disposal of body-wastes, to activate the flow of tears, etc. In other words, the general action of the parasympathetic system is <u>inward-directed, calming, and cathartic</u>.[111]

"Weeping is an overflow reflex for an excess of the participatory emotions, as laughter is for the self-asserting emotions."[112]

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[109] <u>Ibid</u>., p. 679.

[110] <u>Ibid</u>., p. 95.

[111] <u>Ibid</u>., p. 274.

[112] <u>Ibid</u>., p. 299.

> Listening to Mozart, watching a great actor's performance, being in love or some state of grace, may cause a welling up of happy emotions which moisten the eye or overflow in tears. Compassion and bereavement may have the same physical effect. The emotions of this class, whether joyous or sad, include sympathy, identification, pity, admiration, awe, and wonder. The common denominator of these heterogeneous emotions is a feeling of participation, identification, or belonging; in other words, the self if experienced as being a part of a larger whole, a higher unity--which may be Nature, God, Mankind, Universal Order, or the Anima Mundi; it may be an abstract idea, or a human bond with persons living, dead, or imagined. I propose to call the common element in these emotions the participatory or self-transcending tendencies. This is not meant in a mystical sense (though mysticism certainly belongs to this class of emotion); the term is merely intended to convey that in these emotional states the need is felt to behave as a part of some real or imaginary entity which transcends, as it were, the boundaries of the individual self; whereas when governed by the self-assertive class of emotions the ego is experienced as a self-contained whole and the ultimate value.[113]

The interaction of the two matrices in esthetic experience is not represented by a "collision" ending in laughter or a "fusion" ending in a permanent union of matrices, but by a "confrontation" or juxtaposition of two matrices which do not fuse but remain as landmarks for all to see. The differences between discovery in the sciences and innovation in the arts, as understood by Koestler, are well described in this quote:

> The discoveries of yesterday are the truisms of tomorrow, because we can add to our knowledge but cannot subtract from it. When two frames of reference have become integrated into one it becomes difficult to imagine that previously they existed separately. The

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[113] Ibid., p. 54.

> synthesis looks deceptively self-evident, and does not betray the imaginative effort it needed to put its component parts together. In this respect the artist gets a better deal than the scientist. The changes of style in the representative arts, the discoveries which altered our frames of perception, stand out as great landmarks for all to see. The true creativity of the innovator in the arts is more dramatically evident and more easily distinguished from the routine of the mere practitioner than in the sciences, because art (and humour) operate primarily through the transitory juxtaposition of matrices, whereas science achieves their permanent integration into a cumulative and hierarchic order.[114]

It is interesting to note that: "the bisociative patterns found in any domain of creative activity are trivalent; that is to say, the same pair of matrices can produce comic, tragic, or intellectually challenging effects."[115] Thus the bringing together of incompatible matrices "will be experienced as ridiculous, pathetic, or intellectually challenging, according to whether aggression, identification, or the well-balanced blend of scientific curiosity prevails in the spectator's mind."[116]

To summarize, "the humorist's motives are aggressive, the artist's participatory, the scientist's exploratory."[117]

Kuhn's arguments for the necessity of an essential tension between the traditional and revolutionary, or the convergent and the divergent, are based on the history of

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[114] Ibid., p. 658.

[115] Ibid., p. 45.

[116] Ibid., pp. 304-305.

[117] Ibid., p. 72.

science and his personal experience as a scientist rather than upon human biology and psychology. While there is apparently no great overlap between Koestler's and Kuhn's theories, the fact that they both emphasize the importance of a blending of opposites may be significant. The incorporation and harmonization of opposites in the actualization of the higher levels of human potential is demonstrated in a number of recent studies; for instance, in those by Maslow concerning self-actualizing individuals.[118] And the need for such incorporation is seen in the theoretical formulations of such workers as Fromm.[119] Also, it would seem that this growing consensus among holistic thinkers that the highest levels of human functioning are only reached through the successful accommodation of many polarities within an individual's personality structure would impressively underscore the difficulties inherent in both personal growth and socially significant originality.

Kuhn insists that convergent and divergent thinking are equally indispensable in scientific advance and that one must be able to support the tension that is inevitably

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[118]Abraham Maslow, Motivation and Personality (New York: Harper and Brothers, 1954), pp. 232-234.

[119]Eric Fromm, Psychoanalysis and Religion (New Haven: Yale University Press, 1950).

produced by these two conflicting modes of thought if socially useful originality is to ensue.[120]

Hudson, who was much impressed with Kuhn's studies of convergent and divergent thinking, has made extensive studies of these two modes of thinking with bright English boys of high school age.[121] He notes that in the American literature on creativity that the diverger is seen as being emotionally open and the converger as closed. His studies indicate that both are actually defended--"that convergers and divergers differ, not in being defended or open, but simply in the defensive style which they employ."[122] Hudson holds that "we can unify the evidence we have about convergers and divergers by considering each as the embodiment of a different defensive system."[123]

In exploring the subject of the expression of violence, as an illustrative example, Hudson finds some interesting data concerning tension and the convergent mode.

> The boy who experiences both a powerful impulse, and the need to control it, may try to dissipate some of the resulting tension by exploring and elaborating trains of thought which others lack the energy to pursue. Just such a train of thought may be one involving extreme violence or cruelty. The converger who suggests taking a blanket off his sister's bed in midwinter whilst she

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[120] Kuhn, op. cit., p. 342.

[121] Hudson, op. cit., pp. 35, 152.

[122] Ibid., p. 76.

[123] Ibid., p. 83.

> is asleep has bothered to explore an idea which no other boy in the sample has touched upon. And it is of some interest that "morbid" responses occur most frequently not at the extremes of the convergent/divergent spectrum, but amongst all-rounders and mild convergers. This suggests that in divergers the process of inhibition is too weak to create much tension, whilst in most extreme convergers, the inhibition is so successful that little remains.
>
> This discovery of "morbid" responses amongst all-rounders and convergers is an intriguing one; and not solely for the light it throws upon the internal processes of convergers and divergers. It also has implications for the theory of creative thought. Originality in most spheres would seem to depend, amongst other qualities, on persistence: on the pursuit of a given train of thought far beyond the limits that the ordinary citizen can countenance. And the evidence about "morbidity" offers an interesting clue as to where the roots of such persistence may lie. . . . It may be that all elaborate and persistent thought has analogous origins. . . . The habit of thinking, of pursuing ideas for their own sake, may be a by-product of the individual's need to keep the irrational elements of his personality under control.[124]

And concerning the openness of the diverger, he says:

> Emotional pyrotechnics may be complex in origin. Emotions may be displayed as a mask, hiding the individual's true feelings; as a source of self-reassurance; as a way of gaining social approval; or for a number of other reasons. There is no guarantee that because an emotion is expressed, it reflects unambiguously what is felt. The diverger sometimes has the air of a boy whose real feelings are buried, or lost, and who reassures himself of his capacity for pleasure by a reiteration of its external signs. He may express emotion, yet drain it, as an actor does, of its proper experiential content. The diverger feels more freely than the converger, but not necessarily more fully.[125]

Hudson summarizes his thoughts about convergence, divergence, and original thought thusly:

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[124] Ibid., p. 90.

[125] Ibid., p. 92.

> The diverger, it seems to me, has too readily been adopted as the paradigm of Creative Man. My own belief is that original work will come from convergers and divergers alike; and that the convergence and divergence of an individual will determine not whether he is original but, if he is original, the field and the style in which his originality will manifest itself. The roots of his originality lie, I shall suggest, not in his convergence or divergence, but in other aspects of his personality.[126]

Barron extends Kuhn's and Hudson's idea of tension between convergent and divergent thinking to include a more generalized tension between many common antinomies.

> There seems to be an essential and continuing tension between the maintenance of environmental constancies and the interruption of such constancies in the interest of new possibilities of experience.
>
> The creative process itself embodies this tension, and individuals who distinguish themselves in artistic, scientific, and entrepreneurial creation exemplify vividly in their persons the incessant dialectic between integration and diffusion, convergence and divergence, thesis and antithesis. I have attempted in my own research, employing highly creative people as subjects of study, to understand the specifics of this essential tension in terms of such dualities as intellect and intuition, the conscious and the unconscious, mental health and mental disorder, the conventional and the unconventional, complexity and simplicity.[127]

The description of these tension systems tells us of important biological, psychological, and sociological concomitants and, to some extent, determiners of originality, but what about the original act itself? Koestler's elaboration of the original act begins with the lower life forms.

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[126] Ibid., p. 138.

[127] Barron, op. cit., p. 81.

As the basic model of the original act, he suggests the bisociation of two genetic codes as in conception.[128] He extends the analogy between creativity in the realm of ideas and the combination of two genetic codes by pointing out that as the embryo develops, less and less of the original plasticity inherent in the original fertilized cell remains as tissue specialization and inhibition of the genetic potential in the somatic cells takes place. However, Koestler places considerable theoretical importance on the fact that organisms are capable of releasing some of this inhibited genetic potential when it is injured. "The essence," he says, "of organic regeneration is a release of genetic cell potentials which are normally inhibited in adult tissue."[129] This regenerative potential only becomes manifest when a severe challenge causes the organism to retrace its steps on the genetic gradient and make a fresh start. The anaology Koestler draws between the regenerative potential, and what it takes to activate it, at this level and at the level of ideas is apparent in this quote:

> The challenge which sets the process going is in all cases a traumatic experience; physical mutilation or mental laceration--by data which do not fit, observations which contradict each other, emotions which disrupt approved styles in art: experience which create mental conflict, dissonance, perplexity. The "creative stress" of the artist or scientist corresponds to the "general alarm reaction" of the traumatized animal;

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[128] Koestler, The Act of Creation, p. 452.

[129] Ibid.

> the anabolic-catabolic sequence of de-differentiation and reintegration corresponds to the "physiological isolation" of the over-excited part which tends to dominate, corresponds to the single-minded and obsessive preoccupation with the idee fixe . . . which monopolizes the whole mind; it will either lead to its reorganization by giving birth to a new system, or to the cancerous proliferation of a degenerate tissue of ideas.[130]

As the last sentence above points up, there are dangers inherent in the creative process. According to Harris, the truth of this is a matter of simple logic; thus those who would be creative must have the courage to live with danger.[131] Kierkegaard suggested long ago that, because of the destructive aspects of the creative process, there would be a tendency on the part of creative people to suppress their abilities for fear of reprisal.[132] Gardner expresses the same general idea of the need for courage in his book Self-Renewal.[133] Since the danger is real, to society as well as to the individual, it is certainly a moot point as to how much condemnation should be meted out to society on this score.

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[130] Ibid., p. 463.

[131] Harris, op. cit., pp. 460-461.

[132] Soren Kierkegaard, "The Concept of Dread," The Meaning of Anxiety, ed. by Rollo May (New York: Ronald Press, 1950).

[133] John W. Gardner, Self-Renewal (New York: Harper and Row, 1964), pp. 14-15.

Even if society should not be hostile, courage would still be required because one cannot expect to be understood and supported when his essays are truly original:

> A great deal of faith and courage is needed for perseverance, because the farther we reach out from the commonplace into the unknown the more inaccessible our aim--and the less understanding and support can we expect from others.[134]

The regressive aspects of the creative process refer to a reversion to more primitive levels of mentation in order to escape the inhibitions of conscious thought.

> The fact that art and discovery draw on unconscious sources indicates that one aspect of all creative activity is a regression to ontogenetically or philogenetically earlier levels, an escape from the restraints of the conscious mind, with the subsequent release of creative potentials--a process paralleled on lower levels by the liberation from restraint of genetic potentials or neural equipotentiality in the regeneration of structures and functions. The scientist, traumatized by discordant facts, the artist by the pressures of sensibility, and the rat by surgical intervention, share, on different levels, the same super-flexibility enabling them to perform "adaptations of a second order," rarely found in the ordinary routines of life.[135]

Land, the inventor of the polaroid camera, alludes to the importance of these earlier phylogenetic and ontogenetic competences in his creative work.

> I find it is very important to work intensively for long hours when I am beginning to see solutions to a problem. At such times atavistic competences (italics mine) seem to come welling up. You are handling so many variables at a barely conscious level that you can't afford to be interrupted. If you are, it may

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[134] Selye, op. cit., p. 34.

[135] Koestler, The Act of Creation, p. 462.

> take a year to cover the same ground you could cover otherwise in sixty hours.[136]

The most important specific regression that enables man to utilize his potential creative powers is a regression to thinking in pictures and dream imagery.[137]

> Thinking in pictures dominates the manifestations of the unconscious--the dream, the hypnogogic half-dream, the psychotic's hallucinations, the artist's "vision." (The "visionary" prophet seems to have been a visualizer, and not a verbalizer; the highest compliment we pay to those who trade in verbal currency is to call them "visionary thinkers.")
>
> But, on the other hand, pictorial thinking is a more primitive form of mentation than conceptual thinking, which it precedes in the mental evolution of the individual and of the species.[138]

Words often have little utility in the initial stages of the original account Einstein wrote:

> The words or the language, as they are written or spoken, do not seem to play any role in my mechanism of thought. The physical entities which seem to serve as elements in thought are certain signs and more or less clear images which can be "voluntarily" reproduced and combined. . . . Taken from a psychological viewpoint, this combinatory play seems to be the essential feature in productive thought--before there is any connection with logical construction in words or other kinds of signs which can be communicated to others.
>
> The above-mentioned elements are, in any case, of visual and some of muscular type. Conventional words or other signs have to be sought for laboriously only in a secondary stage, when the mentioned associative play is sufficiently established and can be reproduced at will.

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[136] Francis Bello, "The Magic That Made Polaroid," Fortune, LIX (April, 1959), 158.

[137] Koestler, The Act of Creation, pp. 322-325.

[138] Ibid., p. 168.

> According to what has been said, the play with the mentioned elements is aimed to be analogous to certain logical connections one is searching for.
>
> In a stage when words intervene at all, they are, in my case, purely auditive, but they interfere only in a secondary stage as already mentioned.[139]

Speaking of Hadamard's inquiry, from which the quote above was taken, Loestler made this judgment: "The inquiry brought conclusive proof that among mathematicians, verbal thinking plays only a subordinate part in the decisive phase of the creative act; and there is a mass of evidence to show that this is also the rule among original thinkers in other branches of science."[140] Koestler further elaborates this idea in another context:

> On the question how the new synthesis comes into being, the evidence indicates that verbal thinking, and conscious thinking in general, plays only a subordinate part in the decisive phase of the creative act. Hadamard's inquiry among leading mathematicians in America revealed that "practically all of them . . . avoid not only the use of words but also . . . the mental use of algebraic or any other signs." On the testimony of those original thinkers who have taken the trouble to record their methods of work, this also seems to be the rule in other branches of science. Their virtually unanimous emphasis on spontaneous intuitions, unconscious guidance, and sudden leaps of imagination which they are at a loss to explain, suggests that the role of strictly rational thought-processes in scientific discovery has been vastly over-estimated since the Age of Enlightenment.[141]

The visual thinker eludes the cast-iron character which obtains in verbal thought. "The Theory of Relativity

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[139] Quoted in Hadamard, op. cit., pp. 142-143.

[140] Koestler, The Act of Creation, p. 172.

[141] Ibid., p. 208.

was an affront to conceptualized thinking, but not to visualized thinking."[142]

Established linguistic forms always have to be broken up and repatterned to accommodate significant new insights. That is why "verbal thinking always plays only a subordinate part in the decisive phase of the creative act."[143] Language can become an obstacle which stands between thinker and reality.

> Words are essential tools for formulating and communicating thoughts, and also for putting them into the storage of memory; but words can also become snares, decoys, or strait-jackets. A great number of the basic verbal concepts of science have turned out at various times to be both tools and traps: for instance, "time," "space," "mass," "force," "weight," "ether," "corpuscle," "wave," in the physical sciences; "purpose," "will," "sensation," "consciousness," "conditioning," in psychology; "limit," "continuity," "countability,""divisibility," in mathematics. For these were not simple verbal tags, as names attached to particular persons or objects are; they were artificial constructs which behind an innocent facade hid the traces of the particular kind of logic which went into their making. . . . Each revolution had to make a hole in the established fabric of conceptual thought. Kepler destroyed the "self-evident" doctrine of uniform circular motion; Galileo the equally commonsense notion that any moving body must have a "mover" which pulls or pushes it along. Newton, to his horror, had to go against the obvious experience that action is only possible by contact; Rutherford had to commit the contradiction in terms of asserting the divisibility of the atom, which in Greek means "indivisible." Einstein destroyed our belief that clocks move at the same rate anywhere in the universe; quantum physics has made the traditional meaning of words like matter, energy, cause and effect, evaporate into thin air.

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[142] Ibid., p. 183.

[143] Ibid., p. 172.

. . . . . .

> The prejudices and impurities which have become incorporated into the verbal concepts of a given "universe of discourse" cannot be undone by any amount of discourse within the frame of reference of that universe. The rules of the game, however absurd, cannot be altered by playing that game.[144]

Woodsworth sums it up: "often we have to get away from speech in order to think clearly."[145]

There seems to be a solid consensus that the tool of originality is imagination or, more specifically, imagined conception.[146] "Imagination is the instrument of discovery. The poet and the scientist agree. Discovery is conceiving in imagination, or, more succinctly, discovery is imagined conception. The process of imagining, then, becomes the key to our problem."[147]

Lowes avers that the difference between the chaotic welter of the stream of consciousness and art or scientific discovery lies not in the constituents of the imagination

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[144] Ibid., pp. 176-177.

[145] Quoted in Koestler, The Act of Creation, p. 173.

[146] Hadamard, op. cit., p. 97; Mario Bunge, Intuition of Science, A Spectrum Book, S 22 (Englewood Cliffs, New Jersey: Prentice-Hall, 1962), pp. 78-80; William I. B. Beveridge, The Art of Scientific Investigation, A Modern Library Paperback, P 68 (New York: Random House, 1957), p. 78; Lowes, op. cit., p. 72; Rugg, op. cit., p. 38; Jacob Bronowski, Science and Human Values, A Harper Torchbook, TB 505 (New York: Harper and Row, 1965), p. 19; Bruner, "The Conditions of Creativity," p. 10; Selye, op. cit., p. 45; and Polanyi, Personal Knowledge, p. 46.

[147] Rugg, op. cit., p. 36.

but "in the presence or absence of imaginative control."[148] Building on this idea, he says: when the imagination "acts on what it sees, through the long patience of the will, the flux itself is transformed and fixed in the clarity of the realized design."[149] Imagination in the service of originality apparently refers to an alternation between the primitive and the more sophisticated levels of mentation. Koestler speaks to this point:

> The poet who reverts to the pictorial mode of thought is regressing to an older and lower level of the mental hierarchy--as we do every night when we dream, as mental patients do when they regress to infantile fantasies. But the poet, unlike the dreamer in his sleep, alternates between two different levels of the mental hierarchy; the dreamer's awareness functions on one only. The poet thinks both in images and verbal concepts, at the same time or in quick alternation; . . . each original find bisociates two matrices. The dreamer floats among the phantom shapes of the hoary deep; the poet is a skindiver with a breathing tube.[150]

The critical importance of intelligence is clearly manifest in this key concept of imagined conception. In the alternating periods when the conscious forms of mentation must necessarily select from, and give shape to, the visual imagery produced during the periods of regression, intelligence is the chief tool. Rugg reminds us that the essence of the creative task is always the same: "that of reducing

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[148] Lowes, op. cit., p. 92.

[149] Ibid., p. 432.

[150] Koestler, The Act of Creation, pp. 268-269.

a miscellany to order." However insights may be originally gained, the final selection and ordering must be accomplished by intelligence. In fact, as Kubie points out, the root meaning of intelligence is "to select among."[151]

Selye emphasizes another equally important aspect of the relationship between intelligence and imagined conception. He reminds us of the difficult task of coordinating the many facts into what we call understanding--this must be done, Selye insists, within a single brain.[152] The fact that this coordination is helped by regression to more primitive levels and the promptings of the unconscious does not relieve the conscious intelligence of hammering out the final reordering.

Butterfield disabuses us of the popular misconception that new observations in themselves lead to progress. New observations are inert in the absence of the reordering power of intelligence. It is precisely this reordering which can only take place within the central nervous system of the individual men which makes progress possible. To quote Butterfield: "Change was brought about, not by new observations or additional evidence in the first instance, but by transpositions that were taking place inside the

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[151]Lawrence S. Kubie, Neurotic Distortion of the Creative Process (New York: Noonday Press, 1961), pp. 50-51.

[152]Selye, op. cit., p. 98.

minds of the scientists themselves."[153] Quite obviously, one cannot form a pattern without the hard little bits of "fact" or "data"; what matters however, are not so much the individual bits, but the successive patterns into which they are arranged, then broken up and rearranged.

Poincare had all the bits of "fact" and "data" required for the synthesis for which Einstein is famous many years before Einstein made the necessary transpositions.[154] Conant assures us that "the history of science demonstrates beyond doubt that the really revolutionary and significant advances come not from empiricism but from new theories."[155] And Selye said that all of the bits of fact and data necessary for his theory regarding the stress reaction or "general adaptation syndrome" were present for all to see during the Middle Ages, if not earlier.[156] These three commentaries concerning originality in action give emphasis to the decisive importance of the effective use of intelligence.

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[153]Herbert Butterfield, The Origins of Modern Science (London: G. Bell and Sons, 1949), pp. 1-2.

[154]R. Taton, Reason and Chance in Scientific Discovery (London: Hutchinson, 1957), pp. 134-135.

[155]James B. Conant, Modern Science and Modern Man, A Doubleday Anchor Book, No. 10 (Garden City, New York: Doubleday, 1952), p. 53.

[156]Selye, op. cit., p. 97.

How does the holistic position on originality square with those proposed by the factor-analysts? Perhaps the most startling circumstance about the factor-analytic position is that it rests on one stark assumption: that originality is the production of statistically improbable responses.[157] In addition to improbability of response, "cleverness" is also used as a criterion of originality,[158] but "cleverness" is usually determined primarily on the basis of rareness of response.

MacKinnon disagrees strongly with the implications of this assumption:

> Insights, however fresh and clever they may seem, do not enter the stream of creative solutions to urgent problems unless their consequences are tested in application and revised and extended to meet the requirements of the situation for which they were first devised. What I am suggesting is that mere fluency in unusual ideas will not alone make for fresh and creative solutions to problems, but in some persons rather to "freshness" in its worst sense.[159]

MacKinnon quotes a story cited by Getzels and Jackson as evidence of originality of response to a picture in one of their creativity tests:

> This man is flying back from Reno where he has just won a divorce from his wife. He couldn't stand to live with her anymore because she wore so much cold cream on

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[157] Getzels and Jackson, Creativity and Intelligence, pp. 200-201.

[158] Guilford, "Progress in Discovery of Intellectual Factors," p. 292.

[159] MacKinnon, "Personality Correlates of Creativity," pp. 6-7. (Mimeographed.)

> her face at night that her head would slide across the pillow and hit him in the head. He is now contemplating a new skid-proof face cream.[160]

MacKinnon's response to this story is:

> Unlike Getzels and Jackson I would not interpret this story as indicative of "a mind that solves problems by striking out in new directions." Such fresh ideas as one finds in this story are not likely to lead to creative solutions, for they reveal too much freshness for freshness's sake, too much striving for shock effect and insufficient concern for reality problems. Students with this kind of originality, which I refuse to call creativity, need to be taught to pay more attention to the demands of reality and to sacrifice some of their fluency for greater attention to the quality and appropriatenesss of their ideas.[161]

The factor-analyst's apparent preference for the witty over the wise, the casual over the exact, and the verbal, emotional, and superficial over the thoughtful, objective, and penetrating, probably accounts, in large measure, for the almost total lack of correspondence between the anecdotal and objective material given to us by those who are unequestionably creative and the end result of factor-analytic speculation and technique.

Intuitiveness

Although intuition is unquestionably a prominent contributing factor over the whole range of socially useful creativity, many workers have warily avoided its examination

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[160] *Ibid.*, p. 7.

[161] *Ibid.*

because it involves a consideration of mental processes which operate below the level of awareness. And phenomena of these murky realms are considered off limits to many psychologists, especially those of the atomistic school of thought. Rugg elucidates their reluctance in these terms:

> Another handicapping preconception is the almost universal emphasis on thinking as purely verbal with corresponding neglect of feeling and non-verbal symbolization. Most of us in the Western academic world have been brought up to pay attention only to what can be sensed through the eyes, ears, and other obvious organs of perception. Our world was the circumscribed one of traditional linguistics. The problems of mind could be approached and thinking could be done only through words. All thinking must be rational, must "make sense," and its most intelligent forms were logical, verbal propositions; in fact, normal mental life was logical thinking. All else--including feeling--was "nonsense," irrational, on a par with fantasy, hallucination, illusion.
>
> Moreover, the conventional academic psychologists--connectionist, Gestalt, and experimental--have, for a long time, dealt only with conscious knowing and behaving. To this day most of our philosophic students, both the positivists and the typical followers of Dewey, have scorned or neglected the theories of nonconscious life. They have attended only to the reality-oriented mind of the sensory world, ignoring the strange but actual autistic phenomena which occurred in their own minds--dreams and other off-conscious phenomena. They stoutly maintained that attributing value to trance states was the act of crackpots and charlatans. Thus the philosophers and psychologists theorized about life and knowing on the basis of less than half of life--the conscious linguistic half--and ignored or ridiculed the unconscious and the nonverbal.[162]

Holistically oriented investigators hold that unconscious processes are manifestly important in creative thinking and therefore cannot be disregarded in any attempt to

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[162] Rugg, op. cit., pp. xx-xxi.

understand human creativity. Many of these workers agree with Murphy that all thinking is primarily unconscious: "all thinking . . . is in its core unconscious; it is only its shadow which is conscious, and this is true of free as of directed thought."[163] Other workers simply point out that "the role of the unconscious mind in creative work is clearly substantial."[164] The great creators in science and art consistently disparage the role that consciously directed thought plays in certain stages of the creative act, while ascribing the greatest importance to unconscious processes. After analyzing autobiographical statements of mathematicians and physical scientists, Koestler remarks:

> The themes that reverberate through their intimate writings are: the belittling of logic and deductive reasoning (except for verification after the act); horror of the one-track mind; distrust of too much consistency . . .; scepticism regarding all-too-conscious thinking (it seems to me that what you call full consciousness is a limit case which can never be fully accomplished. This seems to me connected with the fact called the narrowness of consciousness. . . .)[165] This sceptical reserve is compensated by trust in intuition and in unconscious guidance by quasi-religious or by aesthetic sensibilities.[166]

All through history many of those who have attempted to understand human thought have recognized that thinking

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[163]Gardner Murphy, Personality: A Biosocial Approach to Origins and Structure (New York: Harper and Brothers, 1947), pp. 410-411.

[164]Gardner, Self-Renewal, p. 34.

[165]Hadamard, op. cit., 143.

[166]Koestler, The Act of Creation, p. 146.

and reasoning, even of a trivial order, involves unconscious processes.[167] Whyte, in his book, The Unconscious Before Freud, reveals how mistaken is the popular belief that "the unconscious mind" is an invention of the twentieth century.[168] However, the invention, in a narrow sense, did come much later than did awareness of the phenomena because there was no occasion to dichotomize thinking before the Age of the Enlightenment. It was not until Descartes chose awareness or consciousness as the defining characteristic of mind that there was sufficient inducement to invent the idea of unconscious mind.[169] Whyte makes it clear that such ancients as Plotinus and Augustine took unconscious processes for granted; he also shows by quoting later luminaries, such as Aquinas, Paracelsus, Kepler, Dante, Cervantes, Montaigne, and Shakespeare, that awareness of unconscious mentation was always present until the scientific revolution was well underway. However, under the impact of the scientific revolution, and more specifically, Descartes' philosophy, this knowledge was temporarily lost.

Long before Freud, however, there was a reaction against Descartes' notion. According to Whyte, Leibnitz,[170]

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[167] Ibid., p. 163.

[168] Lancelot L. Whyte, The Unconscious Before Freud (New York: Anchor Books, 1962).

[169] Ibid., p. 25.

[170] Ibid., p. 93.

Kant,[171] Goethe,[172] and Wundt[173] among others, made knowledge of the unconscious common currency by 1870. Whyte summarizes his data on the pre-Freudian reaction in this way: "the general conception of unconscious mental process was conceivable (in post-Cartesian Europe) around 1700, topical around 1800, and fashionable around 1870-1880."[174]

Rugg thinks that the current indisposition among educators to ponder the handiwork of the unconscious was influenced by Dewey's book, How We Think[175] which appeared over fifty years ago:

> It became clear that the key to the nature of the creative act lay in giving up long-held presuppositions concerning the conscious problem-solving nature of the act of thought and in beginning again with a new orientation. It is fifty years since Dewey first set us on the track of problem-solving. Since his first edition of How We Think, most educational philosophy has followed his emphasis on problem-solving and has neglected the prior phase--discovery of the problem. This reorientation led to the second theorem.
>
> The great scientists and artists and their biographers (Einstein-Wertheimer, Kepler-Koestler, Cezanne-Gasquet, Coleridge-Lowes, to cite only four) saw the problem in new dimensions, centering attention on the nature of discovery. The examination of scores of such reports, buttressed by thirty years of handling the experimental data from the biosocial-psychology of thinking, brought to light a reorienting new dimension in the study of the act of thought. While there is only one basic human act of response, it is governed by two different orientations: the feeling mood of discovering and the logical thinking mood of verifying.[176]

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[171] Ibid., p. 107.

[172] Ibid., pp. 119-120.

[173] Ibid., p. 152.

[174] Ibid., pp. 160-161.

[175] John Dewey, How We Think (Boston: D. C. Heath, 1910).

[176] Rugg, op. cit., pp. 289-290.

Many recent writers agree with Rugg concerning the weighty importance of the discovery phase.[177] And Russell called attention to this two-fold relationship concerning the feeling mood and the logical thinking mood using slightly different terms: "we must consider man in the light of a kind of marriage between mysticism and science, between reason and intuition."[178]

Whatever the reason for ignoring unconscious processes, the verdict of creative thinkers is unequivocal concerning the inadequacy of logical reasoning and conscious thought for certain phases of creativity. And an increasing number of workers are turning from the exclusive focus on the intentional regulation of the thought processes by the will and intellect to other equally important phases of the creative process. Taylor, for example, reporting on the proceedings of The Fifth Utah Creativity Research Conference said: "we are probing into complex and unwieldy areas that deal with numerous characteristics, some of which appear to be almost intangible, such as intuition and the various stages in the complex creative process."[179]

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[177]Henle, op. cit., p. 58; Newell, Shaw, and Simon, op. cit., p. 69; Golovin, op. cit., p. 15; Cantril, op. cit., p. 340; and Selye, op. cit., p. 45.

[178]Bertrand Russell, Mysticism and Logic (New York: Doubleday, 1917).

[179]Calvin W. Taylor (ed.), Widening Horizons in Creativity (New York: John Wiley and Sons, 1964), p. xiv.

The growing awareness of the crucial importance of intuition in creativity is illustrated by this excerpt from the 1962 presidential address by Allendoerfer to the Mathematical Association of America:

> Let me describe briefly the process of mathematical discovery. Beginning with nature, we seek to find as many relationships within it as we can. If we can systematize these, we do so, but a lack of organization of our material does not keep us from pushing forward. On the basis of what we have observed, we guess theorems and use these to derive other theorems. Immediately we rush to apply these back again to nature and proceed headlong if our predictions are successful. Axioms, logic, and rigor are thrown to the winds, and we become intoxicated with our success and open to dreadful errors.
>
> This process is called "intuition" and its nature is a matter of the greatest conjecture, in spite of the writings of several of our most distinguished colleagues. The successful unraveling of this process would be a major contribution to the understanding of the human mind. But, it is by this means, explained or not, that the great majority of mathematical theorems are first discovered. The products of this intuitive discovery are frequently wrong, usually unorganized, and always speculative. And so there follows the task of sorting them out, weaving them into a proper theory, and proving them on the basis of a set of axioms. It is at this stage that the mathematical model is likely to be constructed. The details of this process go in our seminars and in our discussions in the corridors of meetings like this, but almost never appear in print. Hence the inner circle of creative mathematicians have the well-kept secret that in a great many cases theorems come first and axioms second. This process of justifying a belief by finding premises from which it can be deduced is shockingly similar to much reasoning in our daily lives, and it is somewhat embarrassing to me to realize that mathematicians are experts in this art. . . .
>
> As I turn now to the reform movement in the teaching of mathematics, let me first discuss intuition. It is here that the learning process must begin, for in some sense the student must follow the path by means of which mathematics developed in the first place. . . .[180]

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[180] Carl B. Allendoerfer, "The Narrow Mathematician," The American Monthly, LXIX, No. 6 (1962), 461-469.

The following statement by Koestler concerns the work of mathematicians and physicists and is relevant to the statement above:

> The evidence for large chunks of irrationality embedded in the creative process, not only in art (where we are ready to accept it) but in the exact sciences as well, cannot be disputed; and it is particularly conspicuous in the most rational of all sciences: mathematics and mathematical physics.
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> . . . . . .
>
> Here, then, is the apparent paradox. A branch of knowledge which operates predominantly with abstract symbols, whose entire rationale and credo are objectivity, verifiability, logicality, turns out to be dependent on mental processes which are subjective, irrational, and verifiable only after the event.[181]

Polya, a contemporary mathematician, and Gauss, a great mathematician of the past, agree. Polya, as paraphrased by Koestler, remarks: "when you have satisfied your self that the theorem is true, you start proving it."[182] Gauss described in a letter to a friend how he finally proved a theorem on which he had worked unsuccessfully for four years:

> At last two days ago I succeeded, not by dint of painful effort but so to speak by the grace of God. As a sudden flash of light, the enigma was solved. . . . For my part I am unable to name the nature of the thread which connected what I previously knew with that which made my success possible.[183]

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[181] Koestler, The Act of Creation, pp. 146-147.

[182] Ibid., p. 118.

[183] J. M. Montmasson, Invention and the Unconscious (London: K. Paul, 1931), p. 77.

Einstein categorically agrees with Allendoerfer, Koestler, Gauss, and Polya: "there is no logical way to the discovery of these elemental laws. There is only the way of intuition which is helped by a feeling for the order lying behind the appearance."[184]

Koestler compares the two types of thinking, showing clearly some of the strengths and weaknesses of each:

> Purposive thinking, then, may be compared to the scanning of a landscape with the narrow beam of focal vision--whether it is a panorama, a chessboard or an "inner landscape." Those features which are relevant to the purpose of the operation will stand out as "members" of the matrix, while the rest sinks into the background. Thus the first act in skilled routine-thinking and problem-solving is the "tuning-in" of the code appropriate to the task, guided by some obvious similarity with situations encountered in the past. This leads to the emergence of a matrix which provides a preliminary selection of possible moves; the actual moves depend on strategy, guided by feedback, and distorted by emotional interference.
>
> However, the problems which lead to original discoveries are precisely those which cannot be solved by any familiar rule of the game, because the matrices applied in the last to problems of similar nature have been rendered inadequate by new features or complexities in the situation, by new observational data, or a new type of question. The search for a clue, for Poincare's "good combination" which will unlock the blocked problem, proceeds on several planes, involving unconscious processes at various levels of depth.[185]

And Selye affirms that: "only development can be guided by a preconceived design. True discovery is an unconsciously directed intuitive process."[186] Selye also adduces other

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[184]Quoted in Selye, op. cit., p. 47.

[185]Koestler, The Act of Creation, p. 209.

[186]Selye, op. cit., p. 224.

reasoned statements to support his contention that logical reasoning is a weak tool in producing new knowledge:

> Paradoxical as this may seem, the practical value of formal logic, the laws of thought and the scientific method is very limited indeed, both in everyday life and in science.
>
> . . . . . .
>
> The impression that scientific research is based on the planned application of logic is largely due to the fact that intuitively directed probings into the unknown are forgotten and only the simplest logical road to success is published and remembered. This artificial path is also the only one taught to students.[187]

Bridgman, a Nobel prize-winner in physics, has little regard for the "scientific method":

> It seems to me that there is a good deal of ballyhoo about scientific method. I venture to think that the people who talk most about it are the people who do least about it. . . . Scientific method is something talked about by people standing on the outside wondering how the scientist manages to do it. These people have been able to uncover various generalities applicable to at least most of what the scientist does, but it seems to me that these generalities are not very profound, and could have been anticipated by anyone who knew enough about scientists to know what is their primary objective.[188]

And Poincare,[189] Planck,[190] and Einstein[191] see little use for "logical reasoning" in new discoveries. Selye submits this metaphorical distinction between logical and intuitive thinking:

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[187] Ibid., pp. 264-265.

[188] Quoted in Selye, op. cit., p. 263.

[189] Beveridge, op. cit., p. 263.

[190] Ibid., p. 75.

[191] Ibid., p. 77.

> To my mind, logic is to Nature as a guide is to a zoo. The guide knows exactly where to locate the African lion, the Indian elephant or the Australian kangaroo, once they have been captured, brought together and labeled for inspection. But this kind of knowledge would be valueless to the hunter who seeks them in their natural habitat. Similarly, logic is not the key to Nature's order but only the catalog of the picture gallery in man's brain where his impressions of natural phenomena are stored.[192]

Rugg contends that the superiority of intuition is due to the fact that a far greater number of premises can be drawn into simultaneous consideration.[193] Kubie proposes that the primary purpose of conscious thought is for communication. We can formally communicate, says Kubie, only one meaning at a time, whereas in much thinking many things must be considered simultaneously--and that is done in the preconscious (that is, intuitively).[194] Selye also alleges that "the weakness of the conscious mind is that it can handle only one problem at a time,"[195] and outlines his hypothesis concerning the way unconscious thinking leads to intuitive insight. He does this by drawing an analogy between the multitudinous physiological processes which must be carried on concurrently and the apparent ability, based on objective outcomes, of unconscious mental processes to process information on several levels simultaneously:

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[192]Selye, op. cit., p. 266.

[193]Rugg, op. cit., p. 262.

[194]Kubie, op. cit., pp. 24-25.

[195]Selye, op. cit., p. 54.

> As the study of physiologic phenomena has shown, unconscious (e.g., biochemical) activities can proceed on a very large scale and concurrently in essentially different directions. Perhaps this is true of unconscious thinking also. Perhaps our unconscious mind can think sumultaneously of the most varied subjects and, hence, compare the seed of a new idea with many more potentially relevant facts than conscious intellect could.
>
> Unjustified prejudices, the habitual approach to a problem from an unapproachable side, and other mistakes about the way we consciously handle a subject are forgotten while the conscious mind is otherwise occupied or asleep. Consequently, when our idea comes up from incubation to the fringe of consciousness again, it is not only more mature but we are more likely to catch it. When unexpectedly faced with a glimpse of its outlines we are then more likely to grasp the idea through a new approach by a sudden, unpremeditated mental reflex. In other words, during incubation, established fruitless associations lapse from memory and thereby give new, potentially fruitful associations a chance.[196]

Koestler concurs with Selye and gives examples from key creative episodes in the work of such men as Gutenberg, Archimedes, Pasteur, Darwin, and Fleming.[197]

The energy that activates the unconscious processes, according to Rugg, is complete absorption in contemplation of the goal--absorption such that the whole personality becomes saturated with the problem.[198] Koestler concurs again:

> When all hopeful attempts at solving the problem by traditional methods have been exhausted, thought runs around in circles in the blocked matrix like rats in a

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[196] Ibid., p. 57.

[197] Koestler, The Act of Creation, p. 209.

[198] Rugg, op. cit., p. 309.

> cage. Next, the matrix of organized, purposeful behavior itself seems to go to pieces, and random trials make their appearance, accompanied by tantrums and attacks of despair--or by the distracted absent-mindedness of the creative obsession. That absent-mindedness is, of course, in fact single-mindedness; for at this state--the "period of incubation"--the whole personality, down to the unverbalized and unconscious layers, has become saturated with the problem, so that on some level of the mind it remains active, even while attention is occupied in a quite different field. . . .[199]

One important aspect of intuition which Rugg makes clear, and which we have touched on previously, is the role of intelligence. Rugg holds that the unifying or clarifying idea which we call intuition can not spring into consciousness unless the key concepts have been mastered by the individual. In other words, intelligence must prepare the way for intuition:

> Every idea that has moved the world has been created by one imaginative mind or by a succession of them. This means that enough of the factual minutiae to guarantee understanding of the key concepts must be passed through a single organism, if the spark, the flash of meaning, is to jump across the barrier.[200]

While intuition is an immediate apprehension or cognition without rational thought,[201] a high level of rational thought, i.e., dynamic intelligence, must enter into the development of the pertinent matrices before they can be connected by the

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[199]Koestler, The Act of Creation, p. 119.

[200]Rugg, op. cit., p. xvi.

[201]Selye, op. cit., p. 47.

spark of intuition.[202] Minor intuitive leaps occur at all levels, including responses to questions on factor-analytic creativity tests, but socially significant novelty can only emerge after the highest levels of existing knowledge have been mastered and found wanting: "Minor, subjective bi-sociative process do occur on all levels, and are the main vehicle of untutored learning. But objective novelty comes into being only when subjective originality operates on the highest level of the hierarchies of existing knowledge."[203]

MacKinnon found his creative subjects were intuitive, which he defines primarily in terms of perception. He reports that his highly creative subjects were not bound to "sense-perception" but were "imaginatively alert" and "responsive to the deeper meanings, the implications, and the possibilities for use or action of what is experienced by way of the senses." He calls this "immediate grasping of the real as well as the symbolic bridges between what is and what can be . . . intuitive perception."[204] MacKinnon's "intuitive-perception" is thus very similar to Rugg's "imagined conception" which, as we saw in the last section, is contingent upon the effective use of intelligence. While high intelligence will not assure intuitive-perception,

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[202]Rugg, op. cit., pp. 12-13; and Koestler, The Act of Creation, p. 575.

[203]Ibid., p. 658.

[204]MacKinnon, "Personality Correlates of Creativity," p. 13.

socially useful intuitive-perception is dependent on a background of knowledge and understanding that can only issue from intelligent behavior.[205] To understand the importance of intelligence in intuitive-perception, we must distinguish between imagination itself and the ability to choose potentially important imaginary pictures and actively conceive, at the pre-verbal, intuitive level, general applications:

> The flair for the potential practical or theoretic importance of the things that we imagine is not itself imagination; it is merely a prerequisite for the selection, among innumerable imaginary pictures, of those having significant applications in reality.
>
> The combined activity of first imagining and then fixing the important aspects of the imagined picture on to conscious reality is the basis of creative thought--the most elevating and satisfying activity of which the human mind is capable. The act of scientific and artistic creation, much like that of procreation, gives the enjoyment of release from the tensions of a need--a hunger--which, when appeased, leaves our whole being delightfully flagged by the sense of fulfillment.
>
> Most of the discoveries which are usually attributed to chance are actually made by virtue of a prodigious power of imagination which immediately visualizes manifold general applications of the chance observation.[206]

There is an interesting point to be brought out concerning intuition and the Guilford-type creativity tests. These tests, as Cronbach suggests,[207] do probably place a greater demand on the intuitive facility than the traditional tests of convergent thinking. However, although

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[205]Bruner, "The Conditions of Creativity," p. 4; Golovin, op. cit., pp. 18-20; and Rugg, op. cit., pp. 303, 311.

[206]Selye, op. cit., p. 45.

[207]Lee J. Cronbach, Educational Psychology (2nd ed.; New York: Harcourt, Brace and World, 1963), p. 234.

these tests do require many intuitive insights in the service of very minor productions, the analytic, reductionistic, reactivistic, theoretical orientation of the factor-analysts has led them to judge intuition to be an inappropriate subject for investigation per se. They are interested in certain specific products of intuition--but they are not particularly concerned with the psychic transmutations involved. Holistic investigators on the other hand, with the indispensable help of some of the greatest creators themselves, have compiled a considerable literature on the subject of intuition itself.

Theoretical and Esthetic Orientation

In considering theoretical and esthetic values together we are following the precedence of Allport-Vernon-Lindsey[208] and MacKinnon.[209] Creative individuals have been found to score highest on these two scales of the Allport-Vernon-Lindsey Study of Values by numerous studies. For instance, in discussion scores made on this instrument, MacKinnon stated that "all of our creative subjects hold most dear the theoretical and esthetic values."[210] Another main reason for considering these two values, or interests,

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[208]Allport, Vernon, and Lindzey, op. cit.

[209]MacKinnon, "Personality Correlates of Creativity."

[210]Ibid., pp. 14-15.

together is the fact that certain esthetic aspects of creativity were explored rather extensively in the first section of this chapter, making it unnecessary to devote a great amount of space to this subject.

It would appear, on the surface at least, that "the theoretical value with its cognitive and rational concern with truth and the esthetic value with its concern with form and beauty"[211] would represente distinct polarities and thus be more or less incompatible elements within an individual personality. Undoubtedly, theoretical and esthetic values are often antagonistic within individual personalities and often cause psychological conflict between groups; however, Koestler explains why they belong together in the creative act:

> The experience of truth, however subjective, must be present for the experience of beauty to arise; and vice versa, the solution of any of "nature's riddles," however abstract, makes one exclaim "how beautiful" . . . . Beauty is a function of truth, truth a function of beauty. They can be separated by analysis, but in the lived experience of the creative act--and of its recreative echo in the beholder--they are inseparable as thought is inseperable from emotion. They signal, one in the language of the brain, the other the bowels, the moment of the Eureka cry. . . .[212]

Koestler also expresses the relationship in these terms:

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[211] Ibid., p. 16.

[212] Koestler, The Act of Creation, p. 331.

> The intellectual aspect of this Eureka process is closely akin to the scientist's--or the mystic's--"spontaneous illumination"; the perception of a familiar object or event in a new, significant, light; its emotive aspect is the rapt stillness of oceanic wonder. The two together--intellectual illumination and emotional catharsis--are the essence of the aesthetic experience. The first constitutes the moment of truth; the second provides the experience of beauty. . . . Every scientific discovery gives rise, in the connoisseur, to the experience of beauty, because the solution of the problem creates harmony out of dissonance; and vice versa, the experience of beauty can occur only if the intellect endorses the validity of the operation--whatever its nature--designed to elicit the experience.[213]

There are other reasons for considering these two values together. A theory is fundamentally an expression or prediction of something that can be done with objects or concepts. In other words, a theory is an imagined conception which, as we have seen, many workers claim is dependent upon, or at least facilitated by intuitions guided by esthetic sensitivity.[214] Theory-making also depends upon the discovery of similarities or anaolgies in otherwise dissimilar things, which is also dependent upon intuitive perceptiveness.[215] MacKinnon offers some reasons why the valuation of theory and intuitive perceptiveness, which as

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[213] Ibid., pp. 328-329.

[214] Hadamard, op. cit., p. 31; Koestler, The Act of Creation, p. 344; Dirac, "The Evolution of the Physicists Picture of Nature," pp. 46-48; and Rugg, op. cit., p. 196.

[215] Jacob Bronowski, "The Creative Process," Scientific American, CXIX, No. 3 (September, 1958), pp. 5-7; Selye, op. cit., p. 271; and Bruner, "The Conditions of Creativity," p. 6.

we have seen, is considered to be guided by esthetic sensitivity, should be closely interrelated:

> A prizing of theoretical values is congruent with a preference for intuitive-perception, for both orient the person to seek some deeper or more meaningful reality which lies beneath or beyond that which is actually present to the senses. Both set one to seek truth which resides not so much in things in themselves as in the relating of them one to another in terms of identities and differences and in terms of over-riding principles of structural and functional relationships.[216]

"The accumulation of new facts do not make a new theory; neither do they alone destroy an outlived theory. In both cases creative originality is necessary to achieve the task."[217] Conant concurs on this point: "we can put it down as one of the principles learned from the history of science that a theory is only overthrown by a better theory, never merely by contradictory facts."[218] The collection of new facts is important, but we lose sight of the fact that "they are found as the result of a search in a definite direction based on theoretical considerations."[219] Even though we are often unaware of it, theoretical considerations are pervasively dominant in all aspects of our search for and use of facts.

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[216]MacKinnon, "Personality Correlates of Creativity," p. 15.

[217]Koestler, The Act of Creation, p. 235.

[218]Quoted in Selye, op. cit., p. 280.

[219]Koestler, The Act of Creation, p. 234.

> The collection of new empirical data is of essential importance, but both the collection and interpretation of the data are selective processes guided by theoretical considerations. The history of every science proves that observations and experiments which prima facie seem to contradict a theory do not necessarily lead to its abandonment; and vice versa, successful theories (such as the heliocentric system of Special Relativity) have been built on data which had been available for a long time by rearranging the mosaic of hard facts into a different pattern.[220]

The contributions of the theory-makers are effected by transformations within the internal conceptual models of the world which their central nervous systems must carry out and then communicate to others.[221] These innovators have not changed civilization by making or doing new things alone, but also, and perhaps primarily, by bringing about new ways of thinking about things.

> We tend to think of innovators as those who contribute to a new way of doing things. But many far-reaching changes have been touched off by those who contributed to a new way of thinking about things. Thus did Planck, Einstein and Rutherford end the Newtonian era and usher in modern physics. Thus did Socrates, Zeno of Citium, St. Augustine, Copernicus and Darwin alter the course of intellectual history.[222]

Rugg speaks of the common esthetic mood which governs the work of both artist and scientist, and avers that in the early stages of creative endeavor both work as

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[220] Ibid., p. 253.

[221] K. J. W. Craik, The Nature of Explanation (London: Cambridge University Press, 1943), p. 61.

[222] Gardner, Self-Renewal, pp. 30-31.

intuitive artists.[223] It is clear that many accept the notion that there is a complementary and synergistic relationship between theoretical efforts toward truth and the esthetic experience of beauty.

Ghiselin points up another aspect of this relationship when he states that "the idea of inspiration as an emergence of new insight attended by more or less intense feelings of conviction and esthetic delight" is "verifiable in terms of the experience of every kind of worker."[224] This is a common theme among those noted for their creativity. Theoretical insight is always accompanied by intense feelings of esthetic delight. Koestler says:

> In both cases the flash of spontaneous illumination is followed by emotional catharsis; "truth" and "beauty" appear as complementary aspects of the indivisible experience. The difference between the two in objective verifiability is a matter of degrees, and arises only after the act; the act itself is in both cases a leap into the dark, where scientist and artist are equally dependent on their fallible intuitions.[225]

Richet gives us another valuable clue regarding the close relationship between the theoretical and the esthetic: "Probably, what characterizes all scientists, whatever they

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[223] Rugg, op. cit., p. 32.

[224] Brewster Ghiselin, "The Creative Process and Its Relation to the Identification of Creative Talent," Scientific Creativity: Its Recognition and Development, ed. by C. W. Taylor and Frank Barron (New York: John Wiley and Sons, 1963), p. 356.

[225] Koestler, The Act of Creation, p. 344.

may be, archivists, mathematicians, chemists, astronomists, physicists, is that they do not seek to reach a practical conclusion by their work."[226] Selye had prefaced this quote by the following clarifying statement:

> The principal "use" of basic research, like that of a rose, a song, or a beautiful landscape is that it gives us pleasure. Every scientific discovery reveals new harmonies in the lawfulness of Nature for our passive enjoyment. But research is not a mere "spectator sport," the scientist actively participates in the unveiling of the enjoyable, and this type of activity is as close as the human mind can come to the process of creation.[227]

And he makes the point crystal clear in the following statements:

> Not everything important to us is practical in the accepted sense of the word. . . . Pure art--a great painting, a piece of music--is useful since it lifts us beyond the preoccupations of everyday life; it brings us peace, serenity and happiness. Basic research, the study of natural laws, is often undertaken for the same reasons. . . . Discovery through basic research is enjoyable, irrespective of its possible practical applications. . . . To the scientist, even the ugliest truth is more beautiful than the loveliest pretense.[228]
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> . . . . . .
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> The inspired painter, poet, composer, astronomer, or biologist never grows up in this respect; he does not lose the abstract treasures of his naive innocence, no matter how poor or how old he may be. He retains the childlike ability to enjoy the impractical. And pleasures are always impractical; they can lead us to no reward. They are the reward.[229]

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[226] Quoted in Selye, op. cit., p. 7.

[227] Ibid., pp. 5-6.

[228] Ibid., pp. 7-8.

[229] Ibid., pp. 9-10.

The most basic and important theorizing is done because truth is self-sufficient--it is its own reward. It thus appears that one of the major motivations of the great contributors is the esthetic satisfaction of gaining insights into the nature of the universe.

Bruner's theory of the creative act holds that theoretical and esthetic values are intimately related. First, he defines creativity as an act that produces effective surprise.[230] Bruner then says that there are three kinds of effectiveness: predictive, formal, and metaphorical. Each of these types of creative effectiveness appears to pertain to the construction of different kinds of theories. Predictive effectiveness appertains to the most easily verifiable kinds of theories such as scientific formulas for natural phenomena. Formal effectiveness refers to the "ordering of elements in such a way that one sees relationships that were not evident before, groupings that were before not present, ways of putting things together not before within reach."[231] Bruner states the the usual place for formal effectiveness is in mathematics and logic. Although he points out that unconscious processes must guide the formal connections made between elements,[232] it is clear that the end results would

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[230]Bruner, "The Conditions of Creativity," p. 3.

[231]Ibid., p. 5.

[232]Ibid.

be more easily verifiable than the third theoretical mode and less easily verifiable than the first.[233] Metaphorical effectiveness "is effective by connecting domains of experience that were before apart, but with the form of connectedness that is art."[234] "Metaphoric combination leaps beyond systematic placement [such as we found in the case of formal effectiveness], explores connections that before were unsuspected." At this point Bruner states in a footnote that each of these three kinds of theorizing ultimately fit a common criterion of beauty:

> The formal, the empirical, and the aesthetic--these are the three principal expressions of cognitive functioning and each generates its own criterion of effectiveness, even of truth. It is worth a note in passing that the three modes have at least one thing in common: at the frontiers of their respective excellence, they all seem to fit a common criterion of beauty.[235]

One very interesting, but largely unanalyzed and ignored, similarity between theoretical and esthetic productions is the necessity of distortion in both. Much less attention has been devoted to the inevitability of distortion in theoretical productions but, nevertheless, it is recognized. The following gleanings from a standard text in educational psychology illustrates this. Cronbach says that a concept is an "imagined action" and that "formal reasoning"

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[233] Ibid., p. 5.

[234] Ibid.

[235] Ibid., p. 6.

occurs only when one imaginatively relates symbols and concepts.[236] This is done by the learner's own efforts[237] at the expense of simplification and misrepresentation.[238] Distortion is inevitable because the individual obviously must ratiocinate with incomplete data--as Cronbach says, "there is no end to improving the precision and depth with which a concept is understood."[239]

Koestler not only elaborates upon the inevitability of distortion, but also the value of distortion in the creative act. Koestler avers that "originality, emphasis, and economy . . . play . . . a significant part in the techniques of scientific theorizing and artistic creation."[240] In terms of artistic creation, these three criteria involve selection, exaggeration, and simplification of human experience and natural phenomena in the service of effectiveness.[241] More generally, when we theorize we "abstract and discriminate only qualities which are relevant to us; and new discriminations arise as a result of changes of our criteria of relevance."[242] Koestler defines originality in

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[236]Cronbach, Educational Psychology, pp. 333-340.

[237]Ibid., p. 342. [238]Ibid., p. 393.

[239]Ibid., p. 393.

[240]Koestler, The Act of Creation, p. 82.

[241]Ibid., pp. 333-334.

[242]Ibid., p. 612.

terms of the magnitude of the deviation of the emphasis: "the measure of an artist's originality, put into the simplest terms, is the extent to which his selective emphasis deviates from the conventional norm and establishes new standards of relevance."[243] While deviation from the norm does not necessarily signify distortion of reality, the abstraction, exaggeration, and simplification, which do obtain in at least some phases of the creative act, means that distortion plays an important role in both conceptual and artistic creativity.

Rugg is very specific concerning this point. He says that the very essence of the creative act is the distortional nature of the imagery that obtains when the preconscious is freely associating upon a problem which concerns the individual.[244] Rugg claims that every creative act abstracts and thus distorts because "distortion is the name given technically to the process of producing an abstraction."[245] Rugg contends that "the artist can produce a creative and unified work of art only by distorting."[246] Leo Stein said that distortion "is the essence of aesthetic

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[243] Ibid., p. 334.

[244] Rubb, op. cit., pp. 218-219.

[245] Ibid., p. 219.

[246] Ibid.,

expression."[247] And he quoted Matisse as saying that "he never began a picture without hoping that this time he would be able to carry it through without any distortion that would disturb the ordinary onlookers." But that in every case the creative requirements upon him led to pictorial dimensions which "had been pulled entirely out of shape."[248]

A close relationship between theoretical interests and intelligence is to be expected. Theoretical interests according to MacKinnon, are carried largely in abstract and symbolic terms. In science, for example, "the change the world of phenomenal appearances into a world of scientific constructs."[249] This would indicate that theoretical interests would tend to correlate well with the ability to do abstract thinking which is an important aspect of intelligence. Broudy states that intellectual power is greatest when theoretical competence is reached.[250] Cronbach sees intellectual development in terms of transfer of learning,[251] and Dewey avers that this can only take place through

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[247]Leo Stein, The A-B-C of Aesthetics (New York: Boni and Liveright, 1927), p. 122.

[248]Ibid., p. 124.

[249]MacKinnon, "Personality Correlates of Creativity," p. 15.

[250]H. S. Broudy, "Mastery," Language and Concepts in Education, ed. by B. O. Smith and Robert O. Ennis (Chicago: Rand McNally, 1961), p. 84.

[251]Cronbach, Educational Psychology, pp. 314-348.

abstraction: "Abstraction is indispensable if one experience is to be applicable in other experiences."[252]

There is a small amount of empirical evidence extant concerning the relationship between the two characteristics of theoretical and esthetic valuation and that of intelligence. The Allport-Vernon-Lindzey Study of Values was administered to three populations of college freshmen which differed considerably in scholastic ability. The populations consisted of 256 freshmen at Michigan State University, 82 freshmen at the University of California at Berkeley, and 604 National Merit Scholars. In scholastic ability the MSU freshmen were slightly higher than the national mean for college freshmen, the UC freshmen showed a mean aptitude score a full standard deviation above the national mean, and the National Merit Scholars showed a mean which was one and one-half standard deviations above the UC mean.[253]

Because of the interdependence of scores on the six A-V-L scales, tests of significance should not be applied to the differences between groups on the individual scales,[254]

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[252]John Dewey, Reconstruction in Philosophy, A Mentor Pocketbook, M 53 (New York: The New American Library, 1950), p. 124.

[253]Jonathan R. Warren and Paul A. Heist, "Personality Attributes of Gifted College Students," Science, CXXXII (September, 1960), 333.

[254]Ibid., p. 334.

however, for both men and women the profiles diverged most sharply on the theoretical and esthetic scales.[255] The University of California sample was considerably higher than the Michigan State University sample and the National Merit Scholar sample was much higher than the University of California sample.

> The gifted students value the theoretical and esthetic orientations relatively higher and the economic, or utilitarian, relatively lower than do the students in the comparative samples. . . . The gifted, then, take greater interest than do the more typical students in cognitive and intellectual pursuits. They are more concerned with harmony and form in sensory experience and have a greater appreciation of the artistic. These higher theoretical and esthetic values appear in connection with a lower interest in the utilitarian and the practical.[256]
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> . . . . . .
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> High Esthetic scores have repeatedly proved to be a strong correlate of scholastic and intellectual interests. . . . This orientation, often more than the theoretical, denotes a set of attitudes which serves as a strong component of intellectualism. A combination of high Esthetic and high Theoretical scores is even more indicative of a strong intellectual orientation.[257]

Social Maturity and Independence

We assume with McLeod that "the cognitive field includes not only all the things, events, and relations as they are apprehended, but also the self which is the crucial

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[255] *Ibid.*, p. 334.

[256] *Ibid.*, pp. 334-335.

[257] *Ibid.*, p. 336.

anchorage point of all apprehension."[258] The focal point of this section is the importance of the relationship between the self and society in terms of creative and intelligent behavior. There are obviously numerous times in the typical creative act when filling certain social roles adequately is necessary for establishing and maintaining indispensable communication networks. In fact, this is often a prerequisite for even an opportunity to be creative.[259] The creative act inescapably occurs within a social context, is circumscribed by social requirements, and is evaluated by social standards.[260] As Stein says, "creativity is the resultant of processes of social transaction."[261]

Allport believes that thought is an integral part of personality and that the basic weakness of the socially immature is an inability to discern reality.

> Thought is an integral part of personality. One might say that the life of feeling and emotion is the warp and that higher mental processes are the woof of the fabric. . . . The everyday perceptions and cognitions of the sound personality are on the whole marked

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[258] McLeod, "Retrospect and Prospect," p. 190.

[259] Morris I. Stein, "A Transactional Approach to Creativity," Scientific Creativity: Its Recognition and Development, ed. by Calvin W. Taylor and Frank Barron (New York: John Wiley and Sons, 1963), p. 224.

[260] Richard S. Crutchfield, "Conformity and Creative Thinking," Contemporary Approaches to Creative Thinking, ed. by Howard E. Gruber et al. (New York: Atherton Press, 1962), p. 138.

[261] Stein, "A Transactional Approach to Creativity," p. 218.

> by efficiency and accuracy. One might say that the sound person has "sets" that lead to veridicality to a greater degree than do persons not so sound. Maturity does not bend reality to fit one's needs and fantasies.
> . . . . . .
> Not only are the preceptions mostly veridical, and cognitive operations accurate and realistic, but appropriate skills are available for solving objective problems. An otherwise sound person who lacks the know-how of his trade--be it mechanics, statecraft, or housekeeping--will not have the security or the means for self-extension that maturity requires. Although we often find skillful people who are immature, we never find mature people without problem-pointed skills.[262]

Only the socially mature are able to stay in close touch with reality and to see objects, people and situations for what they really are.[263]

Rugg and Maslow express a very similar idea when they speak of the need to be free of the defensive mind in order to see clearly.[264] It is the truly independent thinker who is able to shed defensiveness and thus benefit from the favorable contributions of society while avoiding the unfavorable. Social maturity thus appears to be a non-cognitive dimension of personality which, nevertheless, may be a necessary foundation for creative production of a high order.[265]

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[262]Allport, Pattern and Growth in Personality, pp. 288-290.

[263]Ibid., p. 290.

[264]Rugg, op. cit., p. 211; and Abraham H. Maslow, Toward a Psychology of Being, An Insight Book (Princeton, New Jersey: Van Nostrand, 1962), pp. 42-56.

[265]Crutchfield, "Conformity and Creativity," p. 139.

Selye may have specified a particular aspect of this foundation by arguing that independence of thought is the basis of imagination and intuition. He also, rather interestingly, and paradoxically, states that independence of thought also depends on imagination. He avers that independence of thought, which he sees primarily as "initiative and resourcefulness in taking the introductory step" depends upon imagination, which in turn is, "the power to form a conscious idea of something not previously perceived in reality."[266] The complementary aspect of this complex phenomena is expressed in this statement by Selye: ". . . far-reaching independence of thought is also the basis of imagination and intuition, the most important attributes of scientific genius."[267] Attainment of independent thinking and imaginative intuition is thus, for Selye, obviously the result of a synergistic interaction. In any event, Selye holds that social maturity and independence of thought form a requisite substratum for creative productivity and intelligent behavior in general.

We have known for some time that independence and other personality characteristics have a decided effect on measured intelligence. In comparing those who gained in IQ over a period of time with those who lost, Sontag et al.

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[266]Selye, op. cit., p. 42.

[267]Ibid., p. 43.

found that the ones who gained were characterized by independence, mastery, and self-confidence.[268] Other studies have arrived at much the same conclusion.[269] If independence is important in intelligent behavior, as measured by mental aptitude tests, it clearly is at least as important, if not much more so, in creativity. Henle speaks of the independence and freedom in thinking which enables one to break out of the existing conceptual system when that system of assumptions, meanings, and knowledge no longer does justice to the given situation.[270] Selye says that the most important thing he has learned during a lifetime of creative scientific endeavor, is self-confidence,[271] and one prerequisite of self-confidence is one's ability to think independently.[272]

Great progress can only be made, affirms Selye, "by ideas which are very different from those generally accepted

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[268]L. M. Sontag, C. T. Baker, and V. Nelson, "Mental Growth and Personality Development: A Longitudinal Survey," Monographs of the Society for Research in Child Development, XXIII, No. 68 (1958).

[269]Jerome Kagan et al., "Personality and IQ Change," Journal of Abnormal Social Psychology, LVI (1958), 261-266; and Nancy Bayley, "On the Growth of Intelligence," The American Psychologist, X (December, 1955), 805-818.

[270]Henle, op. cit., p. 37.

[271]Selye, op. cit., p. xii.

[272]Hudson, op. cit., p. 124.

at the time."[273] Empirical studies make it clear that independence is necessary in at least two different stages in the emergence of unique ideas. The first stage concerns the perception of a new idea. The experiments of Asch,[274] and others[275] demonstrate that our basic perceptual capacities are dependent on such personality factors as emotional maturity, independence, and nonconformity. Unique ideas will not be perceived with clarity by individuals who have not achieved a certain level of independence.[276] The other stage has to do with the development and communication of the idea, which patently requires independence and social maturity. No one is going to develop and adequately communicate a significant new idea without an independence from external standards of value and the ability to successfully meet the social requirements implicit in the process of communication.

Another most interesting and critical facet of the creative act is the necessity of being intensely interested in the subject while simultaneously remaining detached. The

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[273] Selye, op. cit., p. 151.

[274] Solomon E. Asch, "Studies of Independence and Conformity," Psychological Monographs, LXX, No. 9 (1956).

[275] Jerome S. Bruner, J. J. Goodnow, and G. A. Austin, A Study of Thinking (New York: John Wiley and Sons, 1956); and Richard S. Crutchfield, "Personal and Situational Factors in Conformity to Group Pressure," Acta Psychologica, XV (1959), 386-388.

[276] Crutchfield, "Conformity and Creativity," pp. 120-121.

countless studies showing the detrimental effects of ego involvement, considered together with the many studies demonstrating the beneficial effects of task involvement, point up the importance of this facet of the creative process. Crutchfield makes the point well in this statement:

> There is a large body of laboratory and clinical evidence indicating that ego-involvement, as compared with task-involvement, is detrimental to cognitive functioning. When there is intensely aroused motivation, especially when it is predominantly ego-involved with widespread emotional reverberations in the person, adaptive cognitive processes tend to become more inflexible.[277]

The immature person finds this particular combination, of intense interest and detachment in terms of ego involvement, a most difficult obstacle because personal needs tend to prevent complete involvement in the task itself. "Real thinkers," writes Wertheimer, "forget about themselves in thinking. The main vectors in genuine thought often do not refer to the I with its personal interests; rather, they represent the structural requirements of the given situation."[278] Perhaps Henle sums it up best:

> . . . paradoxically, creative work seems to demand both a passionate interest on the part of the thinker and a certain detachment from his work and ideas. It seems safe to say that significant discovery, really creative thinking, does not occur with regard to problems about which the thinker is lukewarm. . . . On the other hand, laboratory findings as well as everyday observation suggest that very intense motivation may

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[277] Ibid., p. 124.

[278] Quoted in Henle, op. cit., p. 46.

> impede problem-solving. If the individual is narrowly concentrated on the goal, to the exclusion of other relevant aspects of the problem situation, he is often unable to achieve a solution. The creative thinker must stand sufficiently detached from his work that he is able to examine it, criticize it, destroy or reject it if necessary.
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> The condition of intense interest together with detachment can be achieved, in other words, if the ego lends itself to the work rather than dominating the task. The forces responsible for carrying on the work derive to a large extent from the perceived demands of the task itself rather than from the personal needs of the individual.[279]

Social maturity and independence are not only vital personality ingredients in creative and intelligent behavior, they are also essential, as we have seen, for the psychological strength that is needed in the pursuit of consequential creativity. Another aspect of this idea is elegantly expressed by one of the foremost creative scientists of our time, Norbert Wiener:

> I learned that scholarship is a calling and a consecreation, not a job. I learned a fierce hatred of all bluff and intellectual pretense, as well as a pride in not being baffled by any problem which I could possibly solve. These are worth a price in suffering, yet I would ask this price to be exacted of no man who has not the strength to stand up to it physically and morally. This price cannot be paid by a weakling, and it can kill.[280]

Thompson describes a related feature of the creative personality that, like the above, is not a part of the image

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[279] Ibid., pp. 45-46.

[280] Norbert Wiener, Ex-Prodigy (Cambridge, Massachusetts: The M.I.T. Press, 1953), p. 292.

engendered by the factor-analysts: "Creative thinking is only possible for an individual who not only has the ability but the motivation to submit both to disciplined preparation and the self-discipline needed in all original work."[281] The personality that emerges as we consider maturity and independence in terms of a holistic conception of creativity is quite different from the typical facile, self-expressive, divergent stereotype.

The direct empirical evidence regarding relative measures of social maturity and their relationships to measures of creativity and intelligence is thin, but the Warren and Heist study found that the more able college students made higher scores on the Social Maturity scales of the OPI than less able students. This may indicate that although this scale is not a cognitive dimension, it is nevertheless important in high cognitive performance.

> The more advanced psychological development of the gifted, indicated by results on [the Social Maturity Scale], and the correspondingly greater potential for growth and positive change may, as much as superior mental ability, provide the basis for superiority both in achievement and in more general forms of behavior in an academic environment.[282]

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[281] Robert Thomson, The Psychology of Thinking (Baltimore: A Pelican Book, 1959), p. 195.

[282] Warren and Heist, op. cit., p. 334.

Reflective Thinking and Complexity

A preference for reflective thinking and complexity have direct cognitive connotations as well as noncognitive implications. These particular attributes of holistic creativity have a more noticeable empirical flavor than most attributes we have passed in review. There is little in the literature of, and about, the great creative thinkers which is specifically concerned with these traits, however, both are represented by scales on the OPI and several empirical studies have been concerned with understanding and measuring these qualities.

It should be pointed out that the primary incentive for combining these two attributes in one section is the present thinness of background material. There is no particular intrinsic reason for considering reflective thinking and complexity together.

Reflective thinking, or Thinking Intorversion as it is labeled in the OPI, pertains to a proclivity for reflective thought of an abstract, conceptual nature. Perhaps the main function of this personality characteristic is to combine ideas with other ideas by connecting them in meaningful ways. This is the process by which knowledge becomes a part of the individual. Kneller has set forth this notion very clearly:

> It is clear that, to learn creatively, that is, so as to affect the whole personality, the pupil must combine the knowledge he acquires in a given lesson with knowledge drawn from other areas of his experience. This creation of connections not immediately present in the items themselves is what Whitehead calls the "activation of inert ideas." Instead of merely adding one more idea to those he already has, the student actually creates new patterns of ideas. How does this help him to fulfill himself? By incorporating an idea with ideas drawn from other fields of experience, he is placing the idea where it can touch his experience at many points and where it can interact with a range of thought and feelings. In this way it truly fertilizes his intellectual and emotional life.[283]

Most connections made among ideas are the product of insight, "of a sudden grasping of latent connections."[284] And insights, as we know, do not come often by sheer force of conscious effort alone. As we said previously, rigorous conscious preparation is necessary to prepare the way, but the insight itself almost always comes when we are off guard.[285] Underhill gives us the flavor of this important aspect of reflective thinking:

> The condition of all valid seeing and hearing, upon every plane of consciousness, lies not in the sharpening of the senses, but in a peculiar attitude of the whole personality: in a self-forgetting attentiveness, a profound concentration, a self-merging, which operates a real communion between the seer and the seen--in a word, in Contemplation.[286]

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[283] Kneller, op. cit., pp. 96-97.

[284] Ibid., p. 97.

[285] Rugg, op. cit., p. 11.

[286] Underhill, op. cit., p. 300.

Cattell agrees that the inhibition of sensory input enhances reflective thought. It is noteworthy that a certain inactivation and closure of the senses is called for when openness is considered, for well-grounded reasons, to be earmarks of the creative disposition. In fact, openness is manifestly important in reflective thinking; not openness to sensory input, but openness to the possibility of unsuspected connections among the ideas with which one is concerned and other information and intuitions that one may possess. Cattell puts it this way:

> As long as you use a lot of the channels for input, you have too few free channels for scanning. . . . The typical extrovert has too many channels taking in information--or, at least, alert to the external trivia of everyday life--and not enough for scanning.[287]

Because he sees the introvert as clearly more inclined toward reflective thinking, Cattell regards him as much more likely to be creative in the realm of ideas than the extrovert.

> My main contention is that whereas the schools for at least two generations have cherished the ideal of the extrovert, almost as if it were synonymous with mental health, the evidence is overwhelming that the creative person is an introvert. . . . I believe that the greatest single cause of this poor performance is the cult of the extrovert in our schools, and that worship of conformity, or fads, and of fashions which goes therewith.[288]

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[287]Cattell, "The Personality and Motivation of the Researcher from Measurement of Contemporaries and from Biography," p. 127.

[288]Ibid., pp. 129-130.

The preference for complexity is indicative of perceptual attitudes and personality characteristics very important to a holistic conception of creativity. Barron, an important empirical investigator of this subject, found striking differences between those who preferred complexity and those who preferred simplicity.

> The preference for complexity is associated with a perceptual attitude which seeks to allow into the perceptual system the greatest possible richness of experience, even though discord and disorder result, while the preference for simplicity is associated with a perceptual attitude which allows into the system only as much as can be integrated without great discomfort and disorder, even though this means excluding some aspects of reality.[289]

Gardner lays stress on a slightly different view of complexity. He directs attention to the great obstacle which internal conflict presents to the creative individual. This conflict is caused by the ambiguity of suspended judgment, unresolved differences, and the pull of polarities in his nature. The creative person has a high tolerance for ambiguity of this kind, which enables him to incorporate more reality into his creative endeavors. To quote Gardner:

> In the current fashion we talk much of the limitations on freedom that result from outside pressures and tend to forget the limitations imposed by one's own compulsions, neuroticisms, habits and fixed ideas. . . . The [creative] individual has a capacity to tolerate

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[289]Frank Barron, "The Disposition Toward Originality," Scientific Creativity: Its Recognition and Development, ed. by Calvin W. Taylor and Frank Barron (New York: John Wiley and Sons, 1963), p. 146.

> internal conflict, a willingness to suspend judgment. He is not uncomfortable in the presence of unanswered questions or unresolved differences. He does not find it difficult to give expression to opposite sides of his nature at the same time--conscious and unconscious mind, reason and passion, aesthetic and scientific impulses.[290]

As May has so competently shown, the thoughtful, intelligent, creative man contains much paradox. May also submits that the chief sin of contemporary psychology is oversimplification.[291]

Preference for complexity in external problems and ability to tolerate and turn to account internal conflict are undoubtedly closely related characteristics which interact synergistically in the creative personality. Barron believes that a preference for external complexity is paralleled by a concomitant effort toward complex personal synthesis.

> This in the individuals whom in retrospect we identify as the bearers of the creative impulse in our generation there appears a positive preference for what we are accustomed to call disorder, but which to them is simply the possibility of a future order whose principle of organization cannot now be told.
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> . . . . . .
>
> The creative individual is one who not only attempts complex solutions of problems external to himself through special attention to and preference for apparent

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[290]Gardner, Self-Renewal, p. 38.

[291]Rollo May, Psychology and the Human Dilemma (Princeton, New Jersey: Van Nostrand, 1967), pp. 1-24.

> disorder, but also attempts to create himself through commitment to a complex personal synthesis.[292]

Preference for complexity alone, of course, is no indicant of creativity. Koestler says:

> Even these very special and complex skills can be practiced by sheer routine; and vice versa some of the most original discoveries arose out of relatively simple problems. Complexity of thought is no measure of originality.
>
> . . . . . .
>
> The degree of originality which a subject will display depends, ceteris paribus, on the nature of the challenge--that is, the novelty and unexpectedness of the situation.[293]

The Heist-Warren study, which compared freshmen of various levels of ability, found that mean scores on reflective thinking proved to be one of the best ways of differentiating between groups of gifted and less able students. This is not surprising in the least, as it has long been known that gifted individuals are "interested in reflective thought, in working with ideas and concepts, and intellectual independence," all of which contribute to high Thinking Introversion scores.[294]

Also, as would be expected, the gifted made higher scores on the Complexity scales. Higher scores on this

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[292]Frank Barron, "The Needs for Order and for Disorder as Motives in Creative Activity," Scientific Creativity: Its Recognition and Development, ed. by Calvin W. Taylor and Frank Barron (New York: John Wiley and Sons, 1963), pp. 156-158.

[293]Koestler, The Act of Creation, pp. 652-653.

[294]Warren and Heist, op. cit., p. 333.

scale indicate a "greater intellectual independence, a tendency toward original, unconventional ways of responding to the environment, and as well, greater tolerance for ambiguity and greater potential for creativity."[295] They also "indicate a preference for complex stimulus patterns and an inclination and ability to deal imaginatively and adequately with apparent disorder."[296]

It is apparent that these important personality characteristics of holistic creativity are also salient components of high-level intelligence.

Summary

This chapter is a prefatory attempt to bring together the essential elements of a theory of creativity which can be reconciled with the composite objective requirements of the unabridged, unreduced creative act and the collective subjective experience of unquestionably creative individuals. It is maintained that all three aspects of personality--cognitive, affective, and conative--are indispensable in the socially significant creative act and therefore must be included in a valid theory of creativity. The experience of the great seminal thinkers, as expressed in general literature, and the works of those investigators who have meticulously

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[295] Ibid., p. 334.

[296] Ibid., p. 335.

scrutinized the psychology and products of these thinkers, have been utilized, among other data, to demonstrate that the phenomena of creativity can only be apprehended by a multidimensional approach which takes into consideration the total personality.

In the first section evidence is adduced and arguments are assembled to put in plain sight the intimate, interwoven relationship between the undivided, undiminished, integrated personality and significant creative achievement. The three aspects of personality are presented in terms of their individual essentiality and their synergistically cumulative importance to an unimpaired conception of creativity.

The following six sections consider the whole personality within an expanded framework which seems most likely, at the present time, to promote an understanding of holistic creativity. The nine qualities examined were chosen on the basis of both the intrinsic value and utility accorded them by noted creative individuals and by respected holistic-type, experimental investigators. As our knowledge of creativity increases this expanded framework will, naturally, be modified accordingly.

The view presented in this chapter is in sharp contradistinction to the factor-analytic view which is based on the assumption that creativity is to be understood as

essentially cognitive phenomena. In application, the divergence between the theories is accentuated even more by the decidedly reductive nature of the cognitive operations that are called for on the Guilford-type tests. In comparing the previous chapter with the present chapter, the dissimilarities between the holistic and the factor-analytic theories appear to be so great that one may wonder: Are these two theories qualitatively different?

CHAPTER IV

PROCEDURES USED IN THIS STUDY

Introduction

In the preceding chapters a brief outline of an approach to the understanding of creativity has been presented which focuses attention on the complete, unreduced, socially useful creative act and the personality attributes which are associated with it. Extensive reference has been made to those investigators who have studied in detail the creative acts and the psychology of the great creators of western civilization, and also to the original writings of the creators themselves.

From the vantage point of this holistic approach, the atomistic factor-analytic theory of creativity is seen as being much too narrow in scope and grossly deficient in its overall conceptualization of the creative person and the creative act. One result of this narrow view is the limitation of focus to the production of novelty per se, rather than perceiving novelty within the context of the logical demands of problem situations. By limiting the concept of creativity to the production of novelty and "divergent thinking," other aspects of intelligence, including "convergent

thinking," have, unfortunately, been considered more or less extraneous to creativity. The holistic position presented in this paper is that "creation" does not occur until the logical, practical demands of a non-trivial task have been met, and that the convergent aspects of intelligence, which are emphasized in IQ tests, are as vitally important as the divergent.

In this and the following chapter an attempt will be made to translate and utilize the theoretical insights gained in the previous chapters concerning intelligence and creativity in an empirical study of bright high school students.

Sample Population

This empirical study is one outgrowth of an extensive investigation of the creative intellectual style in gifted adolescents by Elizabeth Drews.[1] The sample population was selected on the basis of scores on a reading test.[2] The criterion for inclusion in the investigation was a reading score of two or more years beyond grade level. One advantage of this limitation of the population sample to bright adolescents, and its chief justification, is that it

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[1] Drews, op. cit.

[2] California Reading Test (CRT), Advanced Form, ed. by W. E. Tiegs and W. W. Clark (California Test Bureau, 1950).

makes it fairly comparable with the population used by Getzels and Jackson in their well-known study of creativity and intelligence.

The group selected consisted of all the eleventh grade students from four Lansing high schools who met this criterion.[3] The fact that the entire population for this study were excellent readers should be kept in mind when considering the statistical results. When it is remembered that those who scored within or near the average range in IQ could read at least two years above grade level, we might entertain some legitimate doubt as to the validity of their relatively low IQ scores. Martinson found that it is not unusual for the individuals to score in this range on group intelligence tests while scoring 20 or 30 points higher on the Stanford-Binet.[4] It is quite possible that the population is more homogeneous in verbal abilities than the IQ scores would indicate, making any differences between high and low groups in terms of the OPI scores more noteworthy. In any event, Drews felt justified in considering this population intellectually superior.

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[3]The four high schools were: Otto, Pattengill, French, West.

[4]Ruth Martinson, Educational Programs for Gifted Pupils (Sacramento, California: State Department of Education, 1961), pp. 36-38.

Instruments

Verbal scores on the California Test of Mental Maturity (CTMM) were used as a measure of intelligence.[5] As the subjects were initially chosen on the basis of reading scores rather than IQ, IQ ratings were lower than would ordinarily be expected of individuals in an intellectually superior population. Scores on the CTMM ranged from 97 to 159, with the mean score being 123.

The Omnibus Personality Inventory (OPI) was used as a measure of creative potential. This inventory has been found to differentiate between more and less creative individuals in high school, college, and adult populations.[6] The OPI was constructed by Paul Heist and Phoebe Williams in 1957 at the Center for the Study of Higher Education in Berkeley, California. Concerning the purpose and characteristics of the OPI, we quote from Drews:

> The purpose of the OPI varies from that of many personality tests in that it measures motivation to learn and openness to psychological growth rather than psychopathology. The items are clustered into a number of personality scales that are considered by the Berkeley researchers to be particularly pertinent to the study of intellectual and psychological growth in college students. In our earlier research the instrument appeared to be equally valuable to measure the attitudes (and attitude change) of able high school students.[7]

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[5] California Test of Mental Maturity (CTMM), High School Level, California Test Bureau.

[6] Drews, op. cit., p. 184.

[7] Ibid., p. 185.

It should be pointed out that not all the scales of the OPI were used in this study. Six scales--Originality, Complexity, Theoretical Orientation, Thinking Introversion, and Social Maturity--were chosen which are specifically concerned with personality variables that have been hypothesized, on theoretical and experimental grounds, to be characteristic of creative college students. This thesis is supported by the research findings of Heist on college students[8] and Drews on bright high school students.[9]

Brief descriptions of the attributes that these six scales primarily measure are given below. The descriptions are taken from the OPI research manual.[10] Following each description is a sample of five items with the appropriate response for that particular characteristic.

Originality (O): This scale is adapted from the research of Barron and others at the University of California, Berkeley. Characteristics of high scorers are independence of judgment, freedom of expression, rebelliousness, rejection of suppression, and novelty of insight.

(true) I enjoy reading essays on serious or philosophical subjects.

(true) I like to fool around with new ideas, even if they turn out later to have been a total waste of time.

(false) Things seem simpler as you learn more about them.

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[8]Heist and Williams, op. cit.

[9]Drews, op. cit., p. 185.

[10]Omnibus Personality Inventory--Research Manual, Center for the Study of Higher Education (Berkeley, California, 1962).

(false) How well a person gets along with others is eventually more important to him than any of his intellectual accomplishments.

(false) Straightforward reasoning appeals to me more than metaphors and the search for analogies.

Complexity (Co): The Complexity scale is also adapted from Barron and distinguishes between people who perceive and react to complex aspects of their environment and those who generally react to more simple stimulus patterns. This measure reflects an experimental orientation rather than a fixed way of viewing and organizing phenomena. High scorers are tolerant of ambiguities and uncertainties, are fond of novel situations and ideas, and are frequently aware of subtle variations in the environment. Low scorers tend to be compliant, conservative, accepting of authority and tradition, and simpler in their organization and perceptions.

(false) I prefer to engage in activities from which I can see definite results rather than those from which no tangible or objective results are apparent.

(false) For most questions there is just one right answer, once a person is able to get all the facts.

(true) I have always had goals and ambitions that were impractical or that seemed incapable of being realized.

(false) Facts appeal to me more than ideas.

(true) It doesn't bother me when things are uncertain and unpredictable.

Estheticism (Es): The high scorers endorse statements indicating diverse interests in artistic matters and activities. They find value and beauty in the concinnity of forms and relationships and seek major satisfactions in the appreciation and production of beauty in art, music, dramatics, and literature.

(true) I enjoy listening to poetry.

(true) Colored lights sometimes arouse feelings of excitement in me.

(true) I enjoy looking at paintings, sculpture, and architecture.

(true) Courses in literature and poetry have been as satisfying to me as most other subjects.

(true) As a youngster I acquired a strong interest in intellectual and esthetic matters.

Theoretical Orientation (TO): This scale measures the tendency of people to look for theoretical implications from arrays of isolated facts. Scientists, especially the more creative scientists, tend to be strongly oriented in this direction. High scorers are generally logical, rational, and critical in their approach to the problem.

(true) I much enjoy thinking about some problem which is a challenge to the experts.

(true) The main object of scientific research should be the discovery of truth rather than its practical applications.

(true) I like to look for faulty reasoning in an argument.

(false) I would rather read about the lives and works of men such as Alexander, Julius Caesar, and Charlemagne than about Aristotle, Socrates, and Kant.

(true) I like assignments which require me to draw on my own conclusions from some data of facts.

Thinking Introversion (TI): This scale was adapted from the Evans-McConnell research on the introversion-extroversion concept. Persons scoring high on this measure are characterized by a liking for reflective thought, particularly of an abstract nature. Their thinking tends to be less dominated by objective conditions and generally accepted ideas than that of thinking extroverts (low scorers). Extroverts show a preference for overt action and tend to evaluate ideas on the basis of their practical, immediate application.

(false) I give more attention to the action of the story than to the characterizations or to the form and style of the literature I read.

(true) I question statements and ideas expressed by my teachers.

(true) I like to write my reactions to and criticisms of a given philosophy or point of view.

(false) I like to do work which requires little study or thought after it is once learned.

(false) The thinking which I do is largely limited to that which I must do in the course of my work.

Social Maturity (SM): High scorers are not authoritarian, and they are flexible, tolerant, and realistic in their thinking. They are not dependent upon authority, rules, or rituals for managing social relationships. In general they are inpunitive, although capable of expressing aggression directly when it is appropriate. High scorers are also frequently interested in intellectual and esthetic pursuits.

(false) Nothing in life is worth the sacrifice of losing contact with your family.

(false) It is better never to expect much; in that way you are rarely disappointed.

(false) I have been inspired to a way of life based on duty which I have carefully followed.

(false) I am in favor of strict enforcements of all laws, no matter what the consequences.

(false) Only a fool would try to change our American way of life.

One should bear in mind that the above attributes have been found by MacKinnon and others to be a common denominator of creative adults.[11] The statistical aspect of the present study is based on the assumption that adolescents

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[11] MacKinnon, "Personality Correlates of Creativity"; Roe, op. cit.; and Barron, "The Disposition Toward Originality."

with similar personality patterns are more likely to have greater potential for creativity than those who do not. It should also be remembered that, although other personal qualities seem to be more important, one of the qualities that creative adults have in common is high intelligence.[12]

Hypotheses Tested

The hypotheses which were tested in this study were stated as follows:

1. The scores on each of the six personality dimensions will be positively correlated with verbal intelligence.
2. The high group in verbal intelligence will be significantly higher (.05) than the low group on all six personality dimensions.

Identification of Groups for Statistical Analysis

As was mentioned previously, the chief purpose of this investigation is to explore the relationship between the personality factors associated with creativity and intelligence. To test the first hypothesis, intercorrelations were made among the verbal IQ and the other personality variables for the total group. To test the second hypothesis that differences in intelligence will reveal interesting and significant variations in measured potential

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[12] MacKinnon, "Personality Correlates of Creativity," p. 3.

for creativity, high and low groups in measured IQ were formed for comparison. To do this, all subjects with IQ's in the standard deviation between 115 and 130 were eliminated from this aspect of the study.

There were 59 in the high group with a mean IQ of 137, and 60 in the low group with a mean IQ of 112. The assumption which underlies this comparison is that intelligence is an important element in the personality structure which enables and predisposes one to conceptualize and manipulate ideas imaginatively, adventurously, and effectively.

Should this assumption be correct, groups high in intelligence could, other things being equal, be expected to demonstrate, by the time of adolescence, more of the interests, attitudes, and qualities common to unquestionably creative adults.

Summary

A sample population consisting of 180 eleventh grade students who scored at least two years beyond grade level in reading were the subjects of the statistical study.

The other instruments were employed to obtain the data. The California Test of Mental Maturity furnished the verbal IQ and six scales of the Omnibus Personality Inventory were used to measure correlates of creativity.

Intercorrelations among OPI scores and the IQ score were made for the entire group. And t-tests were used to compare high and low IQ groups, consisting of the top and bottom thirds, for significant differences between mean scores on the OPI.

CHAPTER V

ANALYSIS OF THE DATA CONCERNING THE RELATIONSHIP BETWEEN HOLISTIC CREATIVITY AND INTELLIGENCE

The major hypothesis of this study is that creative potential, measured in terms of the personality attributes found to be associated with socially significant creative production, is positively related to IQ. This hypothesis was tested by calculating interrelations among the six personality variables and IQ.[1] Complete intercorrelations were made because, in addition to establishing the relationship between the IQ score and the six personality variables, intercorrelations among the six personality variables were also considered desirable.

It should be noted that there is no composite score for creativity. This is true for several reasons. First, there is no claim, at this stage of development, that these variables are sufficiently refined or inclusive of creative characteristics so as to constitute a valid "creativity test." Further, since the relative importance of the

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[1] All calculations were made with the high speed computer at Michigan State University.

different variables in creative productivity is unknown at this time, a composite score would be unwarranted. The rationale for the use of these variables is not dependent on their being a neat, equipotential measure of creativity, but on the insights they may afford concerning the nature and development of socially useful creativity. It is held for reasons which will follow, as well as those expressed previously, that this approach to creativity is a realistic and justifiable alternative to the factor-analytic viewpoint.

Intercorrelations

An examination of Table 1 indicates that there is a slight to moderate relationship among the seven variables. The Originality subtest correlates, on the whole, better with the other variables, including the IQ, than any other variable. All of the personality measures do correlate positively with IQ but the associations are relatively weak.

The intercorrelations are much lower in the present study than those obtained in an early study which is reported in the OPI Research Manual.[2] In this early study of 2,390 college freshmen, the lowest correlation was .65 and the highest .89 with the majority of correlations in the .70's and 80's. It should be pointed out that the IQ variable was not considered in the early study.

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[2] Omnibus Personality Inventory--Research Manual, op. cit., p. 61.

Table 1. Intercorrelations among six personality correlates of creativity and verbal IQ (total sample, N = 180)

Variable Number	1	2	3	4	5	6	7
1 Originality							
2 Social Maturity	.58						
3 Complexity	.55	.38					
4 Estheticism	.37	.54	.35				
5 Theoretical Orientation	.49	.00	.23	.29			
6 Thinking Introversion	.71	.17	.41	.51	.66		
7 CMM Verbal IQ	.34	.20	.30	.29	.18	.26	

In Table 2 we see an intercorrelation of the scores of all girls and boys separately. In every case the relationships among the scores of the girls are higher than those of the boys. Although the reason is not apparent it is very interesting, from the standpoint of the major hypothesis of this study, that the correlations with verbal IQ are considerably higher among the girls than the boys. Table 2 does show a positive relationship in all but one case.

In all three groups IQ is most closely related with Originality. Complexity is rated the second highest association with IQ for the total group and the girls, while Estheticism is slightly higher for the boys. Estehticism ranks third for the total group and the girls, while

Table 2. Intercorrelations among six personality correlates of creativity and verbal IQ*

Variable Number	1	2	3	4	5	6	7
1 Originality		.51	.55	.24	.45	.67	.29
2 Social Maturity	.63		.41	.34	-.08	.03	.15
3 Complexity	.55	.35		.20	.15	.36	.25
4 Estheticism	.46	.56	.43		.26	.47	.28
5 Theoretical Orientation	.57	.08	.32	.34		.66	.12
6 Thinking Introversion	.74	.28	.44	.57	.68		.20
7 CMM Verbal IQ	.40	.26	.38	.32	.25	.31	

*Boys (above diagonal) N = 83; girls (below diagonal) N = 97.

Complexity ranks third for the boys. One unexpected relationship is that shown between IQ and Theoretical Orientation which ranks last in all three groups. It is thought-provoking that such seemingly neutral characteristics as Estheticism and Social Maturity should be more highly associated with IQ than the apparently more cognitive characteristic of Theoretical Orientation.

A rather interesting comparison is possible at this point. We remember that the Getzels-Jackson study was also of a bright to gifted population (mean IQ 132)[3] of high

[3]Getzels and Jackson, Creativity and Intelligence, p. 15.

school students and that the main purpose of the study was to investigate the relationship between intelligence and creativity. Getzels and Jackson, using five factor-analytic sub-tests of creativity, found the intercorrelations given in Table 3. There was very little difference between the correlations found among the creativity sub-tests and the correlations between these sub-tests and IQ, but it was concluded by Getzels and Jackson that IQ was not very important in creative thinking.

Table 3. Intercorrelations among factor-analytic sub-tests of creativity and IQ* as found by Getzels and Jackson[a]

Variable Number	1	2	3	4	5	6
1 Word Association		.37	.34	.30	.42	.38
2 Uses	.37		.21	.22	.18	.19
3 Hidden Shapes	.35	.20		.16	.41	.37
4 Fables	.32	.28	.15		.22	.13
5 Make-Up Problems	.49	.28	.53	.27		.25
6 Intelligent Quotient	.37	.15	.30	.12	.39	

*Boys (above diagonal) N = 292; girls (below diagonal) N = 241.

[a]Getzels and Jackson, Creativity and Intelligence, p. 15.

In making the comparison between Table 2 and Table 3 the numerical differences are not as important as the nature of the inherent differences between the two different types of creativity tests. DeMille and Merrifield pointed out that verbal meaning, which is a chief factor in most IQ tests, was an important factor in all of the creativity sub-tests which Getzels and Jackson used.[4] This factor alone could account for much of the correlation with IQ found by using the factor-analytic tests. Contrast this with the fact that correlations found between the holistic-type measures and IQ depend on a positive relationship between such affective attributes as attitudes and interests and the cognitive attribute of verbal intelligence.

In view of these circumstances, it is noteworthy that, in comparing the girls, there is a slightly greater correlation between the holistic measures and IQ than between the factor-analytic sub-tests and IQ. This difference is slight but consistent. In comparing the boys, we find the correlations are approximately equivalent.

While the holistic measures do not correlate highly with verbal IQ, the correlations would seem to be high enough to suggest that verbal intelligence cannot be ignored as a factor in creativity. This view is reinforced when we take into consideration the noncognitive nature of the holistic sub-tests.

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[4] DeMille and Merrifield, op. cit., pp. 803-808.

Comparison of High and Low Groups

The main hypothesis that creative potential, as measured by six selected scales of the OPI, is positively related to IQ was further tested by comparing the highest one-third in IQ with the lowest one-third by means of t-tests. The middle third, which comprised almost precisely the standard deviation between 115 and 130, was not considered in this comparison.

Table 4 gives the results of comparing the highest 59 in IQ with the lowest 60 in IQ on the six creativity variables.

Table 4. Comparison between high and low groups in verbal IQ on six personality correlates of creativity

	High IQ (N = 59)		Low IQ (N = 60)			
Personality Correlates	$\bar{X}$	s	$\bar{X}$	s	t	P
Originality	48.0	7.4	42.2	5.8	4.65	.0005
Social Maturity	42.0	8.0	38.3	6.6	2.75	.005
Complexity	55.8	10.5	48.1	8.4	4.34	.0005
Estheticism	45.9	9.8	41.5	7.7	2.67	.005
Theoretical Orientation	47.3	9.5	44.4	8.6	1.74	.05
Thinking Introversion	46.1	9.0	42.6	8.5	2.13	.025

The high group was significantly higher on the creativity variables in every case. The lowest level of significance was .05 for Theoretical Orientation and the highest level of significance was .0005 for both Originality and Complexity.

Table 5 gives the results of comparing the high IQ girls with the low IQ girls on the six creativity variables. Once again the high group is significantly higher on every creativity variable. The lowest level of significance was .05 for Theoretical Orientation and the highest level of significance was .0005 for Originality.

Table 5. Comparison between high and low girls in verbal IQ on six personality correlates of creativity

	High IQ (N = 34)		Low IQ (N = 35)			
Personality Correlates	$\bar{X}$	s	$\bar{X}$	s	t	P
Originality	48.2	7.9	41.3	5.3	4.16	.0005
Social Maturity	42.8	9.1	36.9	5.2	3.25	.005
Complexity	55.9	11.4	47.5	8.8	3.42	.005
Estheticism	47.9	10.7	43.1	7.7	2.18	.025
Theoretical Orientation	45.1	9.2	41.1	8.1	1.89	.05
Thinking Introversion	46.8	8.5	41.8	7.7	2.55	.01

Table 6 compares the high IQ and low IQ boys on the six personality variables. In only one case, Theoretical Orientation, is the difference insignificant. However, the levels of significance are not as great as were obtained for the girls alone or for the boys and girls together. The level of significance was .05 for Estheticism and Thinking Introversion and the highest level of significance was .01 in the case of Complexity.

Table 6. Comparison between high and low boys in verbal IQ on six personality correlates of creativity

	High IQ (N= 25)		Low IQ (N = 25)			
Personality Correlates	$\bar{X}$	s	$\bar{X}$	s	t	P
Originality	47.8	6.9	43.5	6.2	2.23	.025
Social Maturity	40.7	6.3	35.6	7.8	2.12	.025
Complexity	55.6	9.4	49.1	7.8	2.61	.01
Estheticism	43.0	7.7	39.3	7.3	1.73	.05
Theoretical Orientation	49.0	9.9	46.8	7.1	1.14	insig.
Thinking Introversion	47.8	9.8	43.8	9.5	1.88	.05

Summary

Intercorrelations were made among the six personality variables and verbal IQ. Intercorrelations among the six personality variables were somewhat higher than they were individually with verbal IQ, however, each of the six variables was positively associated with verbal IQ which confirmed the major hypothesis of the statistical investigation. Among the girls this relationship was much more pronounced than among the boys, but no reason can be advanced to explain this difference. The sub-tests of Originality, Complexity, and Estheticism correlated most highly with verbal IQ, while Thinking Introversion, Social Maturity, and Theoretical Orientation correlated lower. It was somewhat unexpected that Theoretical Orientation, which showed the lowest correlation of all, should show a much lower correlation with verbal IQ than, for instance, Estheticism. While Estheticism was hypothesized to correlate positively with verbal IQ, it seemed reasonable to expect Theoretical Orientation to show a closer relationship.

High and low groups were formed by eliminating the standard deviation of IQ scores between 115 and 130. This left one-third of the total number in the high group and one-third in the low group. The average IQ for the high group was 137 and that for the low group 112. The two groups were then compared by means of t-tests to test for

significant differences between the groups on each of the personality correlates of creativity. For the total group and for the girls alone, the differences were significant in every case. For the boys alone, only one comparison, that for Theoretical Orientation, was not significant. The differences for the girls showed a much higher level of significance than did those for the boys.

CHAPTER VI

SUMMARY AND RECOMMENDATIONS

Summary

There are two main schools of thought in the realm of creativity research; namely, the organismic-holistic and the atomistic-reductionistic schools. Both of these somewhat polar positions were presented so that pertinent contrasts could be readily perceived. Evidence was adduced to show that these two schools of thought have selected from the vast array of heterogeneous phenomena labeled "creativity," radically different domains in which to apply their radically different theories, criteria, and methods. The rationale for contrasting these approaches was based on the need to disentangle ourselves from the present confusion which is inherent in the attempt to subsume excessively different phenomena within the same category, and to circumvent the danger of encouraging or discouraging expectations of socially useful creativity on the basis of current creativity tests.

The specific focus of this study was to examine the relationship between IQ and holistic creativity. This particular relationship was considered especially appropriate

because of the many recent studies on this subject within the atomistic frame of reference. The theoretical background regarding this relationship was reviewed from both points of view and statistical data were presented as an initial empirical study of IQ in relation to the creative attitude or disposition, as distinguished from its relation to the purely cognitive criteria of the current atomistic-type tests, in adolescent boys and girls.

One of the fundamental distinguishing features of the holistic position is the assumption that a valid and fruitful approach to the study of creativity must be derived from the life and work of unquestionably creative individuals. Criteria are developed by ascertaining common personality characteristics among creative people and by analysing the process of significant and unabridged creative acts. The complete creative act, as depicted by those who have probed its process as well as by the subjective analysis of the creators themselves, is seen to involve much more than "divergent thinking." Socially useful creativity demands the synergistic cooperation of the entire personality, including all psychical mechanisms and modes of thought. Affective and conative dimensions are as essential as the cognitive ones.

The atomistic, factor-analytic counterpart to the preceding assumption is the notion that creativity consists in such cognitive skills as the ability to think of many and

unusual alternatives, to respond in rare and clever ways to various stimuli, and to be fluent in association. It is further assumed that these "divergent thinking skills" can be measured by simple, short-answer tests.

For purposes of understanding the differences between the two schools of thought, it is highly relevant that none of the atomistic criteria--unusualness, cleverness, fluency, etc.--are considered in terms of the implicit logical demands of the overall situation defined by the tasks presented and the answers given. It follows that atomistic creativity focuses on unusualness, cleverness, fluency, etc. per se as the criteria of creativity, whereas from the holistic viewpoint these qualities, considered apart from the demands of a significant task, are more or less by-products of creativity; not the essence. The fact that the creative act is novel or clever is quite secondary to the fact that something desirable comes to pass. The important thing is how or why someone was able to achieve the creative act. It is abundantly clear that, in most areas of knowledge, highly creative adults do not achieve the distinction of that appellation by striving to be "novel" or "clever," but by focusing on the actual demands of a task which greatly concerns them. Novelty or cleverness for the sake of novelty or cleverness is, on the whole, irrelevant within the holistic context except, perhaps, at the lowest levels of Taylor's hierarchy and in a few professions such as advertising.

It is also clear that self-selection of the problem and the time dimension is important in creativity. Since socially useful creative acts are normally self-imposed and extend through a long period of time, it is not unreasonable to postulate that novelty and cleverness, which is achieved as an incidental by-product of an extended period of effort and commitment to a self-imposed task, may be by means of a distinctively different process and motivational stance from that produced in seconds or minutes in response to a trivial task which is externally imposed. Creativity, in terms of the holistic conception, is the novel resolution of important problems or the conceptualization and explication of noteworthy new ways of looking at some aspect of the world. Holists argue that this ability has its genesis in various personality attributes, including intelligence; the atomists believe that creativity has its origin in, and should be defined in terms of, certain cognitive skills alone.

In the statistical study the hypothesis that six personality attributes, selected from the OPI scales as being possible causative factors in creativity, would be positively correlated with IQ was accepted in each case for the total group of 180 bright eleventh grade high school students and for the girls and boys considered alone. The correlations were higher for the girls in every case than for the boys.

In comparing the high and low IQ groups on the six personality dimensions, it was found that the high IQ groups were significantly higher (.05) in every case when comparing the total sample and when comparing the girls only. However, in considering the boys alone, there was no significant difference between the high and low IQ groups in the case of Theoretical Orientation, although the association in this case was also positive.

Recommendations

The findings of this study suggest the following recommendations.

1. Further empirical investigation of adolescents with holistic-type instruments, such as biographical, interest, and personality inventories, would appear to offer promise as a means of discovering creative potential and providing insight into the dynamics of creativity. These instruments should be pointedly developed and refined for increased use with junior high age youth and older.

2. The relationship between intelligence and the so-called non-cognitive personality attributes, which correlate well with creative productivity, should be further explored. Evidence presented indicates that these attributes, in addition to their peripheral supporting role in creativity which investigators have long recognized, may

have some surprising causative effects on the higher levels of cognition.

3. More attention should be given to apprehending and conceptualizing what is entailed when we speak of the various levels and kinds of creativity. We need to distinguish the similarities and differences among the levels and kinds of creativity as a first step toward understanding their interrelationships--or, which is equally important, their lack of relationship. One likely result of this improved conceptualization would be an increased appreciation of the role of intelligence in the more significant kinds and in the higher levels of creativity.

4. Comprehensive and detailed studies of the lives and significant works of highly creative individuals should be utilized more often than at present in developing and continuously modifying a valid frame of reference for the study of creativity.

5. It is recommended that the current factor-analytic "Creativity Tests" be renamed "Divergent Thinking Tests." Since divergent thinking is only one aspect of the complete creative act, this would be a more accurate designation and would reduce confusion among those who are in any way affected by the use of these tests.

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