

# Creativity, Intelligence, and Personality

*Frank Barron and David M. Harrington<sup>1</sup>*

## Introduction

Divergent thinking; creativity in women; hemispheric specialization opposing right brain to left as the source of intuition, metaphor, and imagery; the contribution of altered states of consciousness to creative thinking; an organismic interpretation of the relationship of creativity to personality and intelligence; new methods of analysis of biographical material and a new emphasis on psychohistory; the relationship of thought disorder to originality; the inheritance of intellectual and personal traits important to creativity; the enhancement of creativity by training; these have been the main themes emerging in research on creativity since the last major reviews of the field (Stein 1968; Dellas & Gaier 1970; Freeman, Butcher & Christie 1971; Gilchrist 1972).

Much indeed has happened in the field of creativity research since 1950, when J. P. Guilford in his parting address as president of the American Psychological Association pointed out that up to that time only 186 out of 121,000 entries in *Psychological Abstracts* dealt with creative imagination. By 1956, when the first national research conference on creativity was organized by C. W. Taylor at the University of Utah (under the sponsorship of the National Science Foundation), this number had doubled. By 1962, when *Scientific Creativity* (compiled by C. W. Taylor and F. Barron) went to press with a summary of the

---

**Source:** *Annual Review of Psychology*, 32 (1981): 439–476.

#### 4 Personal Indicators of Individual Creativity and Innovation

first three biennial Utah-NSF conferences, approximately 400 references post-1940, mostly of an empirical research character, were found for citation. In 1965, the comprehensive bibliography of the Creative Education Foundation (Razik 1965), which includes articles and books outside the professional field of psychology, contained 4176 references, nearly 3000 of them dated later than 1950. This almost exponential increase has leveled off to a stream of approximately 250 new dissertations, articles, or books every year since 1970.

New journals attest to the vigor of this still growing field of study. *The Journal of Creative Behavior*, under the editorship of Angelo Biondi, has proved to be much more than a house organ of the Foundation for Creative Education, with whose sponsorship it was founded. Its listing of creativity-related dissertations and theses is an invaluable scholarly resource. *The Gifted Child Quarterly*, both in its publication of research on the relationship of the various forms of giftedness to creativity in general and in its attentive book reviews, has kept a professional readership up to date on new developments in a socially important movement in education. Other new journals of general importance to the field are: *Intelligence*, *Journal of Mental Imagery*, *The Psychocultural Review*, and *The Journal of Altered States of Consciousness*. Several important publications emerged from conferences and symposia involving creativity during this period (Steiner 1965; Roslansky 1970; Taylor 1972; Stanley, Keating & Fox 1974; Keating 1976; Stanley, George & Solano 1977) along with a collection of pieces by investigators invited to take stock of the field 25 years after Guilford's 1950 APA address (Taylor & Getzels 1975).

Scholarship was also facilitated by the publication of two major reference works by Rothenberg & Greenberg – *Creative Men and Women* (1974) and *The Index of Scientific Writings on Creativity: General, 1566-1974* (1976). Torrance's impressively lengthy cumulative bibliography on the *Torrance Tests of Creativity and Thinking* (1979) and an unpublished cumulative bibliography of research at the University of California's Institute of Personality Assessment and Research (IPAR) containing more than 600 references (and available from the Institute) are valuable guides to significant lines of research during the past 15 years.

In addition to the comprehensive reviews cited above and the many more specialized reviews noted later in this chapter, particularly useful surveys and analyses of the field include those by Chambers (1969), Bloomberg (1973), Taylor (1975), and Rothenberg & Hausman (1976).

### The Varieties of "Creativity"

The term creativity stands in need of precise distinctions among the referents it has acquired. Commonly used definitions of creativity vary in several ways. First of all, some definitions require socially valuable *products* if the act or person is to be called creative, while others see creativity itself as being intrinsically valuable,

so that nothing of demonstrable social value need be produced; dreams thus may be creative, or unexpressed thoughts or simply the imaginative expressiveness or curiosity of a child. Definitions may vary also in terms of the level of accomplishment recognized as creative: difficulty of the problem seen or solved, e.g., or elegance or beauty of the product or the nature of the impact. A third kind of distinction is between creativity as achievement, creativity as ability, and creativity as disposition or attitude.

By way of illustration, let us take the two main categories of definition of a criterion of creativity actually used in large bodies of research: 1. creativity as socially recognized achievement in which there are novel products to which one can point as evidence, such as inventions, theories, buildings, published writings, paintings and sculptures and films; laws; institutions; medical and surgical treatments, and so on; and 2. creativity as an ability manifested by performance in critical trials, such as tests, contests, etc, in which one individual can be compared with another on a precisely defined scale.

The first category may lead to a definition of a field of activity and its products as intrinsically creative: all inventors, e.g., or all artists or all poets. This has led to a certain amount of research in which practitioners of a creative activity are compared with people in general, leading to a portrait of "the creative person" in terms of intellectual and personality differences between the criterion group and the generality. But these intrinsically creative products may differ among themselves in qualities such as originality, elegance, impact, and far-reachingness. Studies of individual differences as to creativity *among* members of such groups (architects, artists, mathematicians, and writers in the IPAR studies, for example) give a different picture of the components of creativity than do "field vs the generality" studies. A good example is measured intelligence. Creative architects do not score higher than comparison groups in architecture on standardized intelligence tests, but *all* architects studied scored an average of about two standard deviations higher than the general population (MacKinnon & Hall 1971). What does one then conclude about the relationship of creativity to intelligence?

Many such examples could be given, not just in relationship to intelligence but to personality, interests, values, life history. The point is that results will appear confusing and contradictory unless the implications of the adopted definition of creativity and the assumptions of the methods are kept clearly in mind.

Creativity as an ability manifested by performance on tests is dogged by even more formidable difficulties. What kind of test is it? What abilities is it tapping? What effect do different methods of scoring it (and different, usually anonymous, scorers) have upon its correlates? How does timing affect the test? How do the instructions themselves affect performance in defining the implicit work schedule? The literature since 1970 reflects increasing sophistication about these difficulties as will be seen below.

## 6 Personal Indicators of Individual Creativity and Innovation

Let us take divergent thinking (DT) tests as a prime example. There is a certain uncriticalness of analysis embedded in DT tests and their scoring methods. High scores on the Consequences test, e.g., are considered evidence of divergent thinking, although in fact the criterion of high quality is remoteness, perhaps combined with cleverness and aptness. Remoteness implies a process of going a distance from the obvious, but does it rule out the process of thought by which one *converges*, sometimes by occasional divergence, on an idea or result? Divergent thinking in fact goes hand in glove with convergent thinking in every thought process that results in a new idea. The aha! comes when the process reaches a conclusion. But process is precisely what is invisible in the usual DT test used in creativity research. A problem is set, and a written answer is obtained. What happens in between is anybody's guess, except the respondent's, who hasn't been asked.

Short, closely timed tests in which a problem is set and a brief response is required are ideal for use in a battery of tests destined for factor analysis. Has this requirement, which deliberately excludes scrutiny and analysis of process, been more of a bane than a blessing to research on creativity? Has the distinction between convergent and divergent, though real enough in the life of thought, been a mischievous one? We have for this review surveyed hundreds of reports on DT tests and are left wondering.

The actual sampling of persons, using either criterion of creativity, may also confound the search for commonalities of "the creative person." Creative women may be quite different from creative men, e.g., and different too in each field of endeavor. Age and level of training must also enter the picture. While this review cites many studies which individually respect the distinctions noted here (ability vs achievement, sex of person, etc), we believe the field needs a comprehensive catalog of empirical studies and a set of conceptual categories and dimensions with which a meta-analysis of results in the entire domain of creativity could be conducted. Though such an analysis was beyond the scope of this review, we urge its undertaking and refer colleagues to exemplary meta-analytic efforts in other domains (e.g. Block 1976, Smith & Glass 1977, Cooper 1979).

Before turning to our review of 15 years' work, a few comments regarding our space-and self-imposed restrictions are in order. In general we have emphasized empirical rather than theoretical work and studies employing achievement-rather than ability-based criteria. For some important topics we have only been able to recommend other reviews to the interested reader. Regarding creativity enhancement, e.g., we refer the reader to Stein's (1974) definitive two-volume work, *Stimulating Creativity*. Prentky's (1979) lengthy review and theoretical analysis of some of the psychobiological questions, "Creativity and Psychopathology: a neurocognitive approach", gives a full picture of relevant work in the neurosciences, including cerebral lateralization and cortical arousal. For the latter topic, see the very interesting work of Martindate (1977-1978) and Martindate & Hasenfus (1978). An excellent analytical treatment of laterality has appeared recently (Corballis 1980).

## Creativity and Intelligence

Intelligence itself is a term with many meanings and referents. While an analysis of this construct is beyond the scope of this chapter (see Resnick 1976 and numerous articles in the new journal *Intelligence* for some current perspectives), we would like to note that creativity investigators have used the term “intelligence” variously to refer to (a) that which **IQ** tests measure; (b) the entire multifactorial domain of human cognitive abilities (including such creativity-related components as **DT** abilities, problem-finding abilities, special talents such as musical and artistic abilities, and the ability to access primary process modes of thought by regressing in the service of the ego); and (c) that which qualified observers (peers, teachers, etc) describe as “intelligence” on the basis of repeated observations of behavior in many situations. Our brief review of research of the past 15 years regarding creativity and intelligence will deal briefly with each of these perspectives.

### Models of Intellect, Old and New

Though Guilford's Structure-of-Intellect (SI) model has continued to dominate discussions of the relationship between intelligence and creativity, the SI model has been increasingly criticized on technical and conceptual grounds. (See Butcher 1973, Horn 1977, and Vernon 1979 for summaries and evaluations of such criticism). Critics object to the alleged subjectivity of the underlying rotational procedures, to Guilford's insistence upon orthogonal rather than oblique factors, to some possible narrowness in the 120 (!) SI abilities, to the alleged psychological superficiality of the SI's “product” category, and to the tendency of the model to suggest that the operations (cognition, memory, evaluation, convergent production, and divergent production) are mutually exclusive and isolatable. Despite these criticisms, the SI model has spurred the development of interesting new tests [e.g. Lang & Ryba's (1976) SI-inspired tests of auditory abilities which nicely discriminated musicians, artists, and controls] and provided a conceptual framework for many investigators.

During this same period, Cattell continued to develop his alternative model of fluid and crystallized intelligence. In its radically elaborated 1971 form, this appeared to involve about 500 sub-abilities (Cattell 1971, Butcher 1973). A study by Rossman & Horn (1972) found modest positive *rs* between indices of creative achievement or reputation and a broad “fluency” factor, but insignificant and very small *rs* with “fluid” and “crystallized” intelligence factors. While Cattell's model of intellect will surely receive much deserved attention, and while the thirteenth chapter (“Genius and the processes of creative thought”) of Cattell's 1971 book is must reading for serious students of creativity, the links between Cattell's model of intellect and achievement-based creativity are primarily speculative at this point.

## 8 Personal Indicators of Individual Creativity and Innovation

The emergence of what one might term “differential cognitive psychology” in recent years also holds enormous potential for future research involving the cognitive underpinnings of creativity. This approach, which involves the simultaneous attempt to understand test performances and intellectual abilities in terms of underlying cognitive processes and the reciprocal effort to view cognitive processes in terms of potentially measurable subskills and component abilities, may lead to a much needed blending of the process and ability approaches to the study of creativity. Recent efforts by Carroll (1976), for example, to identify and characterize DT abilities in terms of underlying information-processing components have obvious implications for creativity research. (See also the review by Stankov 1980, the effort by Mendelsohn 1976 to understand Remote Association Test (RAT) performance in terms of attentional abilities, and the attempt by Sternberg 1977 to analyze analogical thinking skills into component abilities). In our view, differential cognitive psychology has the potential to deepen our understanding of creative processes and abilities quite substantially. For further introductions to this perspective, the reader is referred to Resnick (1976), to a series of articles appearing in the second volume of *Intelligence* (1978), to Carroll & Maxwell (1979), to Pellegrino & Glaser (1979), to Sternberg (1979), and to Royce (1980).

### Creativity and Traditional Measures of Intelligence

Findings in the last 15 years have tended to confirm the picture which earlier research had suggested. Studies of creative adult artists, scientists, mathematicians, and writers find them scoring very high on tests of general intelligence (e.g. Barron 1969; Bachtold & Werner 1970; Helson & Crutchfield 1970b; Cattell 1971; Helson 1971; Bachtold & Werner 1973; Gough 1976a), though *rs* between tested intelligence and creative achievement in these samples range from insignificantly negative ( $r = -.05$ , Gough 1976a) to mildly and significantly positive ( $r = +.31$ , Helson 1971). In other studies, often involving nonprofessional samples, measures of tested intelligence and indices of creative achievement or reputation are often insignificantly or only very weakly positive (e.g. Helson & Crutchfield 1970b; Rotter, Langland & Berger 1971; Davis & Belcher 1971; Rossman & Horn 1972; R. M. Milgram, Yitzhak & N. A. Milgram 1977; Frederiksen & Ward 1978; and Hocevar 1980) and sometimes modestly positive (e.g. McDermid 1965; Helson 1971; Vernon 1972b; Torrance 1972b; Schmidt 1973; Kogan & Pankove 1974; Gough 1976a; and Hocevar 1980). Though a curvilinear relationship between intelligence and creativity has often been suggested (with intelligence presumably becoming less and less influential as one moves into higher and higher levels of intelligence), the only formal test (with negative results) of this hypothesis we are aware of was conducted by Simonton (1976a) in a reanalysis of Cox’s historical geniuses – a sample quite probably too rarified to be a particularly good test of the curvilinear hypothesis.

## Creativity and Rated or Perceived Intelligence

It should be noted that creative people are often perceived and rated as more intelligent than less creative people even in samples where no corresponding correlations between tested intelligence and creativity obtain. Despite an  $r$  of  $-.08$  between Terman's Concept Mastery Test and professionally rated creativity among the top 40 IPAR architects (MacKinnon 1962a), e.g., staff ratings of the single adjective "intelligent" correlated  $+.39$  with the index of creativity (MacKinnon 1966).

While such an  $r$  may reflect some spurious halo effects, it may also tell us something about the true overlap in meaning of these terms in the natural language. Popular criteria for "intelligence" are much broader than those tested by standard "intelligence" tests. It is also possible that such  $r$ s partially reflect the presence of a set of personality characteristics and processes which influence the degree to which raw talent or aptitude of almost any form is translated into effective and socially impressive behavior. It is conceivable, for example, that factors making for success (such as forcefulness of character, self-confidence, etc) facilitate effective behavior of many forms (including behavior having an "intelligent" and a "creative" look about it) and thereby produce a degree of correlation between "effective creativity" and "effective intelligence" which is higher than the correlation between "raw creative ability" and "raw intelligence." After all, creativity is a social outcome, and so is intelligent action. We believe that this distinction between "raw (or best-measured) intelligence" and "effective intelligence" and between "raw creative ability" and "effective creativity" is certainly one worth making.

## Creativity and Divergent Thinking Abilities

Binet began the development of open-ended, multiple-solution measures (e.g. "Sentence Invention" and "Ink Blots") of the type we now call divergent thinking (DT) tests (Binet & Henri 1896). Upon such tests, much of modern research on creativity depends and is focused. Though DT tests were essentially excluded from Binet's subsequent batteries (see Guilford 1967, chapter 1, for an interesting discussion of this point), the open-ended, multiple-solution format assumed by Binet to facilitate the measurement of imaginative abilities was quickly adopted by early creativity investigators. Indeed, the proliferation of studies involving such tests was so great that by 1915 Whipple was able to devote an entire chapter in the second edition of his *Manual of Mental and Physical Tests* (1915) to "Tests of Imagination and Invention" in which he cites the work of at least 19 investigators actively exploring this domain.

The development and use of DT tests continued quite steadily up to 1950, at which time Guilford's (1950) presidential address to the American Psychological Association introduced many psychologists to his own research group's new efforts

in a research tradition already half a century old. The impact of Guilford's address upon the field of creativity was, of course, catalytic and long term.

Wallach and Kogan's influential book, *Modes of Thinking in Young Children*, which contained a battery of highly intercorrelated DT tests influenced by Guilford's earlier work, was published in 1965. these tests [and Ward's (1968) modification of them for use with much younger children], together with the Torrance Tests of Creative Thinking (TTCT) (Torrance 1966) and a few of the early measures produced by Guilford's group (Alternate Uses, Consequences, Plot Titles), have dominated the DT test scene for the past 15 years.

**THE QUESTION OF VALIDITY** Despite the 80-year history of such measures of productive imagination, the vitally important question of whether divergent thinking tests measure abilities actually involved in creative thinking is not at all easy to answer in satisfying detail. Nevertheless, an imprecisely qualified answer does seem justified by the evidence gathered thus far; some divergent thinking tests, administered under some conditions and scored by some sets of criteria, do measure abilities related to creative achievement and behavior in some domains. Our own extensive review of the literature reveals more than 70 studies in which positive and statistically significant relationships have apparently been observed between various divergent thinking test scores and reasonably acceptable nontest indices of creative behavior or achievement. In addition to the more than 50 studies cited elsewhere and earlier (Harrington 1972, pp. 30-32), validating evidence for DT tests has been reported at the elementary school level (Rotter, Langland & Berger 1971; Schaefer 1971a; Torrance 1974; Wallbrown & Huelsman 1975; Wallbrown, Wallbrown & Wherry 1975); at the junior high school level (Vernon 1971, 1972b); and at the high school level (Lynch 1970; Anastasi & Schaefer 1971; Kogan & Pankove 1972, 1974; Milgram & Milgram 1976). At the undergraduate and graduate levels, significant positive relationships have been reported by Khatena 1971b; Harrington 1972; Rossman & Horn 1972; Domino 1974; Torrance 1974; Lang & Ryba 1976; Holloway & Torrance 1977; Forisha 1978a; Frederiksen & Ward 1978; Hocesvar 1980. Significant results with nonstudent adults have also been reported by Tan-Willman 1974; Getzels & Csikszentmihalyi 1976; Gough 1976a.

Two comments are immediately in order. It should first be noted that DT test scores have often failed to correlate significantly positively with plausible indices of creative achievement and behavior. While there are probably many reasons for this, one factor undoubtedly involves the field-specific relevance of many DT abilities and the primitive state of knowledge regarding the abilities underlying creative behavior in any given field. Because the DT abilities presumably underlying creative achievements probably vary from field to field, there is little reason to expect any randomly selected DT test to correlate with creative achievement in any randomly selected domain. Until greater attention is paid to the matching of DT tests of relevant domains, attempts to validate DT tests will proceed in an essentially shotgun fashion. It is therefore particularly



encouraging to note that several investigators have demonstrated substantial sensitivity to this issue in recent years. Efforts by Cunnington & Torrance (1965) and Lang & Ryba (1976) to develop measures involving auditory stimuli for studies in the domain of musical creativity (Torrance 1969, Khatena 1971b, Holloway & Torrance 1977) and by Gough (1975, 1976a) and Frederiksen & Ward (1978) to develop DT tests particularly relevant to scientific creativity clearly reflect a heightened awareness of this issue. Similar efforts by Hall (1972) and Lunneborg & Lunneborg (1969) to study architectural creativity using tests involving visual stimuli also reflect a growing desire to match ability measures to creative process and product.

The second point involves the possible role of general intelligence in the DT “validity” coefficients reported above. Though most of the studies cited did not report the data necessary to determine whether DT tests are measuring creativity-related variance beyond that measured by intelligence tests, a few did. On the basis of those few studies one can say that some **DT** tests, administered to some samples, under some conditions and scored according to some criteria, measure factors relevant to creativity criteria beyond those measured by indices of general intelligence (see Harrington 1972, pp. 39-40). As investigators begin including measures of general intelligence in DT validation studies routinely and begin to approach their data using the most appropriate analytic techniques (such as the multiple regression methods used by Cronbach 1968 and Hocevar 1980), evidence relevant to this critical issue should accumulate much more rapidly than it has to date.

The questions of scoring, instructions, and test administration. A great deal of attention has been devoted in the last several years to the question of optimal DT test instructions and test conditions (see Hattie 1977, 1980 for recent review). Most of this work has focused on conditions needed to generate DT scores which are as weakly correlated with general intelligence measures as possible or on conditions which maximize raw fluency or uniqueness scores. Though less attention has been directed to the development of test instructions and scoring procedures which, when coordinated, maximize the construct-validity of DT tests, at least two studies (Datta 1963 and Harrington 1975) found that when DT instructions to “be creative” were coordinated with scoring procedures sensitive to creative quality, correlations with indices of creativity were significantly improved. A recent report by Katz & Poag (1979) replicating some aspects of these studies for men but not for women calls attention to the need for much more extensive work in this generally neglected area.

Because the question of optimal scoring methods for DT tests deserves lengthier treatment than we can give it, the reader is referred to useful discussions and illustrations of various scoring methods by Vernon (1971), Harrington (1972, 1975), and Frederiksen & Ward (1978).

DIVERGENT THINKING ABILITIES AND TRADITIONAL MEASURES OF INTELLIGENCE. For those who believe that DT abilities are the key to (and

perhaps even an appropriate operational definition of) creative thinking ability, the relationship between DT abilities and traditional measures of intelligence has been a topic of great interest and the subject of much investigation. (See Butcher 1973, Horn 1976, and Vernon, Adamson & Vernon 1977 for some useful reviews). In general it seems best to summarize these studies by saying that DT X intelligence *rs* vary widely (from zero upward) depending upon the DT tests, the heterogeneity of the sample, and the testing conditions. In a much-cited review, Torrance (1967) summarized 388 *rs* involving intelligence measures and the Torrance Tests of Creative Thinking (TTCT) and reported a median *r* of +.06 for his figural DT tests and +.21 for his verbal DT tests. Guilford (1967) reported average *rs* of +.22 for his figural DT tests, +.40 for symbolic DT tests, and +.37 for semantic DT tests in a sample of 204 ninth graders but a *range* of DT X IQ *rs* from -.04 to +.70. Such wide variations in DT X IQ *rs* are not uncommon; Bennett (1972, as reported by Butcher 1973) obtained aggregate DT X IQ *rs* in the +.5 to +.6 range in a sample of approximately 1000 United Kingdom youngsters, whereas Magnusson & Backteman (1978) reported aggregate DT X IQ *rs* in the range of +.2 to +.3 in a sample of approximately 1000 Swedish teenagers. (The Magnusson and Backteman study was also noteworthy for having demonstrated substantial temporal stability over 2-years period for these DT tests which were largely independent of traditional intelligence measures.)

While the average figure of approximately +.3 sometimes referred to in reviews (e.g. Horn 1976 and Richards 1976) is a reasonable estimate of central tendency, it must be recalled that the actual DT X IQ *rs* vary widely depending upon the nature of the DT tests, the heterogeneity of the sample, and apparently the nature of the testing situation. (For reviews of research dealing with this latter point, see Hattie 1977, 1980).

The possibility that IQ may be a prerequisite to DT performance was proposed by Guilford (1967) and studied by examining relevant scatterplots for triangularity (Guilford 1967, Guilford & Christensen 1973, Schubert 1973, Richards (1976). While this line of investigation is far from conclusive, some DT and IQ scatterplots do seem to form a quasi-triangle compatible with Guilford's hypothesis.

### Creativity and Other Special Abilities

**ASSOCIATIONAL ABILITIES.** The idea that creativity involves the ability or tendency to form numerous and unusual associations is, of course, a very old and sturdy one in the history of psychology. It is therefore not surprising that considerable effort was devoted to examining relationships between creativity and associative abilities and tendencies during the past 15 years. Much of this work centered on the Mednicks Remote Associates Test (Mednick & Mednick 1967). Rather than attempt a superficial review of the substantial work using this measure, we refer the reader to test reviews by Baird (1972), Bennett (1972),

Vernon (1972a), and Backman & Tuckman (1978), to Worthen & Clark (1971) for a critique of the RAT and a possibly improved measures of remote associational ability, to Mendelsohn (1976) for a good review of his studies of attentional processes presumably underlying RAT performance, to Noppe & Gallagher (1977) for a cognitive-style approach to the RAT, and to Sobel (1978) for a very recent review of 18 studies examining the remote associates theory of creativity.

Interesting new work in the associationistic tradition was also reported by Rothenberg (1973a, b), who found evidence supporting his Janusian thinking theory of creativity (Rothenberg 1979) in the fact that opposite-responding on word association tests was significantly and positively related to indices of creativity, and by MacKinnon (1962a) and Gough (1976a), who found that *moderately* unusual associations were positively correlated with rated creativity in their samples of architects, research scientists, and engineering students.

**ACCESS TO MORE PRIMITIVE MODES OF THOUGHT.** The idea that creativity is facilitated by access to relatively primitive modes of cognition is a fundamental aspect of the psychoanalytic theory of creativity, and as such has been a focus of considerable research for many years. The past 15 years have seen a steady stream of research by Child (1965), Wild (1965), Dudek (1968), Taft (1971), Schaefer (1971b, 1972a), Holland & Baird (1968), Rogolsky (1968), Gray (1969), Raychaudhuri (1971, 1972), Aronow (1972), Barron (1972), Schmidt (1973), Eiduson (1974), Dudek (1975), Del Gaudio (1976), Domino (1976), Loshak & Reznikoff (1976), Schaefer, Diggins & Millman (1976), and Frank (1979). Recently this topic has been reviewed comprehensively by Suler (1980).

This line of research has also produced several new measures of relevance to creativity: Singer's Regression in the Service of the Ego (RISE) scale (as reported in Child 1965); Fitzgerald's Experience Inquiry (1966) (which also attempts to measure RISE, among other interesting characteristics); a Preconscious Activity Scale by Holland & Baird (1968); an "Ego-Permissiveness" scale by Taft (1971); and Coan's Experience Inventory (as described in Schaefer et al 1976).

**ANALOGICAL AND METAPHORICAL ABILITIES** During the past 15 years investigators have actively examined the possible role of analogical and metaphorical thinking in creativity (e.g. Gordon 1966, Dreistadt 1968, 1974; Arieti 1976; Khatena 1975; Harrington 1979, 1981). This interest had earlier led to the development of Barron's Symbol Equivalents Test (1969), in use since 1951 at IPAR, and Schaefer's Similes Test (1971a), both of which measure abilities involved in the production of analogical and metaphorical images. Other tests in this domain include Khatena's Onomatopoeia and Images Test (Khatena 1969, Khatena & Torrance 1976), and Kogan's Metaphoric Triads Task (Kogan et al 1980). Winner & Gardner (1977) developed a "metaphoric competence" measure with which to study laterality effects in the thinking of brain-damaged patients. It seems very likely that the 1980s will see a vigorous exploration of the role played in creative thinking by analogical and metaphorical processes and abilities.

**IMAGERY ABILITIES** Spurred by developments in cognitive psychology which “re-legitimized” the topic and partly spurred by a new journal (*Journal of Mental Imagery*), several creativity investigators have also returned to a topic of long-standing interest in this field: imagery. We refer the reader to recent overviews by Lindauer (1977), Forisha (1978a, b), Khatena (1978), and a very interesting piece of earlier work by Juhasz (1972) which has not received the attention we think it deserves.

**PROBLEM FINDING ABILITIES** One of the most interesting developments of the past 15 years was the emergence of problem finding as an important topic of investigation. Significant contributions included Mack-worth’s paper on problem-finding in science (1965), Csikszentmihalyi and Getzels’ interest in problem finding in art (Getzels & Csikszentmihalyi 1976) and life (Csikszentmihalyi & Beattie 1979) and Arlin’s attempts to develop and explore problem finding within a neo-Piagetian developmental perspective (1975, 1977). Recent studies by Kasperson (1978) and Glover (1979) of relationships between creativity and question asking and information obtaining behaviors represent further extensions of this new interest in what is clearly a crucial aspect of creative behavior and one which will almost surely be studied very seriously in the 1980s.

## Creativity and Personality

### A Proliferation of Studies in Many Fields

The search for personality characteristics associated with creative achievement and activity has been carried on in many domains and at many age levels by investigators using a variety of procedures and approaching the task from both the intra and inter-field perspectives described above. Let us first look at the scope of the studies by field before seeking a common core in the diverse findings.

**ART** Studies of personality characteristics associated with artistic activity and creative achievement involved preschool children (Harrington, Block & Block 1974, Trowbridge & Charles 1966); elementary school children (Trowbridge & Charles 1966, Ellison et al 1976, Milgram et al 1977); high school students (Trowbridge & Charles 1966, Schaefer & Anastasi 1968, Holland & Baird 1968, Anastasi & Schaefer 1969, Schaefer 1969a, b, Walberg 1969a, Ellison et al 1976); undergraduates and students in art schools (Cross, Cattell & Butcher 1967, Barron 1972, Rossman & Horn 1972, Gotz & Gotz 1973, Csikszentmihalyi & Getzels 1973, Schaefer 1973, Zeldow 1973, Getzels & Csikszentmihalyi & Getzels 1973, Schaefer 1973, Zeldow 1973, Getzels & Csikszentmihalyi 1976, Rossman 1976, Korb & Frankiewicz 1979, Shelton & Harris 1979); professional artists (Cross et al 1967, Bachtold & Werner 1973, Amos 1978, Gotz & Gotz 1979a, b). Personality correlates of architectural creativity were studied using students of architecture

(Karlins, Schuerhoff & Kaplan 1969, Schmidt 1973) and professional architects (Hall & MacKinnon 1969, Gough 1979). The personality characteristics of undergraduate cinematographers were also examined (Domino 1974).

**LITERATURE** Investigators studied personality characteristics associated with creative writing among elementary school children (Milgram et al 1977); high school students (Schaefer & Anastasi 1968, Holland & Baird 1968, Anastasi & Schaefer 1969, Schaefer 1969a, b); college students (Korb & Frankiewicz 1979); and professional writers (Helson 1970, 1973a, b, Bachtold & Werner 1973, Helson 1977, 1977-1978).

**MUSIC** Personality characteristics of creative musicians in India were studied (Raychaudhuri 1966, 1967) as were characteristics associated with musical composition grades in a sample of music students (Khatena 1971b).

**SCIENCE AND TECHNOLOGY** Personality correlates of scientific achievement and creativity were studied in elementary school children (Milgram et al 1977); high school students (Schaefer & Anastasi 1968, parloff et al 1968, Anastasi & Schaefer 1969, Schaefer 1969a, b, Walberg 1969a); undergraduates, young adults, and graduate students (Rossman & Horn 1972, Schaefer 1973, Gough 1979, Korb & Frankiewicz 1979); psychologists (Chambers 1964, Wispe 1965, Bachtold & Werner 1970); inventors (Bergum 1975, Albaum 1976, Albaum & Baker 1977); mathematicians (Helson 1967b, 1968a, Parloff et al 1968; Helson & Crutchfield 1970a, b; Helson 1971; Gough 1979); chemists (Chambers 1964); and assorted engineers and research scientists (McDermid 1965, Owens 1969, Bachtold & Werner 1972, Bergum 1973, Eiduson 1974, Gough 1979).

**MULTIPLE DOMAINS** Personality correlates of global or multiple field indices of creative achievement, activity, and reputation were studied using elementary school children (Sussman & Justman 1975); undergraduates and young adults (Helson 1967a, Domino 1970, Taft & Gilchrist 1970, Elton & Rose 1974); college professors (Chambers 1973, Bergum 1974); and adults living in Calcutta (Raychaudhuri 1971).

## The Emergence of Core Characteristics

The empirical work of the past 15 years on the personality characteristics of creative people brought few surprises. In general, a fairly stable set of core characteristics (e.g. high valuation of esthetic qualities in experience, broad interests, attraction to complexity, high energy, independence of judgment, autonomy, intuition, self-confidence, ability to resolve antinomies or to accommodate apparently opposite or conflicting traits in one's self-concept, and, finally, a firm sense of self as "creative") continued to emerge as correlates of creative achievement and activity in many domains.

One manifestation of this apparent emergence of core characteristics was the development of several empirically keyed “creative personality” scales for Gough’s *Adjective Check List* (Smith & Schaefer 1969; Domino 1970; Yarnell 1971a, b; Harrington 1972, 1975; Gough 1979). Reasonably encouraging evidence of the construct validity of these scales has subsequently emerged (Domino 1974, Welsh 1975, Albaum & Baker 1977, Domino 1977, Ironson & Davis 1979). A 5-year follow-up (Schaefer 1972c) has demonstrated the temporal stability of one of these scales, and studies (Harrington 1972; unpublished manuscript, 1979) have revealed very high interscale correlations. The magnitude of these correlations (typically in the .70s and .80s after statistical removal of general adjective-endorsing tendencies) establishes the existence of a set of core characteristics associated with creative achievement and activity in a fairly wide range of domains. The adjectives in the Composite Creative Personality scale (Harrington 1972, 1975) provide a good sense of these scales: active, alert, ambitious, argumentative, artistic, assertive, capable, clear thinking, clever, complicated, confident, curious, cynical, demanding, egotistical, energetic, enthusiastic, hurried, idealistic, imaginative, impulsive, independent, individualistic, ingenious, insightful, intelligent, interests wide, inventive, original, practical, quick, rebellious, reflective, resourceful, self-confident, sensitive, sharp-witted, spontaneous, unconventional, versatile and *not* conventional and *not* inhibited.

Because the scales are embedded in a set of 300 extremely diverse adjectives, they are not transparent (and thus unduly face valid) in their naturally administered form. Recent evidence regarding their vulnerability to conscious attempts to “fake creative” (Ironson & Davis 1979), however, suggests that application of the ACL to subjects sensitive to the issue of creativity should be avoided when these scales are used. For example, they would probably be very poor measures to use in evaluating the effectiveness of creativity workshops or training programs.

The apparent emergence of core characteristics also prompted several investigators to survey the pattern of consistent correlates and to construct their own creative personality scales and inventories on a rational, *a posteriori* basis. Creative personality scales were thus developed for use with elementary school children by Schaefer (see Schaefer & Bridges 1970; Schaefer 1971c; and reviews by Vernon 1978 and Yamamoto 1978); Rookey 1971, 1974; Rimm 1976; Rimm & Davis 1976; Davis & Rimm 1977) and for use with adolescents and adults by Torrance and Khatena (Torrance 1970; Khatena 1971a; Khatena & Torrance 1976) and by Davis (1975). Evidence regarding the construct validity of several of these instruments was presented by Rekdal (1977) and is routinely updated in *Gifted Child Quarterly*.

The consistent emergence of certain correlates of creative achievement and activity also led to the development of an empirically based “creativity equation” by Cattell for his widely used 16 PF (Cattell, Eber & Tatsuoka 1970, pp. 129,

241-42). In a partial validation of this equation, Csikszentmihalyi & Getzels (1973) applied Cattell's equation to a sample of student artists and found those students average creativity scores to be at the eighty-ninth percentile using college norms. Though the 16 PF equation was offered as an index of the global creative personality, hope was held out that further research would provide evidence by which different equation weights could be developed for specific types of creativity and situations. Similar indices or composites were developed by the IPAR group for several widely used inventories (Hall & Mackinnon 1969). Which of these "core" personality characteristics facilitate effective social behavior of almost any form? Which specifically facilitate *creative* behavior? Which are by-products of social achievement and recognition of almost any form? Which are specifically by-products of creative achievement and recognition? Which are merely noncausally related correlates of creative achievement? These are questions that deserve careful attention from investigators of the 1980s. We suspect that longitudinal studies and systematic cross-field comparisons may be particularly helpful in illuminating these unresolved issues.

### Increased Attention to Age- and Field-Related Differences

While evidence of a set of core characteristics associated with creative achievement and activity in many domains grew stronger, several investigators became increasingly sensitive to the possibility that the picture of the creative person might vary as a function of age, sex, and field of creative activity.

**AGE** The proliferation of studies of creativity involving adolescents and young adults made possible an expanded search for age-related changes in the picture of the creative person. In an analysis of personality correlates associated with creativity in adolescent and adult men, Parloff et al (1968), for example, identified a factor they called "Disciplined Effectiveness" which correlated positively with indices of creative achievement in their adolescent males and negatively with indices of creative achievement in their adult males. This reversal was discussed at some length in terms of the relative importance of impulse control at certain stages of personal and professional development. Somewhat similar evidence of possible age-related correlational reversal involving the CPI Responsibility scale (slightly positively correlated with creativity among undergraduate cinematographers and significantly negatively correlated with creativity among professional architects) appeared in evidence reported by Domino (1974), who also commented upon apparent age-related correlational differences involving confidence in interpersonal interactions. In a similar vein, change in the apparent role of self-regulatory capacities "creative" artistic achievement was also noted in a longitudinal study of preschool children (Harrington et al 1974) where indices of self-regulation were positively correlated with creative artistic achievement at 3-1/2 and negatively correlated at 5-1/2. This is an important point; the

search for taxonomic simplicity has all too often ignored the phenomenon of developmental ebb and flow in many traits.

**FIELD OF CREATIVITY** As the number of studies in any given area has increased, it has become easier to detect and view with confidence the apparent field specificity of certain characteristics associated with creativity. It has become increasingly clear, for example, that creative scientists tend to be more emotionally stable, venturesome, and self-assured than the average individual, whereas creative artists and writers tend to be less stable, less venturesome, and more guilt prone (Cattell 1971, p. 411). As the studies of Getzels & Csikszentmihalyi (1976) make clear, it may also be necessary to draw distinctions *within* domains (e.g. fine artists vs applied artists) lest intradomain differences cancel one another out and badly obscure overall findings. Important studies in which the role of domain has been explicitly considered have also been reported by Parloff et al (1968); Anastasi & Schaefer 1969; Schaefer 1969a, b, c and 1972b, c, 1973; Schaefer & Anastasi 1968; Helson 1968a; Rossman & Horn 1972; Korb & Frankewicz 1979. It should be noted in this context that Schaefer's studies of biographical inventory correlates of creativity led him to develop field-specific creativity scales (Schaefer 1970a) for his inventory.

The search for field-specific correlates and characteristics is in no way incompatible with the search for a set of core characteristics associated with creativity in fairly diverse domains. The 1980s will surely see a tendency to develop increasingly field-specific pictures of the creative person.

### Creativity in Men and Women: A New Focus on Sex-Related Differences

Led by the pioneering efforts of Ravenna Helson (1966a, b, 1967a, b, 1968a, b, 1970, 1971, 1973a, b, 1974, 1977, 1977-1978, 1978a, b), many creativity investigators turned their attention to the psychology of creativity in women, to the possibility that different stories must be told about creative men and creative women, and to the possible roles played by such constructed as "psychological masculinity", "matriarchal consciousness", and "psychological androgyny."

**STUDIES OF CREATIVE WOMEN** Studies and reviews of creative women focused on women engaged in art (Nochlin 1971, 1979; Greer, 1979); writing (Olsen 1970, 1978; Spacks 1972; Showalter 1971; Helson 1973b); art and literature (Anastasi & Schaefer 1969; Schaefer 1969a,b, 1970b, 1971b, 1972b,c, 1973; Bachtold & Werner 1973); science (Walberg 1969b; Bachtold & Werner 1972); mathematics (Helson 1971); psychology (Bachtold & Werner 1970); elementary school teaching (Torrance, Tan & Allman 1970); college teaching (Groth 1975); and other assorted activities (Helson 1966a,b, 1967a,



1968b; Torrance 1972a; Suter & Domino 1975; Yu 1977; Blaubergs 1978; Morse & Bruch 1978; Lemkau 1969). It is clear that those wishing to examine the psychology of creative women have for more empirical evidence to look at today than they did 15 years ago. Very helpful reviews of this work can be found in Blaubergs (1978), Helson (1978b), and Lemkau (1979).

### *Two Types of Sex Differences*

*Mean differences* Because investigators increasingly included sex as a variable in their analysis, studies comparing males and females on creativity-related indices are simply too numerous to cite. For integrations of these studies the reader is referred to useful reviews by Kogan (1974), Forisha (1978b), and Helson (1978b).

*Correlational differences* Investigators have also become increasingly sensitive to the possibility of sex differences involving correlational patterns or interactions involving sex. For example, investigators have reported and commented upon different patterns of results for males and females related to creative working styles (Helson 1967b, 1968a) and products (Helson 1977), relationship of DT test performances to indices of psychological androgyny (Jones, Chernovetz & Hansson 1978); personality characteristics associated with barrier resourcefulness in preschool children (Block, Block & Harrington 1975); personality correlates of artistic achievement and status (Schaefer 1969b, Barron 1972, Getzels & Csikszentmihalyi 1976); cognitive-perceptual correlates of artistic achievement (Getzels & Csikszentmihalyi 1976); correlations among creative activity-achievement checklist scores (Hocavar 1976); correlations between imagery and creativity indices (Forisha 1978b); correlates of RAT scores (Gall & Mendelsohn 1967, Mendelsohn & Covington 1972, Mendelsohn 1976); validities of divergent thinking test scores (Vernon 1972b); behavioral correlates of DT test scores among kindergarteners (Singer & Rummo 1973); correlations between defensiveness and DT scores in children (Wallach & Kogan 1965, Kogan & Morgan 1969); reliabilities of DT test scores (Kogan & Pankove 1972, Torrance & Allioti 1969); correlations between biographical inventory scales of creativity and indices of openness to experience and sensation seeking (Schaefer et al 1976); and effects of explicit instructions to "be creative" on divergent thinking tests (Katz & Poag 1979).

In some of these studies correlational differences were tested for statistical significance and in many they were not. As differences between correlational and regression patterns become of greater interest, investigators will presumably grow more sophisticated in their analysis.

**PSYCHOLOGICAL FEMININITY, MASCULINITY, AND ANDROGYNY** Studies of the relationship between various indices of creativity (sometimes defined

as achievement and sometimes as ability) and indices of psychological masculinity ("patriarchal consciousness"), psychological femininity ("matriarchal consciousness"), and psychological androgyny were reported by Helson 1966a, 1967b, 1968a, 1970, 1971, 1973b; Littlejohn 1967; Stringer 1967; Hall & MacKinnon 1969; Urbina et al 1970; Domino 1974; Barron 1972; Suter & Domino 1975; Welsh 1975; Kanner 1976; Milgram et al 1977; Jones et al 1978; Harrington & Anderson 1979 and unpublished manuscript, 1980). The results of these studies cannot be summarized briefly. Suffice to say that indices of psychological femininity, masculinity, and androgyny were sometimes positively, ability, or self-concept. This area of research is simply too new for a clear picture to have emerged.

In addition to focusing attention upon creative women as such and thereby enormously broadening our picture of creative people, the study of creativity in women called the field's attention to the critical role which social context, expectation, and pressure play in determining whether creative talent is fostered and, if so, how it is directed. We suspect the benefits of this redirection of attention will be felt increasingly as the 1980s progress.

### Development of New Measures of Personality

In addition to the creative personality scales described above, a number of interesting new personality measures relevant to creativity research were introduced. Based on the early work by Gough & Woodworth (1960) with research scientists, by MacKinnon & Hall (MacKinnon 1963) with architects, and by Barron & Egan (1968) with business managers, Helson (1967b, 1973a,b) developed a Mathematician's Q-set and a Writer's Q-set by which individuals in these fields could describe their own work styles, relationships to their work, and other factors rarely tapped by standard personality assessment devices. By including formally similar items in field-specific Q-sets, Helson is obviously creating the possibility for very interesting studies across fields. Evidence reported thus far suggests that self-description generated with these Q-sets are very useful in drawing connections between personality and process.

Kirton's Adaptation-Innovation Inventory (Kirton 1976, 1977a,b) was designed to measure an individual's tendency to direct creativity either toward innovation or toward creative adaptation. Though validity information is meager at this point, the idea of measuring such a creativity style seems quite intriguing.

Pursuing his five-level definition of creativity, I. A. Taylor (Taylor, Sutton & Haworth 1974) developed the Creative Behavior Disposition Scale to assess dispositions toward expressive, technical, inventive, innovative, and emergentive creativity. Again, though validity data are meager, the concept underlying this instrument is promising.

New personality inventories containing scales of potential relevance to creativity investigators included Jackson's *Personality Research Form* (particularly his scales for autonomy, change, cognitive structure, sentience, and understanding) (Jackson 1967) and the *Jackson Personality Inventory* (Jackson 1976, 1978) (especially the scales for breadth of interest, complexity, conformity, energy level, and innovation).

A fine review of recent progress in the assessment of curiosity has also appeared (Maw & Maw 1978). Reviews of recent methodological and theoretical progress with respect to such potentially relevant dimensions as achievement striving, field dependence, locus of control, and sensation seeking have also appeared recently in an edited collection by London & Exner (1978).

### New Efforts to Link Personality to Process and Product

Extremely interesting attempts have been made in the last few years to link personality characteristics to facets of the creative process and to characteristics of creative products.

In her studies of writers of children's fiction, Helson (1973a,b) has made some progress in relating the placement of her Writers Q-set items to consensually rated characteristics of the children's books themselves. More recently Helson (1977-78) has begun to link personality characteristics of the writers to characteristics of their products via the writers' recollected experiences during the writing process. Dudek & Hall's (1978-79) effort to relate personal style in architecture to personality characteristics of the architect via qualitative analysis of Rorschach responses is another example of this interesting new line of inquiry. Fraught with the difficulties of pioneering efforts as they are, these initial studies seem very promising.

In an intriguingly similar enterprise, Atwood & Tomkins (1976) and Stolorow & Atwood (1979) have attempted to draw clear connections between personality characteristics of personality theorists and the character of their personality theories. The formal similarity to Helson's work is obvious and interesting.

Krantz & Wiggins (1973) have also undertaken a study linking personality characteristics of highly creative psychologists (Hull, Skinner, Spence, and Tolman) to their impact on the field by examining their direct relationships with their students. Implications of this work for a sociology of knowledge have been discussed by Campbell (1979).

These efforts to connect personality, process, and product strike us as extraordinarily exciting and deserving of encouragement and emulation.

## Thought Disorder and Creativity

Disorders of thinking may occur in clinical syndromes such as schizophrenia, manic depressive psychosis, and brain damage. Reasoning and realistic observation may also be diminished in certain readily reversible altered states of consciousness, such as extreme emotion, mystical states, reveries, temporary alcoholic or drug –induced derangements, dreams, and domination by unconscious motives in more or less ordinary individuals.

Meehl (1962) in his APA presidential address saw thought disorder as one of four hypothesized components in schizophrenia (the other three being anhedonia, ambivalence, and personal aversiveness). He proposed that it is necessary to distinguish among *schizotaxia*, *schizotypia*, and *schizophrenia*. *Schizotaxia* is an inherited specific etiology, “an aberration in some parameter of a single-cell function”, and is essentially a neural integrative defect; the *schizotype* is a form of personality organization arising from schizotaxia but conditioned by social learning and including as dispositional tendencies the four components of schizophrenia; *schizophrenia* is the clinical manifestation of a process of decompensation in a subset of schizotypic personalities.

This seems to us an important clarification of the difference between an inherited disposition and a social outcome. By analogy, divergent thinking at the neurological (single cell or not) level is *originotaxic*; the *originotype* is a form of personality organization in which the disposition toward originality, itself having several discernible components (Barron 1955), are present and capable of expression depending upon the presence of other factors, both in the environment and in the personality, *creativity* is a social outcome, certainly not a decompensation but quite possibly an overcompensation, if one employs those terms.

Let us back up a bit and look at the problem of the relationship of divergent thinking (originality) and thought disorder once again.

Studies of “normal” relatives of persons diagnosed as schizophrenic have shown a markedly higher incidence of thought disorder than one finds in the general population. At the same time, among the relatives of such patients there is a higher proportion of individuals who have achieved eminence through creative activities (see Karlsson 1978 for a summary of the evidence from his own and others researches).

Dobzhansky (1964) has argued that schizophrenia is strongly hereditary and may be inherited according to a simple Mendelian model but that incomplete penetrance of the gene is common, so that there may be as many as ten undetected carriers to one who develops a florid psychosis. Furthermore, the percentage of carriers may range from 10 to 20% of the general population. The implication is that an unusual cognitive condition, with a single-gene, single-cell base and sometimes clinically evident as thought disorder, is relatively common. In the presence of certain crucially ameliorative factors

or moderator variables (high intelligence, e.g., or high ego strength) could this condition manifest itself as originality of thought, or creativity? Jarvik & Chadwick (1973) point out that a condition so detrimental to survival as schizophrenia, with a highly probable genetic component, should have declined by natural selection unless it had positive, adaptive aspects.

In a study by Al-issa (1972), 50 schizophrenics were administered ten of the Guilford tests, including Impossibilities, Consequences scored for remoteness, and Alternative Uses. All tests proved to have a high positive correlation with vocabulary. However, Remote Consequence and Alternative Uses were significantly negatively related to a measure of overinclusion, traditionally a sign of thought disorder. (Overinclusion may be a misleading term, a name given by the test interpreter to the respondent's tendency to use, or at least attend to, more and seemingly irrelevant information than is necessary for the solution of the problem at hand. But sometimes that is a very useful habit for the creative problem solver to have; overinclusion today may yield tomorrow's fresh insight). The (complex) W score on the Rorschach, which reflects the respondent's effort to include many aspects of the blot in a single synthesizing image, has been shown by Barron (1955, 1957) to be highly positively correlated with a composite score for originality, including many DT tests; moreover, a substantial correlation of W with originality survives the partialling out of measured intelligence.

Several studies support this line of reasoning. McConaghy & Clancy (1968) showed that "allusive" thinking on object-sorting tasks is common though not so pronounced in the normal population as in schizophrenics, and they showed familial transmission in schizophrenics and nonschizophrenics. Dykes & McGhie (1976) showed that highly creative normal subjects score as high on the Loviband object sorting test as do schizophrenics, Woody & Claridge (1977), using Guilford DT tests and the Eysenck Personality Inventory (EPI) with a group of 100 university students, found "psychoticism" strongly related to divergent thinking. Farmer (1974) (cited by Woody & Claridge 1977) showed that EPI Psychoticism was very highly correlated with Originality on the Consequences test.

In an analysis of the Schizophrenia scale of the MMPI to discover how hospitalized "schizophrenics" differed from at-large "artists" matched for Sc score, age, sex, and education, it was discovered that the two groups clearly earned their identical Sc elevations in very different ways; the analysis yielded a subset of 18 items significantly differentiating the groups (Barron 1972). The item content for the 18-item subscale seems to express mostly a positive hedonic tone in the artists as contrasted with anhedonia in the patients; items on which schizophrenics and artists were similar are reports of odd sensory and perceptual experiences, a preference for solitude, rejection of common social values, and feelings of restlessness leading at times to impulsive outbursts. Claridge (1972) showed that divergent thinking tests were

significantly related to an index of psychoticism based on a principal components analysis of a wide range of psychophysiological parameters known to discriminate psychotics from normal controls.

For an incisive analysis of these questions and a selected brief but excellent review of the literature, see Hasenpus & Magaro (1976), "Creativity and schizophrenia: An equality of empirical constructs." As they show, the research evidence supports the thesis that ideational fluency and "overinclusion" are facets of the same cognitive propensity, and that a tendency to introduce complexity in perception goes both with creativity and with schizophrenia. Yet the core characteristics of the creative person as summarized above are certainly not those of someone in the throes of a bout with schizophrenia, nor even of the schizotypic personality. Here we are badly in need of thoughtful research. The question itself may contain an important key to the psychological and genetic connections between psychological health and psychological disease.

The use of alcohol and its function in creative thinking has been discussed by Karlsson (1978) and others. Alcohol of course produces diminished observation and loss of memory, including at times the loss of whole classes of information necessary for adaptive functioning. However, it also loosens inhibitions, increases "inappropriate" associations, and leads to "cosmic" thoughts and utterances, all of which can be instrumental in certain types of creative activity. But of course alcohol can also be used for its damping effects when the cortical fires are burning too brightly. Research on creativity and the use of alcohol might profitably employ Pavlov's theories concerning cortical inhibition and excitation and their relationship to personality types.

Psychedelic or hallucinogenic (take your pick of the terms) drugs produce altered states of consciousness that clearly are the result of biochemical interventions affecting neural systems. These states result in temporary abrogation of certain perceptual constancies and thereby in novel experience, whether in a passive waking state or accompanied by active behavior that in turn leads to novel situations. Description of the effects of such drugs and their chemical nature, as well as speculation about the way they work, can be found in a summary by Barron, Jarvik & Bunnell (1964). Their effect specifically on creativity has been reviewed by Krippner (1977). In general, it appears that creativity as ability or achievement is little affected one way or another over the long term by such agents, though at the level of momentary direct experience they produce novelty and divergent thinking; their effect on creativity as attitude is difficult to assess, though important.

Perhaps these substances and their effects are best understood in relation to trance states and suggestibility. If someone in a good position to do so should suggest to you that you can do better at something, you probably will – about 10 to 20% better.

Testimony from recognized geniuses (see Ghiselin 1952, e.g.) show that intense motivation and experience in unusual states of consciousness are

instrumental in what is later recognized by society as high creativity. The self-managed introduction of consciousness-altering substances may be a well-thought-out strategy on the part of some creative people; or it may simply be a compulsive method for achieving temporary regression in the service of the ego.

If the disposition to schizophrenia is inherited, is the component called thought disorder inherited too? Is the ability or tendency to think divergently inherited? Twin studies with normal subjects suggests in the whole that twin resemblances in verbal DT abilities do not show zygoty effects (Barron 1972; Pezzullo, Thorsen & Madaus 1972; Barron & Parisi 1977). However those studies as well as the results obtained by Domino et al 1976, support the well-known distinction between verbal and figural abilities (which do seem to be inherited) in creativity. A refinement of design that would include sampling of co-twins of schizophrenic index cases as well as other family members seems in order.

### **Psychobiography, Psychohistory, and the Life-Span Perspective**

Pursuing a recognition in the early 1960s that biographical information provided good bases for predicting creative achievement, many investigators have developed and employed biographical inventories and a life-span approach in creativity research during the last 15 years. The heightened interest in the study of lives received an important impetus from the Henry A. Murray festschrift (*The Study of Lives* by White, 1963) and was evident in perspective-providing developmental reviews and theoretical work by Arasteh (1968), Arasteh & Arasteh (1968, 1976), Wallach (1970), Gowan (1972, 1974), Kogan (1973), Landau & Maoz (1978), Shapiro (1975), Arilin (1976), Alpaugh, Renner & Birren (1976), and Runyan (1978); by methodological pioneering in the field by Simonton (e.g. 1975, 1976b, 1977, 1978); and by empirical studies cast in developmental terms (e.g. Dennis 1966; Roe 1965, 1972; Waterman, Kohutiz & Pulone 1977, Schultz, Hoyer & Kaye 1980). Studies of creativity and DT abilities in increasingly younger children (Dudek 1974, Strarkweather 1976, Ward 1974, and many others) also indicated growing interest in the life-span perspective. So, too, did numerous studies of parental and home influences on the development of creative individuals (Nichols 1964, MacKinnon 1966, Datta 1967, Datta & Parloff 1967, Helson 1968b, Schaefer & Anastasi 1968, Anastasi & Schaefer 1969, Domino 1969, Heilbrun 1971, Baroon 1972, Dewing 1973, Getzels & Csikszentmihalyi 1976, Grant & Domino 1976, Goertzel, Goertzel & Goertzel 1978, Domino 1979). The notoriously awesome problems of conducting longitudinal studies were taken on by several investigators (Helson 1967a, Owens 1969; Cropley 1972;

Kogan & Pankove 1972, 1974; Schaefer 1972b,c, 1973; Torrance 1972b; Eiduson 1974; Getzels & Csikszentmihalyi 1976; Gough 1976b, 1979; Magnusson & Backteman 1978), who obviously realized that many fundamental questions regarding the psychology of creativity can only be approached from a developmental and longitudinal perspective.

At least two biographical inventories with empirically keyed creativity scales have been marketed – the Alpha Biographical Inventory, developed by C. W. Taylor and R. Ellison at the Institute for Behavioral Research in Creativity in 1966 (reviewed by Hemphill 1972 and Ward 1972) and the Biographical Inventory (Schaefer 1970a). These and similar inventories have been used in studies of artistic, scientific, and entrepreneurial creative achievement. Groups have included elementary school children (Ellison et al 1976); high school students (Schaefer & Anastasi 1968; Anastasi & Schaefer 1969; Schaefer 1969a; Walberg 1969a; Schaefer 1972b; Torrance, Bruch & Morse 1973; James et al 1974; Payne & Halpin 1974; Ellison et al 1976); professionals in engineering and scientific creativity (Buel 1965; McDermid 1965; Buel, Albright & Glennon 1966; Taylor & Ellison 1967; Tucker, Cline & Schmitt 1967; Owens 1969; Ellison, James & Carron 1970; Albaum 1976); and business managers (Barron 1969). Cross-validated correlations have typically ranged from the .30s to the high .50s with empirically keyed creativity scales developed from these inventories. Such creativity scales have also been used as creativity *criteria* against which other indices of interest have been correlated (e.g. Davis & Belcher 1971, Lacey & Erickson 1974, Suter & Domino 1975, Patel 1976, and Schaefer et al 1976).

The very factorial complexity (e.g. Morrison et al 1962; Payne & Halpin 1974) which gives these biographical scales their predictive power also creates serious interpretive difficulties if one attempts to derive theoretically pertinent meaning from them. While the inclusion of information about such factors as availability of cultural materials in the home, parental education, childhood hobbies, quality of education, perceived parental pressures and encouragements, previous creative activities, achievements and awards, current motivations, and current self-rated abilities certainly increases the predictive power of these scales, correlations between aggregations of such items and indices of creative achievement do not lend themselves to incisive interpretation. Such scales are factorially complex correlates of creative achievement, and as such should not be substituted for creative achievement indices. We believe that the maximum scientific value of such inventories will come from examining and reflecting upon the content of item-level correlates of creative achievement in particular settings and samples. By providing a wide range of information (particularly regarding situation and life-history factors often neglected in creativity research) biographical inventories have broadened our perspective in important ways. It would therefore be particularly disappointing in the inherent potentials of such



inventories are lost in the tunnel-vision pursuit of large but theoretically unilluminating validity coefficients.

This line of work needs more attention, mostly because the items in a biographical inventory usually relate to life circumstance and can fill in some of the gaps in knowledge about *press* and about situational factors in general. Early foot in many professions, e.g., is based on money in the bank, and creativity is less a card of entry than an ability that might not otherwise find expression. The biographical inventory is especially important to the study of life's outcomes, and to the intersection of historical or socioeconomic conditions with stage of professional and personal development. Studies of cross-cultural and cross-generational effects on creativity are needed, such as the Barron & Young (1970) study of the descendants of immigrants from southern Italy to Rome and Boston respectively. Simonton (1975) has provided innovative systematic methods of generational analysis, with interesting results, for research on changes in creativity over long time spans. Goertzel, Goertzel & Goertzel (1978) have been less systematic methodologically but have given the field a major book, beguiling in its detailed consideration of creative lives. A rash of psychologically sensitive biographies ("psychobiographies") are evidence of new interest in a psychological, personological approach to the understanding of creative lives in their historical context. The study of such lives and careers does itself animate history and makes it more comprehensible. This is an area of study hardly begun. What is needed is a way of encoding observations from psychologically impressionistic and complex psychobiographies to yield data susceptible of analysis relevant to the life course and to historical process. The archives of research centers that have accumulated observations over the years are gold mines of data that can be used for such analyses given a reliable and standardized source of information about later significant events, outcomes if you will, in the lives of creative women and men. A good example of the pooling of such data from many sources is provided by the Murray Research Center for the Study of Lives, founded at Radcliffe College in 1979. Given the unusual difficulties and efforts involved in gathering rich psychological data on creative individuals, we hope that secondary analyses of such data, undertaken with increasingly sophisticated data-analytic techniques and from diverse conceptual perspectives, will become widespread in the 1980s. Such analyses could be greatly facilitated by the Murray Research Center and many other centers which have accumulated archives of unparalleled potential value for the study of creative people. Imaginative cooperation involving such centers and individual investigators who have accumulated valuable longitudinal data could provide very cost-effective bases of time-series data for secondary and meta-analyses. Social support for such centers in the form of money and endorsement from foundations is needed. The basic goal should be to understand integrity, excellence and creativity developmentally, especially

in the later years. A new national center for such studies, not merely archival but newly initiated on the basis of our growing wisdom in these matters, is essential.

## Note

<sup>1</sup> The authors wish to acknowledge the very substantial contributions of UCSC psychology graduate student Teresa Zembower to this review, especially in the culling of important findings from dissertation abstracts and from articles in the *Journal of Creative Behavior*. She also undertook the onerous task of preparing the bibliography and reconciling it with the text. We are also grateful to Wallace B. Hall for many helpful comments and corrections. Financial costs were met by a faculty research grant from the Santa Cruz campus.

## Literature Cited

- Albaum, G. 1976. Selecting specialized creators: The independent inventor. *Psychol. Rep.* 39:175-79.
- Albaum, G., Baker, K. 1977. Cross validation of a creativity scale for the Adjective Check List. *Educ. Psychol. Meas.* 37:1057-61.
- Al-issa, I. 1972. Stimulus generalization and overinclusion in normal and schizophrenic subjects. *J. Clin. Psychol.* 39:182-86.
- Alpaugh, P. K., Renner, V. J. Birren, J. E. 1976. Age and creativity. Implications for education and teachers *Educ. Gerontol.* 1:17-40.
- Amos, S. P. 1978. Personality differences between established and less-established male and female creative artists *J. Pers. Assess.* 42:374-77.
- Anastasi, A., Schaefer, C. E. 1969. Biographical correlates of artistic and literary creativity in adolescent girls. *J. Appl. Psychol.* 53:267-73.
- Anastasi, A., Schaefer, C. E. 1971. The Franck drawing completion test as a measure of creativity. *J. Genet. Psychol.* 119:3-12.
- Arasteh, A. R. Arasteh, J. D. 1968. *Creativity in the Life Cycle: II. An Interpretive Account of Creativity in Childhood, Adolescence and Adulthood*. Leiden, Netherlands: Brill.
- Arasteh, A. R., Arasteh, J. D. 1976. *Creativity and Human Development: An Interpretative and Annotated Bibliography*. New York: Schenkman.
- Arasteh, J. D. 1968. Creativity and related processes in the young child. A review of the literature. *J. Genet Psychol.* 112:77-108.
- Arieti, S. 1976. *Creativity. The Magic Synthesis*. New York: Basic Books.
- Arlin, P. K. 1975. Cognitive development in adulthood: A fifth stage? *Dev. Psychol.* 11:602-6.
- Arlin, P. K. 1976. Toward a metatheoretical model of cognitive development. *Int. J. Aging Hum. Dev.* 7:247-53.
- Arlin, P. K. 1977. Piagetian operations in problem finding. *Dev. Psychol.* 13:297-98.
- Aronow, E. 1972. Comment on Raychaudhuri's "Relation of creativity and sex to Rorschach M Responses." *J. Pers. Assess.* 36:303-4.
- Atwood, G. E., Tomkins, S. S. 1976. On the subjectivity of personality theory. *J. Hist. Behav. Sci.* 12:166-77.
- Bachtold, L. M., Werner, E. E. 1970. Personality profiles of gifted women: Psychologists. *Am. Psychol.* 25:234-43.
- Bachtold, L. M., Werner, E. E. 1972. Personality characteristics of women scientists. *Psychol. Rep.* 32:391-96.

- Bachtold, L. M., Werner, E. E. 1973. Personality characteristics of creative women. *Percept. Mot. Skills* 36:311–19.
- Backman, M. E., Tuckman, B. W. 1978. Review of the Remote Associates Test. In *The Eighth Mental Measurement Yearbook*, ed. O. K. Buros, pp. 369–70. Highland Park, NM: Gryphon.
- Baird, L. L. 1972. Review of the Remote Associates Test. In *The Seventh Mental Measurement Yearbook*, ed. O. K. Buros, pp. 825–29. Highland Park, NJ: Gryphon.
- Barron, F. 1955. The disposition toward originality. *J. Abnorm. Soc. Psychol.* 51:478–85.
- Barron, F. 1957. Originality in relation to personality and intellect. *J. Pers.* 25:730–42.
- Barron, F. 1969. *Creative Person and Creative Process*. New York: Holt, Rinehart & Winston.
- Barron, F. 1972. *Artists in the Making*. New York Seminar.
- Barron, F., Egan, D. 1968. Leaders in innovators in Irish management *J. Manage, Stud.* 5:41–60.
- Barron, F., Jarvik, M. E., Bunnell, S. 1964. The hallucinogenic drugs. *Sci. Am.* April 3–11.
- Barron, F., Parisi, P. 1977. Twin resemblances in expressive behavior. *Acto Genet, Med. Gemellal, Spring.*
- Barron, F., Young H. B. 1970. Rome and Boston: A take of two cities and their differing impact on the creativity and personal philosophy of southern Italian immigrants. *J. Cross-Cult, Psychol.* 1:91–114.
- Bennett, G. K. 1972. Review of the Remote Associates Test. See Baird 1972, p. 829.
- Bergum, B. O. 1973. Selection of specialized creators. *Psychol. Rep.* 33:635–39.
- Bergum, B. O. 1974. Self-perceptions of a graduate faculty whose publication rates are high or low. *Psychol. Rep.* 35:857–58.
- Bergum, B. O. 1975. Self-perceptions of creativity among academic inventors and non-inventors. *Percept. Mot. Skills* 40:78.
- Binet, A., Henri, V. 1896. La psychologie individuelle. *Annoe Psychol.* 2:411–65.
- Blauberger, M. 1978. Personal studies of gifted females: An overview and commentary. *Gifted Child Q.* 22:539–47.
- Block, J. H. 1976. Issues, problems and Pitfalls in assessing sex-differences: A critical review of *The Psychology of Sex Differences* (by E. E. Maccoby & C. N. Jacklin). *Merrill-Palmer Q.* 22:283–308.
- Block, J. H., Block, J., Harrington, D. 1975. *Sex-role typing and instrumental behavior*. Presented at Soc. Res. Child Dev. Meet., Denver.
- Bloomberg, M. 1973. Introduction: Approaches to creativity. In *Creativity*, ed. M. Bloomberg, pp. 1–25. New Haven: College & Univ. Press.
- Buel, W. D. 1965. Biographical data and the identification of creative research personnel. *J. Appl. Psychol.* 49:318–31.
- Buel, W. D., Albright, L. E., Glennon, J. R. 1966. A note on the generality and cross-validity of personal history for identifying creative research scientists. *J. Appl. Psychol.* 50:217–19.
- Butcher, H. J. 1973. Intelligence and creativity. In *New Approaches in Psychological Measurement*, ed. P. Kline New York: Wiley.
- Campbell, D. T. 1979. A tribal model of the social system vehicle carrying scientific knowledge. *Knowledge* 1:181–201.
- Carroll, J. B. 1976. Psychometric tests as cognitive tasks: A new “structure of intellect” See Resnick 1976, pp. 27–56.
- Carroll, J. B., Maxwell, S. E. 1979. Individual differences in cognitive abilities. *Ann. Rev. Psychol.* 30:603–40.
- Cattell, R. B. 1971. *Abilities: Their Structure, Growth, and Action*. Boston: Houghton Mifflin.
- Cattell, R. B., Eber, H. W., Tatsuoka, M. M. 1970. *Handbook for the Sixteen Personality Factor Questionnaire (16 PF)*, Champaign, Ill:Inst, Pers. Ability Test.
- Chamber, J. A. 1964. Relating personality and biographical factors to scientific creativity. *Psychol. Monogr.* 78.
- Chambers, J. A. 1969. Beginning a multidimensional theory of creativity. *Psychol. Rep.* 25:779–99.

### 30 Personal Indicators of Individual Creativity and Innovation

- Chambers, J. A. 1973. College teachers. Their effect on creativity of students. *J. Educ. Psychol.* 65:326–34.
- Child, I. L. 1965. Personality correlates of esthetic judgment in college students. *J. Pers.* 33:476–511.
- Claridge, G. 1972. The Schizophrenias as nervous types. *Br. J. Psychiatry* 121:1–17.
- Cooper, H. M. 1979. Statistically combining independent studies: A meta-analysis of sex differences in conformity research. *J. Pers. Soc. Psychol.* 37:131–46.
- Corballis, M. C. 1980. Laterality and myth, *Am. Psychol.* 35:284–95.
- Cronbach, L. J. 1968. Intelligence? Creativity? A parsimonious reinterpretation of the Wallach-Kogan data. *Am. J. Educ. Res.* 5:491–511.
- Cropley, A. J. 1972. A five-year longitudinal study of the validity of creativity tests. *Dev. Psychol.* 6:119–24.
- Cross, P. G. Cattell, R. B., Butcher, H. J. 1967. The personality pattern of creative artists. *Br. J. Educ. Psychol.* 37:292–99.
- Csikszentmihalyi, M., Bealtie, O. V. 1979. Life themes. A theoretical and empirical exploration of their origins and effects, *J. Hum. Psychol.* 19:45–63.
- Csikszentmihalyi, M., Getzels, J. W. 1973. The personality of young artists: An empirical and theoretical exploration. *Br. J. Psychol.* 64:91–104.
- Cunnington, B. F., Torrance, E. P. 1965. *Sounds and Images*. Boston: Ginn.
- Datta, L. E. 1963. Test instructions and identification of creative scientific talent. *Psychol. Rep.* 13:495–500.
- Datta, L. E. 1967. Family religious background and early scientific creativity. *Am. Social. Rev.* 32:626–35.
- Datta, L. E., Parloff, M. B. 1967. On the relevance of autonomy: Parent-child relationships and early scientific creativity. *Proc. 75th Ann. Conv. Am. Psychol. Assoc.*, pp. 149–50.
- Davis, G. A. 1975. In frumious pursuit of the creative person. *J. Creat. Behav.* 9:75–87.
- Davis, G. A., Belcher, T. L. 1971. How shall creativity be measured? Torrance tests, RAT, Alpha Biographical, and IQ. *J. Creat. Behav.* 5:153–61.
- Davis, G. A., Rimm, S. 1977. Characteristics of creatively gifted children. *Gifted Child Q.* 21:546–51.
- Del Gaudio, A. C. 1976. Psychological differentiation and mobility as related to creativity. *Percept. Mot. Skills* 43:831–41.
- Dellas, M., Gaier, E. L. 1970. Identification of creativity: The individual. *Psychol. Bull.* 73:55–73.
- Dennis, W. 1966. Creative productivity between the ages of 20 and 80 years. *J. Gerontol.* 21:1–8.
- Dewing, K. 1973. Some characteristics of the parents of creative twelve-year-olds. *J. Pers.* 41:71–85.
- Dobzhansky, T. 1964. *Mankind Evolving*. New Haven: Yale Univ. Press.
- Domino, G. 1969. Maternal personality correlates of sons creativity. *J. Consult. Clin. Psychol.* 33:180–83.
- Domino, G. 1970. Identification of potentially creative persons from the Adjective Check List. *J. Consult. Clin. Psychol.* 35:48–51.
- Domino, G. 1974. Assessment of cinematographic creativity. *J. Pers. Soc. Psychol.* 30:150–54.
- Domino, G. 1976. Primary process thinking in dream reports as related to creative achievement. *J. Consult. Clin. Psychol.* 44:929–32.
- Domino, G. 1977. Homosexuality and creativity, *J. Homosex.* 2:261–67.
- Domino, G. 1979. Creativity and the home environment. *Gifted Child Q.* 23:818–28.
- Domino, G. Walsh, J., Reznikoff, M. 1976. A factor analysis of creativity in fraternal and identical twins. *J. Gen. Psychol.* 97:211–21.
- Drestadt, R. 1968. An analysis of the use of analogies and metaphors in science. *J. Psychol.* 68:97–116.
- Drestadt, R. 1974. The psychology of creativity: How Einstein discovered the theory of relativity. *Psychology* 11:15–25.

- Dudek, S. Z. 1968. Regression and creativity. *J. Nerv. Ment. Dis.* 147:535–46.
- Dudek, S. Z. 1974. Creativity in young children—attitude or ability? *J. Creat. Behav.* 8:282–92.
- Dudek, S. Z. 1975. Regression in the service of the ego in young children. *J. Pers. Assess.* 39:369–76.
- Dudek, S. Z. Hall, W. B. 1978–79. Design philosophy and personal style in architecture, *J. Altered States Consciousness* 4:83–92.
- Dykes, M., McGhie, A. 1976. A comparative study of attentional strategies of schizophrenics and highly creative normal subjects. *Br. J. Psychiatry* 128:50–56.
- Eiduson, B. T. 1974. 10-year longitudinal Rorschachs on research scientists. *J. Pers. Assess.* 38:405–10.
- Ellison, R. L., Abe, C., Fox, D. G., Coray, K. E., Taylor, C. W. 1976. Using Biographical information in identifying artistic talent. *Gifted Child Q.* 20:402–13.
- Ellison, R. L., James, L. R., Carron, T. 1970. Prediction of R&D performance criteria with biographical information. *J. Ind. Psychol.* 5:37–57.
- Elton, C. F., Rose, H. A. 1974. Prediction of productivity from personality test scores, *J. Educ. Psychol.* 66:424–31.
- Farmer, E. W. 1974. *Psychoticism and person-orientation as general personality characteristics*. BSc thesis. Univ. Glasgow, Scotland.
- Fitzgerald, E. T. 1966. Measurement of openness to experience. *J. Pers. Soc. Psychol.* 4:655–63.
- Forisha, B. L. 1978a. Mental imagery and creativity: Review and speculations. *J. Ment. Imagery* 2:209–38.
- Forisha, B. L. 1978b. Creativity and imagery in men and women. *Percept. Mot. Skills* 47:1255–64.
- Frank, G. 1979. On the validity of hypotheses derived from the Rorschach: VI. *M* and the intrapsychic life of individuals. *Percept. Mot. Skills* 48:1267–77.
- Frederiksen, N., Ward, W. C. 1978. Measures for the study of creativity in scientific for the study of creativity in scientific problem-solving. *Appl. Psychol. Meas.* 2:1–24.
- Freeman, J., Butcher, H. J., Christic, T. 1971. *Creativity: A Selective Review of Research*. London: Soc. Res. Higher Educ. 2nd ed.
- Gall, M., Mendelsohn, G. A. 1967. Effects of facilitating techniques and subject experimenter interaction on creative problem solving. *J. Pers. Soc. Psychol.* 5:211–16.
- Getzels, J. W., Csikszentmihalyi, M. 1976. *The Creative Vision: A Longitudinal Study of Problem Finding in Art*. New York Wiley.
- Ghiselin, B. 1952. *The Creative Process*. Berkeley: Univ. Calif. Press.
- Gilchrist, M. 1972. *The Psychology of Creativity*. Melbourne Univ. Press.
- Glover, J. A. 1979. Levels of questions asked in interview reading sessions by creative and relatively noncreative college students. *J. Genet. Psychol.* 135:103–8.
- Goertzel, M. G., Goertzel, V., Goertzel, T. G. 1978. *300 Eminent Personalities*. San Francisco, Jossey-Bass.
- Gordon, W. J. 1966. *The Metaphorical Way of Learning and Knowing*. Cambridge, Mass: Porpoise Books.
- Gotz, K. O., Gotz, K. 1973. Introversion extraversion and neuroticism in gifted and ungifted art students. *Percept. Mot. Skills* 36:675–78.
- Gotz, K. O., Gotz, K. 1979a. Personality characteristics of professional artists. *Percept. Mot. Skills* 49:327–34.
- Gotz, K. O., Gotz, K. 1979b. Personality characteristics of successful artists. *Percept. Mot. Skills* 49:919–24.
- Gough, H. G. 1975. A new scientific uses test and its relationship to creativity in research. *J. Creat. Behav.* 9:245–52.
- Gough, H. G. 1976a. Studying creativity by means of word association tests. *J. Appl. Psychol.* 61:348–53.
- Gough, H. G. 1976b. What happens to creative medical students? *J. Med. Educ.* 61:348–51.

## 32 Personal Indicators of Individual Creativity and Innovation

- Gough, H. G. 1979. A creative personality scale for the Adjective Check List. *J. Pers. Soc. Psychol.* 37:1398–1405.
- Gough, H. G., Woodworth, D. G. 1960. Stylistic variations among professional research scientists. *J. Psychol.* 49:87–98.
- Gowan, J. C. 1972. *Development of the Creative Individual*. San Diego: Knapp.
- Gowan, J. C. 1974. *Development of the Psychedelic Individual*. Buffalo: creative Educ. Found.
- Grant, T. N., Domino, G. 1976. Masculinity-femininity in fathers of creative male adolescents. *J. Genet. Psychol.* 129:19–27.
- Gray, J. J. 1969. The effect of productivity on primary process and creativity. *J. Proj. Tech.* 33:213–18.
- Greer, G. 1979. *The Obstacle Race: The fortunes of Women Painters and Their Work*. New York: Farrar, Straus & Giroux.
- Groth, N. J. 1975. Success and creativity in male and female professors. *Gifted Child Q.* 19:328–35.
- Guilford, J. P. 1950. Creativity. *Am. Psychol.* 14:469–79.
- Guilford, J. P. 1967. *The Nature of Human Intelligence*. New York: McGraw-Hill.
- Guilford, J. P., Christensen, P. R. 1973. The one-way relation between creative potential and IQ. *J. Creat. Behav.* 7:247–52.
- Hall, W. B. 1972. A technique for assessing aesthetic predispositions: Mosaic construction test. *J. Creat. Behav.* 6:225–35.
- Hall, W. B., MacKinnon, D. W. 1969. Personality inventory correlates of creativity among architects. *J. Appl. Psychol.* 53:322–26.
- Harrington, D. M. 1972. *Effects of instructions to "Be creative" on three tests of divergent thinking abilities*. PhD thesis, Univ. Calif. Berkeley.
- Harrington, D. M. 1975. Effects of explicit instructions to "be creative" on the psychological meaning of divergent thinking test scores. *J. Pers.* 43:434–54.
- Harrington, D. M. 1979. *Creativity, analogical thinking and muscular metaphors*. Presented at Am. Psychol. Assoc. Meet., New York.
- Harrington, D. M. 1981. Creativity, Analogical thinking and muscular metaphors. *J. Ment. Imagery*. In Press.
- Harrington, D. M., Anderson, S. M. 1979. *Creative-self-concept, masculinity, femininity and three modes of androgyny*. Presented at Am. Psychol. Assoc. Meet., New York.
- Harrington, D. M. Block, J. H. Block, J. 1974. *Measuring facets of creativity and intolerance of ambiguity in pre-school children with the Lowenfeld mosaic test*. Presented at West Psychol. Assoc. Meet., San Francisco.
- Hasenpus, N., Magaro, P. 1976. Creativity and schizophrenia: An equality of empirical constructs. *Br. J. Psychiatry* 129:346–49.
- Hattie, J. A. 1977. Conditions for administering creativity tests. *Psychol. Bull.* 84:1249–60.
- Hattie, J. A. 1980. Should creativity tests be administered under test-like conditions? An empirical study of three alternative conditions. *J. Educ. Psychol.* 72:87–98.
- Heilbrun, A. B. 1971. Maternal child rearing and creativity in sons. *J. Genet. Psychol.* 119:175–79.
- Helson, R. 1966a. Personality of women with imaginative and artistic interests: The role of masculinity, originality, and other characteristics in their creativity. *J. Pers.* 34:1–25.
- Helson, R. 1966b. Narrowness in creative women. *Psychol. Rep.* 19:618.
- Helson, R. 1967a. Personality characteristics and developmental history of creative college women. *Genet. Psychol. Monogr.* 75:205–56.
- Helson, R. 1967b. Sex differences in creative style. *J. Pers.* 35:214–33.
- Helson, R. 1968a. Generality of sex differences in creative style. *J. Pers.* 38:33–48.
- Helson, R. 1968b. Effects of sibling characteristics and parental values on creative interest and achievement. *J. Pers.* 36:589–607.
- Helson, R. 1970. Sex-specific patterns in creative literary fantasy. *J. Pers.* 38:344–63.

- Helson, R. 1971. Women mathematicians and the creative personality. *J. Consult. Clin. Psychol.* 36:210–20.
- Helson, R. 1973a. The heroic, the comic, and the tender. Patterns of literacy fantasy and their authors. *J. Pers.* 41:163–84.
- Helson, R. 1973b. Heroic and tender modes in women authors of fantasy. *J. Pers.* 41:493–512.
- Helson, R. 1974. The inner reality of women. *Arts Soc.* 11:25–36.
- Helson, R. 1977. The creative spectrum of authors of fantasy. *J. Pers.* 45:310–26.
- Helson, R. 1977–78. Experiences of authors in writing Fantasy: Two relationships between creative process and product. *J. Altered States Consciousness* 3:235–48.
- Helson, R. 1978a. The imaginative process in children's literature: A quantitative approach. *Poetics* 7:135–53.
- Helson, R. 1978b. Creativity in women. In *The Psychology of Women: Future Directions in Research*, ed. J. Sherman, F. Denmark, pp. 553–604. New York: Psychol. Dimensions.
- Helson, R., Crutchfield, R. S. 1970a. Creative types in mathematics. *J. Pers.* 38:177–97.
- Helson, R., Crutchfield, R. S. 1970b. Mathematicians: the creative researcher and the average PhD. *J. Consult. Clin. Psychol.* 34:250–57.
- Hemphill, J. K. 1972. Review of the *Alpha Biographical Inventory*. See Baird 1972. p. 1371.
- Hocevar, D. 1976. Dimensions of creativity *Psychol. Rep.* 39:869–70.
- Hocevar, D. 1980. Intelligence, divergent thinking, and creativity. *Intelligence* 4:25–40.
- Holland, J. L., Baird, L. L. 1968. The preconscious activity scale: The development and validation of an originality measure. *J. Creat. Behav.* 2:217–25.
- Holloway, S., Torrance, E. P. 1977. The sounds and images test as a predictor of musical talent. *J. Creat. Behav.* 11:148.
- Horn, J. L. 1976. Human abilities: A review of research and theory in the early 1970s. *Ann. Rev. Psychol.* 27:437–85.
- Horn, J. L. 1977. Personality and ability theory. In *Handbook of Modern Personality Theory*, ed. R. B. Cattell, R. M. Dreger, Washington: Hemisphere.
- Institute for Behavioral Research in Creativity, 1966. *Alpha Biographical Inventory*. Greensboro, N. C.: Inst. Behav. Res. Creativity.
- Ironson, G. H. Davis, G. A. 1979. Faking high or low creativity scores on the Adjective Check List. *J. Creat. Behav.* 13:139–45.
- Jackson, D. N. 1967. *Personal Research Form Manual*. Goshen, NY: Res. Psychol. Press.
- Jackson, D. N. 1976. *Jackson Personality Inventory Manual*. Port Huron, Mich. Res. Psychol. Press.
- Jackson, D. N. 1978. Interpreter's guide to the *Jackson Personality Inventory*. In *Advances in Psychological Assessment*, Vol. 4, ed. P. McReynolds. San Francisco Jossey-Bass.
- James, L. R., Ellison, R. L., Fox, D. G., Taylor, C. W. 1974. Prediction of artistic performance from biographical data. *J. Appl. Psychol.* 59:84–86.
- Jarvik, L. E., Chadwick, S. B. 1973. Schizophrenia and survival. In *Psychopathology: Contributions from the Social, Behavioral Sciences*, ed. M. Hammer, K. Salzinger, S. Sutton. New York: Wiley.
- Jones, W. H., Chernovetz, E., Hansson, R. O. 1978. The enigma of androgyny: Differential implications for males and females? *J. Consult. Clin. Psychol.* 46:298–313.
- Juhasz, J. B. 1972. An experimental study of imagining. *J. Pers.* 40:588–600.
- Kanner, A. D. 1976. Femininity and masculinity: Their relationships to creativity in male architects and their independence from each other. *J. Consult. Clin. Psychol.* 44:802–5.
- Karlins, M., Schuerhoff, C., Kaplan, M. 1969. Some factors related to architectural creativity in graduating architecture students. *J. Gen. Psychol.* 81:203–15.
- Karlsson, J. L. 1978. *Inheritance of Creative Intelligence: A Study of Genetics in Relation to Giftedness and its Implications for Future Generations*. Chicago: Nelson-Hall.
- Kasperson, C. J. 1978. Psychology of the scientist: XXXVH. Scientific creativity: A relationship with information channels *Psychol. Rep.* 42:691–94.

### 34 Personal Indicators of Individual Creativity and Innovation

- Katz, A. N., Poag, J. R. 1979. Sex differences in instructions to "be creative" on divergent and nondivergent test scores. *J. Pers.* 47:518–30.
- Keating, D. P., ed. 1976. *Intellectual Talent: Research and Development*. Baltimore. Johns Hopkins Univ. Press.
- Khatena, J. 1969. Onomatopoeia and images preliminary validity study of a test of originality. *Percept. Mot. Skills* 31:86.
- Khatena, J. 1971a. Something about myself: A brief screening device for identifying creatively gifted children and adults. *Gifted Child Q.* 15:262–66.
- Khatena, J. 1971b. Evaluation and the creative potential in music. *Gifted Child Q.* 15:19–22.
- Khatena, J. 1975. Creative imagination, imagery and analogy. *Gifted Child Q.* 19:149–60.
- Khatena, J. 1978. Frontiers of creative imagination imagery. *J. Ment. Imagery* 2:33–46.
- Khatena, J., Torrance, E. P. 1976. *Manual for Khatena-Torrance Creative Perception Inventory*. Chicago: Stoelting.
- Kirton, M. J. 1976. Adaptors and innovators: a description and measure. *J. Appl. Psychol.* 61:622–29.
- Kirton, M. J. 1977a. Adaptors and innovators and superior-subordinate identification. *Psychol. Rep.* 41:289–90.
- Kirton, M. J. 1977b. *Manual of the Kirton Adaption-Innovation Inventory*. London: Natl. Fed. Educ. Res.
- Kogan, N. 1973. Creativity and cognitive style. A life-span perspective. In *Life-Span Developmental Psychology: Personality and Socialization*, ed. P. B. Baltes, K. W. Schaie. New York: Academic.
- Kogan, N. 1974. Creativity and sex differences. *J. Creat. Behav.* 8:1–14.
- Kogan, N., Connor, K., Gross, A., Fava, D. 1980. Understanding visual metaphor: Developmental and individual differences. *Monogr. Soc. Res. Child Dev.* 45 (1, Serial No. 183).
- Kogan, N., Morgna, F. T. 1969. Task and motivational influences on the assessment of creative and intellectual ability in children. *Genet. Psychol. Monogr* 80:91–127.
- Kogan, N., Pankove, E. 1972. Creative ability over a five-year span. *Child Dev.* 43:427–42.
- Kogan, N., Pankove, E. 1974. Long-term predictive validity of divergent-thinking tests. Some negative evidence. *J. Educ. Psychol.* 66:802–10.
- Korb, R., Frankiewicz, R. G. 1979. *Aptitudes, intellectual styles, and personality characteristics as facilitators and differentiators of creativity*. Presented at Ann. Meet. Am. Psychol. Assoc., New York.
- Krantz, D. L., Wiggins, L. 1973. Personal and impersonal channels of recruitment in the growth of theory. *Hum. Dev.* 16:133–56.
- Krippner, S. 1977. Research in creativity and psychedelic drugs. *Int. J. Clin. Exp. Hypn.* 25:274–308.
- Lacey, L. A., Erickson, C. E. 1974. Psychology of the Scientist: XXXI: Discriminability of a creativity scale for the Adjective Check List among scientists and engineers. *Psychol. Rep.* 34:755–58.
- Landau, E., Maoz, B. 1978. Creativity and self-actualization in the aging personality. *Am. J. Psychother.* 32:117–29.
- Lang, R. J., Ryba, K. A. 1976. The identification of some creative thinking parameters common to the artistic and musical personality. *Br. J. Educ. Psychol.* 46:267–79.
- Lemkau, J. P. 1979. Personality and background characteristic of women in male-dominated occupations: A review. *Psychol. Women Q.* 4:221–40.
- Lindauer, M. S. 1977. Imagery from the point of view of psychological aesthetics, the arts and creativity. *J. Ment Imagery* 2:343–62.
- Littlejohn, M. T. 1967. Creativity and masculinity-femininity in ninth graders. *Percept. Mot. Skills* 25:737–43.
- London, H., Exner, J. E. Jr., ed. 1978. *Dimensions of Personality*. New York: Wiley.
- Loshak, L. J., Reznikoff, M. 1976. Creativity and body image boundaries. *J. Pers. Assess.* 40:81–90.



- Lunneborg, C. E. Lunneborg, P. W. 1969. Architecture school performance predicted from ASAT, intellectual, and nonintellectual measures, *J. Appl. Psychol.* 53:209–13.
- Lynch, P. M. 1970. Creativity in Irish children. *J. Creat. Behav.* 4:53–61.
- MacKinnon, D. W. 1962a. The nature and nurture of creative talent. *Am. Psychol.* 17:484–95.
- MacKinnon, D. W. 1962b. The personality correlates of creativity: a Study of American architects. In *Proc. 14<sup>th</sup> Int. Congr. Appl. Psychol., Copenhagen 1961*, ed. G. S. Nielsen, Vol. 2. Copenhagen: Munksgaard.
- MacKinnon, D. W. 1963. Creativity and images of the self. In *The Study of Lives*, ed. R. W. White, pp. 250–78. New York: Atherton.
- MacKinnon, D. W. 1965. Personality and the realization of creative potential. *Am. Psychol.* 20:273–81.
- MacKinnon, D. W. 1966. *Illustrative material for some reflections on the current status of personality assessment with special references to the assessment of creative persons*. Presented to graduate students, Dep. Psychol., Univ. Utah, Salt Lake City.
- MacKinnon, D. W., Hall, W. B. 1971. Intelligence and creativity. In *The Measurement of Creativity*, pp. 1183–88. *Int. Congr. Appl. Psychol., 17th Liege, Belgium*, H. W. Peter, symp. Chm. Brussels: EDITEST.
- Mackworth, N. H. 1965. Originality, *Am. Psychol.* 20:51–66.
- Magnusson, D., Backteman, G. 1978. Longitudinal stability of person characteristics: Intelligence and creativity. *Appl. Psychol. Meas.* 2:481–90.
- Martindale, C. 1977–78. Creativity, consciousness and cortical arousal. *J. Altered States Consciousness* 3:69–87.
- Martindale, C., Hasenfus, N. 1978. EEG differences as a function of creativity, stage of the creative process and effort to be original. *Biol. Psychol.* 6:157–67.
- Maw, W. H. Maw, E. W. 1978. Nature and assessment of human curiosity. See Jackson 1978, pp. 526–71.
- McConaghy, N., Clancy, M. 1968. Familial relationships of allusive thinking in university students and their parents. *Br. J. Educ. Psychiatry* 114:1079–87.
- McDermid, C. D. 1965. Some correlates of creativity in engineering personnel. *J. Appl. Psychol.* 49:14–19.
- Mednick, S. A., Mednick, M. T. 1967, *Examiner's Manual: Remote Associates Test*. Boston: Houghton Mifflin.
- Meehl, P. E. 1962. Schizotaxia, schizotypy, schizophrenia. *Am. Psychol.* 17:827–38.
- Mendelsohn, G. A. 1976. Associative and attentional processes in creative performance. *J. Pers.* 44:341–69.
- Mendelsohn, G. A., Covington, M. V. 1972. Internal processes and perceptual factors in verbal problem solving: A study of sex and individual differences in cognition. *J. Pers.* 40:451–71.
- Milgram, R. M., Milgram, N. A. 1976. Creative thinking and creative performance in Israeli students. *J. Educ. Psychol.* 68:255–59.
- Milgram, R. M., Yitzhak, V., Milgram N. A. 1977. Creative activity and sex-role identity in elementary school children. *Percept. Mot. Skills* 45:371–76.
- Morrison, R. F., Owens, W. A., Glennon, J. R., Albright, L. E. 1962. Factored life history antecedents of industrial research performance. *J. Appl. Psychol.* 46:281–84.
- Morse, J. A., Bruch, C. B. 1978. A comparison of sex roles of creative productive versus non-productive women. *Gifted Child Q.* 22:520–25.
- Nichols, R. C. 1964. Parental attitudes of mothers of intelligent adolescents and creativity of their children. *Child Dev.* 35:1041–49.
- Nochin, L. 1971. Why are there no great women artists? In *Women in Sexist Society*, ed. V. Gornick, B. K. Moran. Pp. 480–510. Mentor Book, New Am. Libr.
- Nochlin, L. 1979. Review of G. Greer's, *The Obstacle Race*. *NY Times Book Rev.* 3 (Oct. 28):46–47.

### 36 Personal Indicators of Individual Creativity and Innovation

- Noppe, L. D., Gallagher, J. M. 1977. A cognitive style approach to creative thought *J. Pers. Assess.* 41:85–90.
- Olsen, T. 1970. Silences: When writers don't write. *Women: A Journal of Liberation*.
- Olsen, T. 1978. *Silences*. New York: Delacorte.
- Owens, W. A. 1969. Cognitive, noncognitive and environmental correlates of mechanical ingenuity. *J. Appl. Psychol.* 53:199–208.
- Parloff, M. B., Datta, L., Kleman, M., Handlon, J. H. 1968. Personality characteristics which differentiate creative male adolescents and adults. *J. Pers.* 36:528–52.
- Patel, K. 1976. Profiles of creative personality. *Psychologia* 19:173–83.
- Payne, D. A. Halpin, W. G. 1974. Use of a factored biographical inventory to identify differentially gifted adolescents. *Psychol. Rep.* 35:1195–1204.
- Pellegrino, J. W., Glaser, R. 1979. Cognitive correlates and components in the analysis of individual differences. *Intelligence* 3:187–214.
- Pezzullo, T. R., Thorsen, E. E., Madaus, G. F. 1972. The heritability of Jensen's level I and level II and divergent thinking. *Am. Educ. Res. J.* 4:539–46.
- Prentky, R. A. 1979. Creativity and psychopathology: A neurocognitive perspective. *Prog. Exp. Pers. Res.* 9:1–33.
- Raychaudhuri, M. 1966. Perceptual preference pattern and creativity. *Ind. J. Appl. Psychol.* 3:67–70.
- Raychaudhuri, M. 1967. *Studies in Artistic Creativity*. Calcutta: Rabindra Bharati.
- Raychaudhuri, M. 1971. Relation of creativity and sex to Rorschach M responses. *J. Pers. Assess.* 35:27–31.
- Raychaudhuri, M. 1972. Some thorny issues in cross-cultural research on creativity: A rejoinder to Aronow's comment. *J. Pers. Assess.* 36:305–6.
- Razik, T. A. 1965. *Creativity Studies and Related Areas*. Univ. Buffalo Found., NY.
- Rekdal, C. K. 1977. In search of the wild duck. *Gifted Child Q.* 21:501–15.
- Resnick, L. B. 1976. *The Nature of Intelligence*. Hillsdale, NJ: Erlbaum.
- Richards, R. L. 1976. A comparison of selected Guilford and Wallach-Kogan creative thinking tests in conjunction with measures of intelligence. *J. Creat. Behav.* 10:151–64.
- Rimm, S. 1976. *GIFT – An Instrument for the Identification and Measurement of Creativity*. PhD thesis. Univ. Wis. Madison.
- Rimm, S., Davis, G. A. 1976. GIFT: An instrument for the identification of creativity. *J. Creat. Behav.* 10:178–82.
- Roe, A. 1965. Changes in scientific activities with age. *Science* 150:313–18.
- Roe, A. 1972. Patterns in the productivity of scientists. *Science* 176:940–41.
- Rogolsky, M. M. 1968. Artistic creativity and adaptive regression in third grade children. *J. Proj. Tech. Pers. Assess.* 32:53–62.
- Rooke, T. J. 1971. *The Pennsylvania Assessment of Creative Tendency: Norms-Technical Manual*. Penn. Dep. Educ.
- Rooke, T. J. 1974. Validation of a creativity test: The 100 students study. *J. Creat. Behav.* 8:211–13.
- Roslansky, J. D., ed. 1970. *Creativity: A Discussion at the Nobel Conference organized by Gustavus Adolphus College, St. Peter; Minnesata, 1970*. Amsterdam/London: North-Holland.
- Rossmann, B. B. 1976. Art, creativity and the elephant: Some clues to artistic creativity among the gifted. *Gifted Child Q.* 20:392–401.
- Rossmann, B. B., Horn, J. L. 1972. Cognitive, motivational and temperamental indicants of creativity and intelligence. *J. Educ. Meas.* 9:265–86.
- Rothenberg, A. 1973a. Word association and creativity. *Psychol. Rep.* 33:3–12.
- Rothenberg, A. 1973b. Opposite-responding as a measure of creativity. *Psychol. Rep.* 33:15–18.
- Rothenberg, A. 1979. *The Emerging Goddess: The Creative Process in Art. Science and other Fields*. Chicago: Univ. Chicago Press.
- Rothenberg, A., Greenberg, B. 1974. *The index of Scientific Writings on Creativity. Creative Men and Women*. Hamden. Conn. Anchor Books.

- Rothenberg, A., Greenberg, B. 1976. *The Index of Scientific Writings on Creativity. General: 1566-1974*. Hamden, Conn: Anchor Books.
- Rothenberg, A., Hausman, C. R. 1976. Introduction: The creativity question. In *The Creativity Question*, ed. A. Rothenberg, C. R. Hausman, pp. 3-26. Durham, NC: Duke Univ. Press.
- Rotter, D. M., Langland, L., Berger, D. 1971. The validity of tests of creative thinking in seven-year-old children. *Gifted Child Q.* 15:273-78.
- Royce, J. R. 1980. Factor analysis is alive and well. *Am. Psychol.* 35:390-92.
- Runyan, W. M. 1978. The life course as a theoretical orientation. Sequences of person-situation interaction. *J. Pers.* 46:569-93.
- Schaefer, C. E. 1969a. The prediction of creative achievement from a biographical inventory. *Educ. Psychol. Meas.* 29:431-37.
- Schaefer, C. E. 1969b. The self-concept of creative adolescents. *J. Psychol.* 72:233-42.
- Schaefer, C. E., 1969c. Imaginary companions and creative adolescents. *Dev. Psychol.* 1:747-49.
- Schaefer, C. E. 1970a. *Biographical Inventory Creativity*. San Diego: Educ. Ind. Test.
- Schaefer, C. E. 1970b. A psychological study of 10 exceptionally creative adolescent girls. *Except. Child.* 36:431-41.
- Schaefer, C. E. 1971a. *Similes Test Manual*. Goshen, NY: Res. Psychol. Press.
- Schaefer, C. E. 1971b. Primary-process thinking in thematic fantasies of creative adolescents. *Personality* 2:219-25.
- Schaefer, C. E. 1971c. *Creativity Attitude Survey*. Psycholog. Educ.
- Schaefer, C. E. 1972a. Primary process elements with Draw-a-Person protocols of creative young women. *Percept. Mot. Skills* 35:245-46.
- Schaefer, C. E. 1972b. Predictive validity of the Biographical Inventory Creativity: a five-year follow-up. *Psychol. Rep.* 30:471-76.
- Schaefer, C. E. 1972c. Follow-up study of a creativity scale for the Adjective Check List. *Psychol. Rep.* 30:662.
- Schaefer, C. E. 1973. A five-year follow-up of the self-concept of creative adolescents. *J. Genet. Psychol.* 123:163-70.
- Schaefer, C. E., Anastasi, A. 1968. A biographical inventory for identifying creativity in adolescent boys. *J. Appl. Psychol.* 52:42-48.
- Schaefer, C. E., Bridges, C. I. 1970. Development of a creativity attitude survey for children. *Percept. Mot. Skills* 31:861-62.
- Schaefer, C. E., Diggins, D. R., Millman, H. L. 1976. Intercorrelations among measures of creativity, openness to experience and sensation seeking in a college sample. *Coll. Stud. J.* 10(4):332-39.
- Schmidt, H. E. 1973. The identification of high and low creativity in architecture students. *Psychol. Afr.* 15:15-40.
- Schubert, D. S. P. 1973. Intelligence as necessary but not sufficient for creativity. *J. Genet. Psychol.* 122:45-47.
- Schultz, N. R. Jr., Hoyer, W. J., Kaye, D. B. 1980. Trait anxiety, spontaneous flexibility, and intelligence in young and elderly adults. *J. Consult. Clin. Psychol.* 48:289-91.
- Shapiro, E. 1975. Toward a developmental perspective on the creative process. *J. Aesthet. Educ.* 9:69-80.
- Shelton, J., Harris, T. L. 1979. Personality characteristics of art students. *Psychol. Rep.* 44:949-50.
- Showalter, E., 1971. Women writers and the double standard. In *Women in Sexist Society*, ed. V. Gornick, B. K. Moran. New York: Basic Books.
- Simonton, D. K. 1975. Age and literary creativity: A cross-cultural and transhistorical survey. *J. Cross-Cult. Psychol.* 6:259-77.
- Simonton, D. K. 1976a. Biographical determinants of achieved eminence: A multivariate approach to the Cox data. *J. Pers. Soc. Psychol.* 35:218-26.

### 38 Personal Indicators of Individual Creativity and Innovation

- Simonton, D. K. 1976b. Philosophical eminence, beliefs, and zeitgeist. An individual-generational analysis. *J. Pers. Soc. Psychol.* 34:630–40.
- Simonton, D. K. 1977. Creative productivity age, and stress: A biographical time-series analysis of 10 classical composers. *J. Pers. Soc. Psychol.* 35:791–804.
- Simonton, D. K. 1978. The eminent genius in history: The critical role of creative development. *Gifted Child Q.* 22:187–95.
- Singer, D. L., Rummo, J. 1973. Ideational creativity and behavioral style in kindergarten-age children. *Dev. Psychol.* 8:154–61.
- Smith, J. M., Schaefer, C. E., 1969. Development of a creativity scale for the Adjective Check List. *Psychol. Rep.* 25:87–92.
- Smith, M. L., Glass, G. V. 1977. Meta-analysis of psychotherapy outcome studies. *Am. Psychol.* 32:752–60.
- Sobel, R. S. 1978. Remote associates theory of creativity: Fifteen years later. *J. Suppl. Abstr. Serv.* MS 1735.
- Spacks, P. M. 1972. *The Female Imagination*. New York: Avon.
- Stankov, L. 1980. Psychometric factors as cognitive tasks: A note on Carroll's new "structure of intellect." *Intelligence* 4:65–71.
- Stanley, J. C., George, W. C., Solano, C. H., eds. 1977. *The Gifted and the Creative*. Baltimore: Johns Hopkins Press.
- Stanley, J. C. Keating, D. P., Fox, L. H., eds. 1974. *Mathematical Talent: Discovery, Description and Development*. Baltimore. Johns Hopkins Press.
- Starkweather, E. K. 1976. Creativity research instruments designed for use with preschool children. In *Assessing Creative Growth: The Tests – Book One*. ed. A. M. Biondi, S. J. Parnes. Great Neck, NY: Creative Synergetics Assoc.
- Stein, M. I. 1968. *Creativity in Handbook of Personality Theory and Research*, ed. E. F. Borgatta, W. W. Lambert. Chicago. Rand McNally.
- Stein, M. I. 1974. *Stimulating Creativity*. New York: Academic, 2 vols.
- Steiner, G. A., ed 1965. *The Creative Organization*. Chicago: Univ. Chicago Press.
- Sternberg, R. J. 1977. *Intelligence. Information Processing and Analogical Reasoning: The Componential Analysis of Human Abilities*. Hillsdale, NJ: Erlbaum.
- Sternberg, R. J. 1979. The nature of mental abilities. *Am. Psychol.* 34:214–30.
- Stolorow, R. D., Atwood, G. E. 1979. *Faces in a Cloud: Subjectivity in Personality Theory*. New York: Aronson.
- Stringer, P. 1967. Masculinity-femininity as a possible factor underlying the personality responses of male and female art students. *Br. J. Soc. Clin. Psychol.* 6:186–94.
- Suler, J. R. 1980. Primary process thinking and creativity. *Psychol. Bull.* 88:144–65.
- Sussman, G., Justman, J. 1975. Characteristics of preadolescent boys judged creative by their teachers. *Gifted Child Q.* 19:310–16.
- Suter, B., Domino, G. 1975. Masculinity-femininity in creative college women. *J. Pers. Assess.* 39:414–20.
- Taft, R. 1971. Creativity: Hot and cold. *J. Pers.* 39:345–61.
- Taft, R., Gilchrist, M. B. 1970. Creative attitudes and creative productivity: A comparison of two aspects of creativity among students. *J. Educ. Psychol.* 61:136–43.
- Tan-Willman, C. 1974. Assessment and prediction of creativity in teaching. *Psychol. Rep.* 35:393–94.
- Taylor, C. W. ed. 1972. *Climate for Creativity*. New York: Pergamon.
- Taylor, C. W., Barron, F. eds. 1963. *Scientific Creativity*. New York: Wiley.
- Taylor, C. W., Ellison, R. L. 1967. Predictors of scientific performance. *Science* 155:1075–79.
- Taylor, I. A. 1975. A retrospective view of creativity investigation. See Taylor & Getzels 1975, pp. 1–36.
- Taylor, I. A., Getzels, J. W., eds. 1975. *Perspectives in Creativity*. Chicago: Aldine.
- Taylor, I. A., Sutton, D., Haworth, S. 1974. The measurement of creative transactualization: A scale to measure behavioral dispositions to creativity. *J. Creat. Behav.* 8:114–15.

- Torrance, E. P. 1966. *Torrance Tests of Creative Thinking*. Lexington, Mass: Personnel Press. Res. ed.
- Torrance, E. P. 1967. The Minnesota studies of creative behavior: National and international extensions. *J. Creat. Behav.* 1:137–54.
- Torrance, E. P. 1969. Originality of imagery in identifying creative talent in music. *Gifted Child Q.* 13:3–8.
- Torrance, E. P. 1970. What kind of person are you? *Gifted Child Q.* 14:71–75.
- Torrance, E. P. 1972a. Creative young women in today's world. *Except. Child.* 38:597–603.
- Torrance, E. P. 1972b. Predictive validity of the Torrance Tests of Creative Thinking. *J. Creat. Behav.* 6:236–52.
- Torrance, E. P. 1974. *Torrance Tests of Creative Thinking Norms-Technical Manual*. Lexington, Mass: Ginn.
- Torrance, E. P. 1979. *Cumulative Bibliography on the Torrance Tests of Creative Thinking*. Athens, Ga: Dep. Educ. Psychol.
- Torrance, E. P., Allioti, N. C. 1969. Sex differences in levels of performance and test-retest reliability of the Torrance Tests of Creative Thinking. *J. Creat. Behav.* 3:52–57.
- Torrance, E. P., Bruch, C. B., Morse, J. A. 1973. Improving predictions of the adult creative achievement of gifted girls by using autobiographical information. *Gifted Child Q.* 17:91–95.
- Torrance, E. P., Tan, C. A., Allman, T. 1970. Verbal originality and teacher behavior: A predictive validity study. *J. Teach. Educ.* 21:335–41.
- Trowbridge, N., Charles, D. C. 1966. Creativity in art students. *J. Genet. Psychol.* 109:281–89.
- Tucker, M. F., Cline, V. B., Schmitt, J. R. 1967. Prediction of creativity and other performance measures from biological information among pharmaceutical scientists. *J. Appl. Psychol.* 51:131–38.
- Urbina, S., Harrison, J., Schaefer, C., Anastasi, A. 1970. Masculinity-femininity and creativity as measured by the Franck Drawing completion test. *Psychol. Rep.* 26:799–804.
- Vernon, P. E. 1971. Effects of administration and scoring on divergent thinking tests. *Br. J. Educ. Psychol.* 41:245–57.
- Vernon, P. E. 1972a. Review of the Remote Associates test. See Baird 1972, pp. 829–30.
- Vernon, P. E. 1972b. The validity of divergent thinking tests. *Alberia J. Educ. Res.* 18:249–58.
- Vernon, P. E. 1978. Review of "Creativity Attitude Survey" See Bachman & Tuckman 1978, pp. 361–62.
- Vernon, P. E. 1979. *Intelligence: Heredity and Environment*. San Francisco: Freeman.
- Vernon, P. E., Adamson, G., Vernon, D. F., 1977. *The Psychology and Education of Gifted Children*. London Methuen.
- Walberg, H. J. 1969a. A portrait of the artist and scientist as young men. *Except. Child.* 36:5–11.
- Walberg, H. J. 1969b. Physics, femininity and creativity. *Dev. Psychol.* 1:47–54.
- Wallach, M. A. 1970. Creativity in *Carmichael's Manual of Child Psychology*, ed. P. H. Mussen. 1:1211–72. New York Wiley.
- Wallach, M. A., Kogan, N. 1965. *Modes of Thinking in Young Children*. New York: Holt, Rinehart & Winston.
- Wallbrown, F. H., Huelsman, C. B. Jr. 1975. The validity of the Wallach Kogan creativity operations for inner-city children in two areas of visual art. *J. Pers.* 43:109–26.
- Wallbrown, F. H., Wallbrown, J. D., Wherry, R. J. Sr. 1975. The construct validity of the Wallach-Kogan creativity test for inner-city children. *J. Gen. Psychol.* 92:83–96.
- Ward, W. C. 1968. Creativity in young children. *Child Dev.* 39:736–54.
- Ward, W. C. 1972. Review of the *Alpha Biographical Inventory*. See Baird 1972, pp. 1371–73.
- Ward, W. C. 1974. Creativity (?) in young children. *J. Creat. Behav.* 8:101–6.
- Waterman, A. S., Kohutiz, E., Putone, J. 1977. The role of expressive writing in ego identity formation. *Dev. Psychol.* 13:286–87.

#### 40 Personal Indicators of Individual Creativity and Innovation

- Welsh, G. S. 1975. *Creativity and Intelligence: A Personality Approach*. Chapel Hill, NC: Inst. Res. Soc. Sci.
- Whipple, G. T. 1915. *Manual of Mental and Physical Tests Part II: Complex Processes*. Baltimore: Warwick & York.
- While, R. W., ed. 1963. *The Study of Lives*. Reading, Mass, Addison Wesley.
- Wild, C. 1965. Creativity and adaptive regression. *J. Pers. Soc. Psychol.* 2:161–69.
- Winner, E., Gardner, H. 1977. The comprehension of metaphor in brain-damaged patients. *Brain* 100:717–29.
- Wispe, L. G. 1965. Some social and psychological correlates of eminence in psychology. *J. Hist. Behav. Sci.* 1:88–98.
- Woody, C., Claridge, G. S. 1977. Psychoticism and thinking. *Br. J. Soc. Clin. Psychol.* 16:241–48.
- Worthen, B. R., Clark, P. M. 1971. Toward an improved measure of remote associational ability. *J. Educ. Meas.* 8:113–23.
- Yamamoto, K. 1978. Review of “Creativity Attitude Survey” See Backman & Tuckman, pp. 362–63.
- Yarnell, T. D. 1971a. A common item creativity scale for the Adjective Check List. *Psychol. Rep.* 29:466.
- Yarnell, T. D. 1971b. Percentile norms for the Adjective Check List (ACL) creativity scale. *Psychol. Rep.* 29:675–78.
- Yu, M. 1977. *Personality profile and Life Situation of Creative Female Professionals*. Presented at Meet. Can. Psychol. Assoc., Vancouver, B. C.
- Zeldow, P. B. 1973. Replication and extension of the personality profile of “Artists in the Making”. *Psychol. Rep.* 33:541–42.