



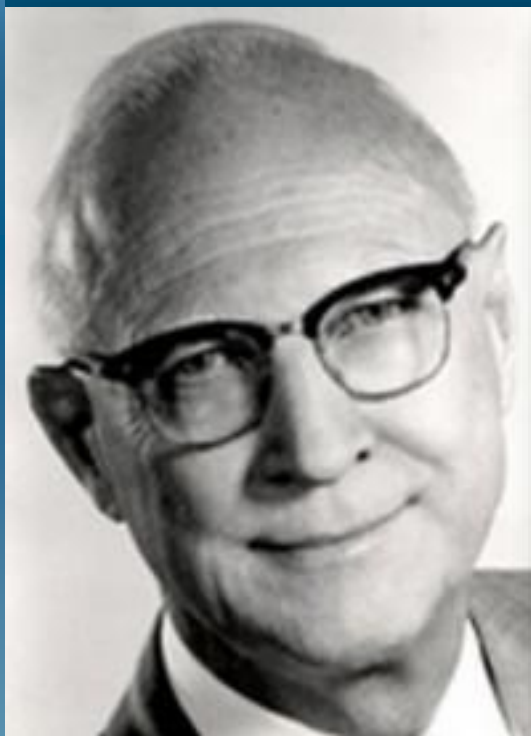
# E. Paul Torrance

## 7th Annual International Roundtable on Creative Thinking

Tuesday 27 July 2021; Venue: Online: 15:45-19:00 (BST)

*First Part Topic: "Concluding thoughts on the 70 Years of Research into Creativity following J.P. Guilford's APA Presidential Address"*

**The E. Paul Torrance International Roundtable on Creative Thinking** aims to refresh the work and legacy of Dr Torrance internationally especially among today's crop of creativity enthusiasts and scholars, push the boundary of knowledge on creative thinking and giftedness as well as increase knowledge sharing within the creativity field.



**Dr Joy Paul Guilford—7 March 1897-26 November 1987:** APA lecture lit bonfires of creativity research



**Dr Ellis Paul Torrance—8 October 1915-12 July 2003:** Father of Modern Creativity

*Second Part Topic: "How Can Creativity Provide Innovative Solutions for Communities in Post-Covid Recovery?"*

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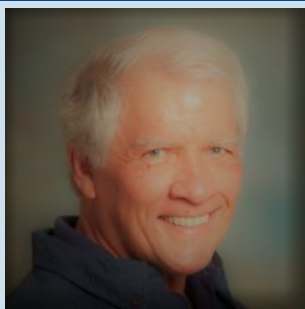
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May 2021



**First Part Keynoters, L-R:** Scott Isaksen, Dean Keith Simonton, & Fredricka Reisman. Chair: Larry Keiser



**Second Part Keynoters, L-R:** Keynoters Todd Lubart, Kobus Neethling, Pamela Burnard & Vlad Petre Glăveanu

## KEYNOTE SPEAKERS FOR THE 2021 TORRANCE ROUNDTABLE



**Keynote:** Dr Scott Isaksen, BI Norwegian Business School, Norway

**S**cott Isaksen, PhD, is the founder of the Creative Problem Solving Group in Buffalo, New York, and a Professor of Leadership and Organizational Behavior at the BI Norwegian Business School. A former professor and director of the International Center for Studies in Creativity within the State University of New York, he has published over 250 books, articles, and chapters in books. He has provided consultation and training on leadership and creativity for over 450 organizations in 35 different countries around the world. Scott is a member of the American Psychological Association; the Society of Consulting Psychologists; the Society for the Psychology of Aesthetics, Creativity, and the Arts; the Academy of Management; and the Product Development Management Association. Scott has served as a consulting editor for the *Journal of Creative Behavior* since 1983, and is a visiting professor to various Universities.

**D**ean Simonton, PhD, is distinguished professor of psychology at the University of California, Davis, USA. He is a member of a number of professional organizations, having served as president of the Society for General Psychology, APA Division 1, from 2011-2012 and previously as the president of the International Association of Empirical Aesthetics, and the Society for Aesthetics, Creativity and the Arts, APA Division 10. He also serves on a number of editorial committees and is currently associate editor of *The Wiley-Blackwell Encyclopedia of Adulthood and Aging*, as well as direct submissions editor for *Proceedings of the National Academy of Sciences*. At UC Davis, Professor Simonton has served in a number of executive roles, including chair of the faculty for the executive committee and representative assembly, and departmental vice-chair, among others. Professor

Simonton's research focuses on genius, creativity, leadership and aesthetics, looking at the cognitive, dispositional, developmental and sociocultural factors behind eminence, giftedness and talent in science, philosophy, literature, music, art, cinema, politics and war, with the greatest emphasis on scientific genius. He has also extensively developed archival data analysis, with an emphasis on cross-cultural, transhistorical, biographical, and content analytical measures, with special stress on the historiometric analyses of eminent personalities, creative products, and notable events. In addition, he studies the history of psychology, including analyses from the standpoint of the psychology of science, especially the psychology of distinguished scientists and eminent psy-



**Keynote:** Dr Dean Simonton, University of California, Davis, USA

chologist .

**F**redricka Reisman, PhD, is founder of Drexel's School of Education and Emerita Professor. Dr Reisman currently serves as Co-Director of the Drexel/Torrance Center while continuing to teach in the School's Creativity & Innovation programs and to chair and serve on dissertation committees for doctoral students interested in the Creativity & Innovation concentration. Dr Reisman received her PhD in Mathematics Education from Syracuse University. Prior to Drexel, Dr Reisman served as Professor and Chair of the Division of Elementary Education at the University of Georgia; a grades 3 and 5 elementary, middle school, high school mathematics teacher in New York State; and as a mathematics education instructor at Syracuse University. Dr Reisman has been awarded over \$14,800,000 private and government grants to support her research and teacher ed projects and have served as evaluator on funded engineering projects and numerous Pennsylvania and New York State university teacher certifi-

cation programs. She has created several books, contributions to books, journal publications, and assessments that focus on mathematics learning and teaching and creativity applications including a 2021 co-authored book published by Routledge entitled *Using Creativity to Address Dyslexia, Dysgraphia, and Dyscalculia: Assessment and Techniques*. She has served since 2013 and continues as editor for the 2021 Knowledge, Innovation & Enterprise (KIE) international creativity focused organization conference book. Dr Reisman was awarded the New Millennium Foundation Technology Award, the national 2002 Champion of Creativity Award by the American Creativity Association (ACA), and was the recipient of the 2017 National Association for Gifted Children E. Paul Torrance Award. She was honored in Spring 2020 by Drexel where the university-wide faculty creativity award has been renamed "*The Freddie Reisman University Creativity Award*."



**Keynote:** Dr Fredricka Reisman, Drexel University, PA, USA



**Chair:** Dr Larry Keiser, Drexel University, USA

**L**arry

Keiser is Clinical Assistant Professor, Program Lead for Creativity & Innovation Programs, and the Executive Director of Special Projects, Communications & Administration for Drexel University's School of Education, as well as Drexel's Teacher Certification Officer.

## KEYNOTE SPEAKERS FOR THE 2021 TORRANCE ROUNDTABLE



**Keynote:** Professor Todd Lubart, Université de Paris (LaPEA lab), France

**T**odd Lubart, PhD, is Professor of Psychology at the Université de Paris (LaPEA lab). Over the past 30 years, he is the author of books, articles and book chapters about creativity. Also, he co-authored measures of creative potential in children (EPoC: Evaluation of Potential Creativity) and adults. Todd Lubart received awards for his work on creativity including the American Psychological Association, World Council of Gifted and Talented, International Center for Innovation in Education. He directed a research laboratory focused on individual differences, human potential and applied psychology, and has been responsible for several large-scale research grants, including work on creativity assessment, creative development, creative process and creative environments. Currently, Todd Lubart is president of the International Society for the Study of Creativity and Innovation ([issci.online](http://issci.online)),

**K**obus Neethling, PhD, is the President of the South African Creativity Foundation, the founder of Kobus Neethling Institute and Creator of the Neethling Brain Instruments (NBI). Dr Neethling is a world-renowned scholar and practitioner in the area of creativity thinking and learning. He has written more than 90 books and 9 TV series including a number of international bestsellers (Including ‘Creativity uncovered’; ‘Very smart parents’; ‘Taking you beyond’; ‘Love, sex and the brain’; ‘Creative rugby’ and the new version of ‘Am I clever or am I stupid’ which has sold more than 200,000 copies); you are a Guinness World Record Holder: Co-author of “Making the Impossible possible”: the book of more than 100 pages written in the fastest time ever (four and a half minutes); you developed the largest battery of Whole Brain Instruments in the world (used in more than 40 countries) including the acclaimed 8-Dimension Brain Model. Every week in Pretoria, you train South Africans from all walks of life—business leaders and executives, civil society workers, teachers, civil servants, etc—on how to be creative.



**Keynote:** Dr Kubos Neethling, South African Creativity Foundation

**P**amela Burnard, PhD, is Professor of Arts, Creativities and Educations at the Faculty of Education, University of Cambridge where she Chairs the Arts and Creativities Research Group and runs an online monthly seminar series called ‘Performing Research’. She has published widely with 20 books and over 100 articles which advance the theory of multiple creativities across education sectors including early years, primary, secondary, further and higher education, through to creative and cultural industries. She is co-editor of the journal *Thinking Skills and Creativity*. Current funded projects include ‘Choices, chances and transitions around creative further and higher education’; ‘future-making education’ and ‘sculpting new creativities’ through innovative research methodologies. She is Fellow of the Royal Society of Arts (RSA) UK and the Chartered College of Teaching, UK.



**Keynote:** Professor Pamela Burnard, University of Cambridge, UK

For the complete list of 2021 KIE Conference keynote speakers, please visit: [www.kiecon.org](http://www.kiecon.org).



**Keynote:** Dr Vlad Petre Glăveanu

**V**lad Petre Glăveanu, PhD, is Associate Professor and Head of the Department of Psychology and Counselling at Webster University Geneva, Switzerland, founder and director of the Webster Center for Creativity and Innovation (WCCI), and Associate Professor II at the Centre for the Science of Learning and Technology (SLATE), University of Bergen, Norway. He received his PhD from the London School of Economics and Political Science, UK, and published extensively in the areas of creativity, culture, imagination, human possibility, culture, wonder, collaboration, migration and perspective-taking. His work is presented in over 150 articles and book chapters. He is the editor of the *Palgrave Encyclopedia of the Possi-*

*ble* (to be completed in 2021), editor or co-editor of various handbooks (e.g., *The Palgrave Handbook of Creativity and Culture Research*; *the Cambridge Handbook of Creativity across Domains*; *the Oxford Creativity Reader*), co-editor of different books (e.g., *Rethinking Creativity*, Routledge) and author of the recent volumes *The Possible: A Sociocultural Theory* (Oxford University Press, 2020) and *Wonder: The Extraordinary Power of an Ordinary Experience* (Bloomsbury, 2020). He is Editor of *Europe’s Journal of Psychology*, an open-access, peer-reviewed journal published by PsychOpen. He received in 2018 the Berlyne Award from the American Psychological Association (Division 10) for early career contributions to the field of aesthetics, creativity and the arts.

# J.P. GUILFORD ON FUTURE RESEARCH ON CREATIVITY

## A Vista for Future Research on Creativity

### Foreword

As the Editor of *Frontiers in Creativity Research: Beyond the Basics* (1987), I invited 20 creativity scholars to contribute chapters. The aim was to take stock of much of the creativity research already accomplished, and point the way forward. Among these was J. P. Guilford. He and I agreed to include two of his previously published sources: his 1950 APA address (Guilford, 1950), and his 25-year review of progress (Guilford, 1975). We also discussed the need for him to write a new part for his section in which he could identify some potentially produc-

tive future inquiry.

At first, he was a bit reluctant as he was retired and did not have access to graduate students or other resources. I encouraged him to think about this as a conversation with future graduate students, and reflect on what might add value to the future. He took the challenge, and we exchanged draft versions. Each time I sent him some edits, the next typed draft was returned within days. The final draft I sent along was delayed. I believe that this new section was his last writing before passing away, as his wife had to mail me his final

edits.

SCOTT ISAKSEN

Professor of Leadership and Organizational Behavior, BI Norwegian Business School, Norway.

### Reference

Guilford, J. P. (1987). Creativity research: Past, present and future. In S. G. Isaksen (Ed), *Frontiers of creativity research: Beyond the basics* (pp. 33-65). Buffalo, NY: Bearly Limited.

J. P. GUILFORD

## Creativity Research: Past, Present and Future

### PART ONE: The 1950 Presidential Address to the American Psychological Association\*

I discuss the subject of creativity with considerable hesitation, for it represents an area in which psychologists generally, whether they be angels or not, have feared to tread. It has been one of my long-standing ambitions, however, to undertake an investigation of creativity. Circumstances have just recently made possible the realization of that ambition. But the work has been started only within the past year. Consequently, if you are expecting answers based upon new empirical research you will be disappointed. What I can do at this time is to describe the plans for that research and to report the results of considerable thinking, including the hypotheses at which my students and I have arrived after a survey of the field and its problems. The research design, although not essentially new, should be of some interest. I will also point out some implications of the problems of creativity in vocational and educational practices.

### Some Definitions and Questions

In its narrow sense, creativity refers to the abilities that are most characteristic of creative people. Creative abilities determine whether the individual has the power to exhibit creative behavior to a noteworthy degree. Whether or not the individual who has the requisite abilities will actually produce results of a creative nature will depend upon his motivational and temperamental traits. To the psychologist, the problem is as broad as the qualities that contribute significantly to creative productivity. In other words, the psychologist's problem is that of creative

personality.

In defining personality, as well as other concepts preparatory to an investigation, definitions of an operational type are much to be preferred. I have often defined an individual's personality as his unique pattern of traits. A trait is any relatively enduring way in which persons differ from one another.

The psychologist is particularly interested in those traits that are manifested in performance; in other words, in behavior traits. Behavior traits come under the broad categories of aptitudes, interests, attitudes, and temperamental qualities. By aptitude we ordinarily mean a person's readiness to learn to do certain types of things. There is no necessary implication in this statement as to the source of the degree of readiness. It could be brought about through hereditary determination or through environmental determination; usually, if not always, by an interaction of the two. By interest we usually mean the person's inclination or urge to engage in some type of activity. By attitude we mean his tendency to favor or not to favor (as shown objectively by approach-withdrawal behavior) some type of object or situation. Temperamental qualities describe a person's general emotional disposition: for example, his optimism, his moodiness, his self-confidence, or his nervousness.

Creative personality is then a matter of those patterns of traits that are characteristic of creative persons. A creative pattern is manifest in creative behavior, which includes such activities as inventing, designing, contriving, composing, and planning. People who exhibit these types of behavior to a marked degree are recognized as being creative.

There are certain aspects of creative genius that have aroused questions in the minds of those who have reflected much about the matter. Why is creative productivity a relatively infrequent phenomenon? Of

all the people who have lived in historical times, it has been estimated that only about two in a million have become really distinguished (Gidding, 1907). Why do so many geniuses spring from parents who are themselves very far from distinguished? Why is there so little apparent correlation between education and creative productiveness? Why do we not produce a larger number of creative geniuses than we do, under supposedly enlightened, modern educational practices? These are serious questions for thought and investigation. The more immediate and more explorable problem is a double one: (1) How can we discover creative promise in our children and our youth? and (2) How can we promote the development of creative personalities?

### Neglect of the Study of Creativity

The neglect of this subject by psychologists is appalling. The evidences of neglect are so obvious that I need not give proof. But the extent of the neglect I had not realized until recently. To obtain a more tangible idea of the situation, I examined the index of the *Psychological Abstracts* for each year since its origin. Of approximately 121,000 titles listed in the past 23 years, only 186 were indexed as definitely bearing on the subject of creativity. The topics under which such references are listed include creativity, imagination, originality, thinking, and tests in these areas. In other words, less than two-tenths of one percent of the books and articles indexed in the *Abstracts* for approximately the last quarter century bear directly on this subject. Few of these advance our understanding or control of creative activity very much. Of the large number of textbooks on general psychology, only two have devoted separate chapters to the subject during the same period.

Hutchinson (1931) reviewing the publications on the process of creative thinking to the year 1931, concluded that the subject had hardly been touched by anyone. Markey (1935), reviewing the subject of imagination four years later, reported very little more in the way of a fundamental contribution to the subject.

Some of you will undoubtedly feel that the subject of creative genius has not been as badly neglected as I have indicated, because of the common belief that genius is largely a matter of intelligence and the IQ. Certainly, that subject has not been neglected. But, for reasons which will be developed later, I believe that creativity and creative productivity extend well beyond the domain of intelligence.

Another important reason for the neglect, of course, is the difficulty of the problems themselves. A practical criterion of creativity is difficult to establish because creative acts of an unquestioned order of excellence are extremely rare. In this respect, the situation is much like that of a criterion for accident proneness which calls for the actual occurrence of accidents. The accidental nature of many discoveries and inventions is well recognized. This is partly due to the inequality of stimulus or opportunity, which is largely a function of the environment rather than of individuals. But if environmental occasions were equal, there would still be *great* differences in creative productivity among individuals.

There are, however, greater possibilities of observing individual differences in creative performance if we revise our standards, accepting examples of lower degrees of distinction. Such instances are more numerous. But even if we can detect and accept as creative certain acts of lower degree of excellence, there are other difficulties. Creative people differ considerably in performance from time to time. Some writers on the subject even speak of rhythms of creativity. This means that any criterion, and probably any tests of creativity as well, would show considerable error variance due to function fluctuation. Reliabilities of tests of creative abilities and of creative criteria will probably be generally low. There are ways of meeting such difficulties, however. We should not permit them to force us to keep foot outside the domain.

Another reason for the oversight of problem of creativity is a methodological one. Tests designed to measure intelligence have fallen into certain stereotyped patterns. Under the demands for objectivity and for scoring convenience. I do not now see how same of the creative abilities, at least, can be measured by means of anything but completion tests of some kind. To provide the creator with the finished product, as in a multiple-choice item, may prevent him from showing precisely what we want him to Show: his own creation. I am not opposed to the use of the multiple-choice or other objectively scorable types of test items in their proper places. What I am saying is that the quest for easily objectifiable testing and scoring has directed us away from the attempt to

measure some of the most precious qualities of individuals and hence to ignore those qualities.

Still another reason for the neglect of the problems of creativity is to be found in certain emphases we have given to the investigations of learning. For one thing, much learning research has been done with lower animals in which signs of creativity are almost nonexistent. For another thing, learning theory has been generally formulated to cover those phenomena that are easiest to order in logical schema. Learning theorists have had considerable difficulty with the behavior known as insight, to which creative behavior shows much apparent relationship (Wertheimer, 1945). It is proper to say that a creative act is an instance of learning, for it represents a change in behavior that is due to stimulation and/or response. A comprehensive learning theory must take into account both insight and creative activity.

### The Social Importance of Creativity

There is general recognition, on the part of those outside the academic fold, at least, of the importance of the quest for knowledge about creative disposition. I can cite recent evidences of the general interest in the discovery and development of creative talent. Large industries that employ many research scientists and engineers have held serious meetings and have had symposia written about the subject (Kettering, 1944). There is much questioning into the reasons why graduates from the same institutions of higher learning, with high scholastic *records* and with strong recommendations, differ so widely in output of new ideas. The enormous economic value of new ideas is generally recognized. One scientist or engineer discovers a new principle or develops a new process that revolutionizes an industry, while dozens of others merely do a passable job on the routine tasks assigned to them.

Various branches of the government, as you all know, are now among the largest employers of scientific and technical personnel. These employers, also, are asking how to recognize the individuals who have inventive potentialities. The most common complaint I have heard concerning our college graduates in these positions is that while they can do assigned tasks with a show of mastery of the techniques they have learned, they are much too helpless when called upon to solve a problem where new paths are demanded.

Both industry and governmental agencies are also looking for leaders. Men of good judgment, planning ability, and inspiring vision are in great demand. How can leaders with imagination and vision be discovered? Can such qualities be developed? If those qualities can be promoted by educational procedures, what are those procedures?

We hear much these days about the remarkable new thinking machines. We are told that these machines can be made to take over much of men's thinking and that

the routine thinking of many industries will eventually be done without the employment of human brains.

We are told that this will entail an industrial revolution that will pale into insignificance the first industrial revolution. The first one made man's muscles relatively useless; the second one is expected to make man's brain also relatively useless. There are several implications in these possibilities that bear upon the importance of creative thinking. In the first place, it would be necessary to develop an economic order in which sufficient employment and wage earning would still be available. This would require creative thinking of an unusual order and speed. In the second place, eventually about the only economic value of brains left would be in the creative thinking of which they are capable. Presumably, there would still be need for human brains to operate the machines and to invent better ones.

### Some General Theories of the Nature of Creativity

It is probably only a layman's idea that the creative person is peculiarly gifted with a certain quality that ordinary people do not have. This conception can be dismissed by psychologists, very likely by common consent. The general psychological conviction seems to be that all individuals possess to some degree all abilities, except for the occurrence of pathologies. Creative acts can therefore be expected, no matter how feeble or how infrequent, of almost all individuals. The important consideration here is the concept of continuity. Whatever the nature of creative talent may be, those persons who are recognized as creative merely have more of what all of us have. It is this principle of continuity that makes possible the investigation of creativity in people who are not necessarily distinguished.

The conception that creativity is bound up with intelligence has many followers among psychologists. Creative acts are expected from those at high IQ and not expected from those of low IQ. The term "genius", which was developed to describe people who distinguish themselves because of creative productivity, has been adopted to describe the child with exceptionally high IQ. Many regard this as unfortunate, but the custom seems to have prevailed.

There is much evidence of substantial positive correlations between IQ as measured by an intelligence test and certain creative talents, but the extent of the correlations is unknown. The work of Terman and his associates is the best source of evidence of these correlations; and yet, this evidence is not decisive. Although it was found that distinguished men of history generally had high estimated IQs, it is not certain that indicators in the form of creative behavior have not entered into those estimations (Cox, 1926). It would be much more crucial to know what the same individuals would have done on intelligence tests when they were children.

Terman's study of the thousand children of exceptionally high IQs who have now reached maturity does not throw much light on this theory. Among the group there is plenty of indication of superior educational attainment and of superior vocational and social adjustment. On the other hand, there seems to be as yet little promise of a Darwin, an Edison, or a Eugene O'Neil, although the members of the group have reached the age level that has come to be recognized as the "most creative years". The writers of that study recognize this fact and account for it on the basis of the extreme rarity of individuals of the caliber of those whom I have mentioned (Terman & Oden, 1947). It is hoped that further follow-up studies will give due attention to criteria of a more specifically creative character.

When we look into the nature of intelligence tests, we encounter many doubts concerning their coverage of creative abilities. It should be remembered that from the time of Binet to the present, the chief practical criterion used in the validation of tests of intellect has been achievement in school. For children, this has meant largely achievement in reading and arithmetic. This fact has generally determined the nature of our intelligence tests. Operationally, then, intelligence has been the ability (or complex of abilities) to master reading and arithmetic and similar subjects. These subjects are not conspicuously demanding of creative talent.

Examination of the content of intelligence tests reveals very little that is of an obviously creative nature. Binet did include a few items of this character in his scale because he regarded creative imagination as one of the important higher mental functions that should be included. Revisions of the Binet scale have retained such items, but they represent only a small minority. Group tests of intelligence have generally omitted such items entirely.

The third general theory about creativity is, in fact, a theory of the entire personality, including intelligence. I have defined personality as a unique pattern of traits, and traits as a matter of individual differences. There are thousands of observable traits. The scientific urge for rational order and for economy in the description of persons directs us to look for a small number of descriptive categories. In describing mental abilities, this economy drive has been grossly overdone when we limit ourselves to the single concept of intelligence. Furthermore, the term "intelligence" has by no means achieved logical or operational invariance and so does not satisfy the demand for rational order.

We do not need the thousands of descriptive terms because they are much interrelated, both positively and negatively. By intercorrelation procedures it is possible to determine the threads of consistency that run throughout the categories describing abilities, interests, and temperament variables. I am, of course, deterring to the factorial conception of personality. From this point of view, personality is conceived geo-

metrically as a hypersphere of  $n$  dimensions, each dimension being a dependable, convenient reference variable or concept. If the idea of applying this type of a description to a living, breathing individual is distasteful, remember that this geometric picture is merely a conceptual model designed to encompass the multitude of observable facts, and to do it in a rational, communicable, and economical manner.

With this frame of reference, many of the findings and issues become clarified. The reason that different intelligence tests do not intercorrelate perfectly, even when errors of measurement have been taken into account, is that each test emphasizes a different pattern of primary abilities. If the correlations between intelligence-test scores and many types of creative performance are only moderate or low, and I predict that such correlations will be found, it is because the primary abilities represented in those tests are not all important for creative behavior. It is also because some of the primary abilities important for creative behavior are not represented in the test at all. It is probably safe to say that the typical intelligence test measures to a significant degree not more than a half dozen of the intellectual factors (Jones, 1949). There are surely more intellectual factors than that. Some of the abilities contributing to creative success are probably non-intellectual; for example, some of them are perceptual. Probably, some of the factors most crucial to creative performance have not yet been discovered in any type of test. In other words, we must look well beyond the boundaries of the IQ if we are to fathom the domain of creativity.

### Development of Creativity

Before referring to the experimental design and to more specific hypotheses concerning the nature of creativity, I will venture one or two opinions on the general problem of the development of creativity. For believe that much can be done to encourage its development. This development might be in the nature of actual strengthening of the functions involved or it might mean the better utilization of what resources the individual possesses, or both. In any case, a knowledge of the functions is important.

We frequently hear the charge that under present-day mass-education methods, the development of creative personality is seriously discouraged. The child is under pressure to conform for the sake of economy and for the sake of satisfying prescribed standards. We are told by the philosophers who have given thought to the problem that the unfolding of a creative personality is a highly individual matter which stresses uniqueness and shuns conformity. Actually, the unfolding of the individual along the lines of his own inclinations is generally frowned upon. We are told, also, that the emphasis upon the memorizing of facts sets the wrong kind of goal for the student. How serious these charges are no one actually knows.

We have very little experimental

evidence that is decisive one way or the other and such evidence is hard to obtain.

Charles Kettering (1944) one time commented upon a survey in which it was found that a person with engineering or scientific training had only half the probability of making an invention compared with others. His comment was that an inventor should be defined as "a fellow who doesn't take his education too seriously." If the results of that survey represent the actual situation, either creative individuals do not seek higher education in engineering and science, or that kind of education has negative transfer effects with respect to inventiveness.

Many of us teachers assert that it is our main objective to teach students how to think, and this means also to think constructively. Certainly, if we succeeded in this objective, there should be much evidence of creativeness in the end product. I am convinced that we do teach some students to think, but I sometimes marvel that we do as well as we do. In the first place, we have only vague ideas as to the nature of thinking. We have little actual knowledge of what specific steps should be taken in order to teach students to think. Our methods are shotgun methods, just as our intelligence tests have been shotgun tests. It is time that we discarded shotguns in favor of rifles.

We all know teachers who pride themselves on teaching students to think and yet who give examinations that are almost entirely a matter of knowledge of facts. Please do not misunderstand me. I have a strong appreciation of knowledge of facts. No creative person can get along without previous experiences or facts; he never creates in a vacuum or with a vacuum. There is a definite place for the learning of facts in our educational system. But let us keep our educational objectives straight. Let us recognize where facts are important and where they are not. Let us remember, too, that the kinds of examinations we give really set the objectives for the students, no matter what objectives we may have stated.

The confusion of objectives is illustrated by the following incident. The story was told by a former dean of a leading Midwestern University. An old, experienced teacher and scholar said that he tried to encourage originality in his students. In a graduate course, he told the class that the term paper would be graded in terms of the amount of originality shown. One school teacher in the class was especially concerned about getting a high mark in the course. She took verbatim notes, continuously and assiduously, of what the learned professor said in class. Her term paper, the story goes, was essentially a stringing together of her transcribed lecture notes, in which the professor's pet ideas were given prominent place. It is reported that the professor read the term papers himself. When the school teacher's paper was returned, the professor's mark was an A, with the added comment, "This is one of the most original papers I have ever read."

Before we make substantial improvement in teaching students to think, in my opinion we will have to make some changes in our conceptions of the process of learning. The ancient faculty psychology taught that mental faculties grow strong by virtue of the exercise of those faculties. We all know from the many experiments on practice in memorizing that exercises in memorizing are not necessarily followed by improvement of memory in general. We all know that exercises in perceptual discriminations of certain kinds are not followed by improvement of perceptual discriminations in general (Thorndike & Woodworth, 1901). Thorndike and others concluded that the study of courses in high-school curricula did not necessarily result in a general improvement in intellect, but that the increases in test scores could be attributed to learning of a more specific nature (Broyler et al., 1927; Thorndike, 1924). Following this series of experiments the conclusion has often been that learning consists of the development of specific habits and that only very similar skills will be affected favorably by the learning process.

In view of the newer findings concerning primary abilities, the problems of formal discipline take on new meaning, and many of the experiments on the transfer of training will have to be reexamined and perhaps repeated with revised conditions. The experiments just cited do justify the rejection of the concepts of a general memory power, a general perceptual-discrimination power, and perhaps, also, rejection of the concept of a single power called intellect. These findings are in harmony with factorial theory. But the other alternative to the idea of format discipline is not necessarily a theory of specific learning from specific practice.

There is certainly enough evidence of transfer effects. Experiments should be aimed to determine whether the instances of positive, zero, and negative transfer effects conform in a meaningful way to the outlines of the primary abilities. The work of Thorndike and others that I have just cited does, in fact, actually throw some light on this question. Although this aspect of their findings is usually not mentioned, they reported that high school students' experiences in numerical, verbal, and spatial types of courses—arithmetic and bookkeeping, Latin and French, and manual training—were associated with relatively greater gains in numerical, verbal, and spatial types of tests, respectively.

A general theory to be seriously tested is that some primary abilities can be improved with practice of various kinds and that positive transfer effects will be evident in tasks depending upon those abilities. At the present time some experiments of this type are going on in the Chicago schools under the direction of Thelma Gwinn Thurstone (1948). In one sense, these investigations have returned to the idea of formal discipline. The new aspect of the disciplinary approach is that the presumed functions that are being "exercised" have been indi-

cated by empirical research.

## Factorial Research Design

The general outline of the design for a factor-analysis investigation is familiar to many of you. It has been described before but needs to be emphasized again (Thurstone, 1948). The complete design involves a number of steps, not all of which are essential but all of which are highly desirable if the investigator is to make the most efficient use of his time and to achieve results of maximum value. The major steps will be mentioned first, then more details concerning some of them.

One first chooses the domain of his investigation. It may be the domain of memory abilities, visual-perceptual abilities, reasoning abilities, or the domain of introversion-extraversion.

One next sets up hypotheses as to the factors he expects to find in that domain. His preparatory task of hypothesis formation goes further. It includes the framing of several alternative hypotheses as to the more precise nature of each factor. This is necessary as the basis for transforming each factor hypothesis into the operational terms of test ideas. He then constructs tests which he thinks will measure individual differences in the kind of ability, or other quality, he thinks the factor to be. He will want to include in the test battery some reference tests that measure already known factors. One reason for this is that the new tests will almost inevitably also measure to some extent factors that have previously been established, such as verbal comprehension, number facility, and visualization. If such variance is probably going to appear in more than one new test in the battery, it is best to have that variance clearly brought out and readily identifiable. Another reason is that it is possible, after all, that one or more of the hypothesized factors will turn out to be identifiable with one or more of the known factors. The possibility of this identification must be provided for by having the suspected, known factors represented in the battery.

The test battery is administered to a sample of adequate size from a population of appropriate qualifications. Certain kinds of populations are better for bringing out variances in some common factors and other kinds are more suitable for other purposes. There should be relative homogeneity in certain features that might be correlated with the factors, such as sex, age, education, and other conditions. Some thought should be given to whether tests should be speed tests or power tests or something between the two. Some consideration should also be given to the most appropriate type of score for each test.

Factors are extracted and their reference axes are rotated into positions that are compelling because of the nature of the configuration of test vectors in the hyperspace. The psychological nature of each factor is surmised by virtue of the kinds of tests that have substantial variance attributable to

that factor in contrast to tests which lack that variance.

In many respects, the complete factor-analysis design has properties parallel to those of a good experiment. In both, we begin with hypotheses. In both, some conditions are held constant while others are varied. In both, the measured outcomes point toward or away from the hypotheses. One important difference is the possibility of a statistical test of significance of the measured result for the experiment but not for the factor analysis. Confidence in the latter case depends upon the compellingness of the factor structure and the repeated verification of a result.

As an illustration of this analogy to an experiment, I will cite the factorial study of the well-known figure-analogies test. In the Army Air Forces research results, the figure-analogies test exhibited variances in three factors denoted as reasoning I, II, and III (Guilford, 1947). They were thus designated because they were peculiar to a number of reasoning tests, but their more precise natures were obscure. Examination of what one does in solving a figure-analogies item suggests several possible psychological functions or activities. First, one has to grasp correctly the relation between figure one and figure two. This suggests an ability to see a relationship between two objects. Second, one must observe the properties of the third figure. Then, one has to see what kind of a fourth figure it takes to satisfy the same relationship between figure three and figure four. Having decided upon the kind of figure needed, one has to find it among four or five that are supplied in the multiple-choice item. This is a kind of classifying act.

There is still another possibility. The mislead responses may be so reasonable that considerable discrimination may be needed to select the best figure for the purpose. Considering the figure-analogies item from a more holistic point of view, there may be a primary ability involved in seeing that there is an identity of two relationships when the elements related are different. Or, there may be a general reasoning-by-analogy ability. Transposability of relations may be a key function here. Thus, we have several hypotheses as to the functions involved. There could be others. For every one of them we also have the further question as to whether the ability implied is restricted to the visual perception of figures or whether it is more general, extending to word meanings, numbers, and sounds. And if it is general, what are its limits?

To seek answers by factorial methods, one would construct special tests, each limited, if possible to one kind of act implied by each hypothesis. One would also vary the kind of material in each type of test to explore the scope of generality. The answers to the hypotheses (for each hypothesis is in reality a question) would be to find that the loading for each factor would rise with some of the variations and fall with others as compared to its loading in the traditional figure-analogies test. We would hope to fine

the changes in factor loadings so marked that we would not feel seriously the lack of *t* tests or *F* tests.

The question of the sources of factor hypotheses calls for some comment. In a domain in which there have already been factorial studies, the previous results are always suggestive. This makes it appear that the factorist merely moves from hypotheses to hypotheses. This is quite true. It is a fundamental truth of all scientists, no matter what their methods. Some hypotheses are merely better supported and more generally accepted than others at the time. There is enough uncertain left in many a hypothesis to invite further investigation. That is what makes science interesting. That is what I think Kettering meant when he stated that the inventor is one who does not take his education (or knowledge) too seriously.

In a personality domain in which there has been little previous illumination of the underlying variables, other sources of hypotheses must be sought. The critical-incident technique of Flanagan (1949) would be one useful exploratory approach. Incidentally, one might say that this method has been used informally in connection with creative people from the "Eureka" episode of Archimedes down to modern times. The literature includes many descriptions of creative events. It would be more correct to refer to these historical reports as anecdotes, however, rather than critical incidents, since they suffer from most of the weaknesses of anecdotes. Where modern writers have attempted to interpret them psychologically, the interpretations have been quite superficial. They abound with *vague* concepts such as "genius," "intuition," "imagination," "reflection," and "inspiration," none of which leads univocally to test ideas. In the writings of those who have attempted to give a generalized picture of creative behavior, there is considerable agreement that the complete creative act involves four important steps.

According to this picture, the creator begins with a period of preparation, devoted to an inspection of his problem and a collection of information or material. There follows a period of incubation during which there *seems* to be little progress in the direction of fulfillment. But, we are told, there *is* activity, only it is mostly unconscious. There eventually comes the *big* moment of inspiration, with a final, or semi-final, solution, often accompanied by strong emotion. There usually follows a period of evaluation or verification, in which the creator tests the solution or examines the product for its fitness or value. Little or much "touching up" may be done to the product.

Such an analysis is very superficial from the psychological point of view. It is more dramatic than it is suggestive of testable hypotheses. It tells us almost nothing about the mental operations that actually occur. The concepts do not lead directly to test ideas. In attempting to distinguish between persons with different degrees of creative talent, shall we say, for example,

that some individuals are better incubators than others? And how would one go about testing for incubating ability? The belief that the process of incubation is carried on in a region of the mind called the unconscious is of no help. It merely chases the problem out of sight and thereby the chaser feels excused from the necessity of continuing the chase further.

It is not incubation itself that we find of great interest. It is the nature of the processes that occur during the latent period of incubation, as well as before it and after it. It is individual differences in the efficiency of those processes that will be found important for identifying the potentially creative. The nature of those processes or functions will have to be inferred from performances of the individuals who have been presented with problems, even though the creator is largely unaware of them.

### Specific Hypotheses Concerning Creative Abilities

The hypotheses that follow concerning the nature of creative thinking have been derived with certain types of creative people in mind: the scientist and the technologist, including the inventor. The consensus of the philosophers seems to have been that creativity is the same wherever you find it. To this idea I do not subscribe. Within the factorial frame of reference there is much room for different types of creative abilities. What it takes to make the inventor, the writer, the artist, and the composer creative may have some factors in common, but there is much room for variation of pattern of abilities. Some of the hypotheses mentioned here may apply also to areas of creative endeavor other than science, technology, and invention, but others may not. Included in the list of primary abilities that may contribute to creative efforts of these special groups are the reasoning factors, but I shall restrict mention here to other possible thinking factors that are more obviously creative in character.

First, there are probably individual differences in a variable that may be called *sensitivity to problem*. How this variation among individuals may come about will not concern us at this time. Whether it is just regarded as an ability or as a temperament trait will not concern us, either. The fact remains that in a certain situation one person will see that several problems exist while another will be oblivious to them.

Two scientists look over a research report. There are generally acceptable conclusions, but there is one minor discrepancy in the results. One scientist attributes the discrepancy to "experimental error." The other feels uneasy about the discrepancy; it piques his curiosity; it challenges him for an explanation. His further thinking about the matter develops into a new research project from which highly important findings result. Such an incident was reported by

Flanagan (1949); it could be Round duplicated many times.

There are questions as to the generality of such a variable. Is the supposed sensitivity restricted to a certain kind of situation or a certain kind of problem? Is it a perceptual quality as well as a thought quality? Could it be a general impressionability to the environment? Is it our old friend "curiosity" under a new name? Is it an ability to ask questions? Is it a general inhibition against closure? There may be other hypotheses just as pertinent. Each one suggests possible tests of individual differences.

Examples of possible tests follow. One might present the examinee with a short paragraph of expository material and instruct him to ask as many questions as he can that are suggested by the statements, with relatively liberal time allowed. A large part of the scientist's success depends upon his ability to ask questions, and, of course, to ask the right questions. In another test, one might name common household appliances, such as a toaster, or articles of clothing, such as trousers, and ask the examinee to list things that he thinks are wrong or could be improved. As a perceptual test, one might present pictures of objects or forms that are conventional and regular except for minor irregularities. Can the examinee detect the usual features or will he overlook them? A third possibility is in the form of what we have called "frustration test," merely because it is somewhat frustrating to many who have tried it. Contrary to the usual test practice, no task instruction is given: only items, and the very general instruction "do something with each item; whatever you think should be done." Each item is of a different type. One or too examinees have refused to do anything with the test.

There is very likely a *fluency* factor, or there are a number of fluency factors, in creative talent. Not that all creators must work under pressure of time and must produce rapidly or not at all. It is rather that the person who is capable of producing a large number of ideas per unit of time, other things being equal, has a greater chance of having significant ideas. There have been precious results yielding several verbal-fluency factors but I have insufficient time to acknowledge those studies properly here. It is probable that there are a number of fluency factors, nonverbal as well as verbal, yet undiscovered. There is a general problem to be investigated, apart from creativity, whether many of the primary thinking abilities have both a power and a speed aspect somewhat independent of each other. Some work of Davidson and Carroll (1945) suggests this in a result with regard to one of the reasoning factors.

One kind of fluency test would consist of asking the examinee to name as many objects as he can in a given time, the objects having some specified property; for example, things round, things red, or things to eat. In another test, the ideas might be more complex, as in naming a list of



appropriate titles for a picture or for a short story. Still more demanding and also more restricting could be the task of naming exceptions to a given statement. Fluency of inferences may be tested by providing a hypothetical statement to which the examinee is to state as many consequences or implications as he can in a limited time. The statement might be: A new invention makes it unnecessary for people to eat; what will the consequences be? This type of test has been previously proposed by several investigators.

The creative person has *novel* ideas. The degree of novelty of which the person is capable, or which he habitually exhibits, is pertinent to our study. This can be tested in terms of the frequency of uncommon, yet acceptable, responses to items. The tendency to give remote verbal associations in a word-association test; to give remote similarities in a similarities test; and to eat. In another test, the ideas might be more complex, as in naming a list of appropriate titles for a picture or for a short story. Still more demanding and also more restricting could be the task of naming exceptions to a given statement. Fluency of inferences may be tested by providing a hypothetical statement to which the examinee is to state as many consequences or implications as he can in a limited time. The statement might be: A new invention makes it unnecessary for people to eat; what will the consequences be? This type of test has been previously proposed by several investigators.

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The individual's *flexibility* of mind, the ease with which he changes set, can possibly be indicated in several ways by means of tests. Although there have been disappointments in the attempt to establish a common factor of this type (Guilford, 1947), the concept of flexibility and of its probable opposite, rigidity, will not be downed. In conjunction with some of the fluency tests, there may be opportunities to obtain some indications concerning flexibility. Does the examinee tend to stay in a rut or does he branch out readily into new channels of thought? Tests whose items cannot be correctly answered by adhering to old methods but require new approaches, in opposition to old habit of thinking, would be pertinent here. Certain types of puzzles fit this requirement fairly well, for example, a problem in which the examinee cannot succeed without folding the paper on which he writes, and the idea of doing so must come from him.

Much creative thinking requires the organizing of ideas into larger, more inclusive patterns. For this reason, we have hypothesized a *synthesizing ability*. As a counterpart to this, one might well expect an *analyzing ability*. Symbolic structures must often be broken down before new ones can be built. It is desirable to explore many kinds of both synthesizing and analyzing *activities*, in both perceptual and conceptual problems, in order to determine the existence of such factors and their numbers and whether they cut across both perceptual and conceptual areas.

From Gestalt psychology comes the idea that there may be a factor involving *reorganization* or *redefinition* of organized wholes (Wertheimer, 1945). Many inventions have been in the nature of a transformation of an existing object into one of different design, function, or use. It may be that this activity involves a combination of flexibility, analysis and synthesis, and that no additional hypothesis of redefinition is really needed, but the possibility must be investigated.

There is a possibility of a dimension of ability that has to do with the degree of *complexity* or of intricacy of conceptual structure of which the individual is capable. How many interrelated ideas can the person manipulate at the same time? The scientist must often keep in mind several variables, conditions, or relationships as he thinks out a problem. Some individuals become confused readily; they can keep only one or two items of structure delineated and property related. Others have a higher resistance to confusion—a greater span of this type. Such an ability might be identifiable with the hypothesized synthesizing factor, but the study should make possible a separation of the two if the distinction is real.

Creative work that is to be realistic or accepted must be done *under* some *degree* of evaluative restraint. Too much restraint, of course, is fatal to the birth of new ideas. The selection of surviving ideas, however, requires same *era/nation*. In this direction there must be a factor or two. The evaluations are conceivably of different kinds, consequently the kinds of possible tests are numerous. In a paragraph of exposition, we may *ask* the examinee to say whether every underlined statement is best classified as a fact, a definition, or a hypothesis. He will, to be sure, need some preliminary instruction in these distinctions. In another test, we can present him with a stated problem, then ask him which of several items are relevant to its solution and which ones are not. In still another test, we can give a problem and several alternative solutions, all correct. The examinee is to rank the solutions in the order of degree of excellence or fitness.

The hypotheses mentioned, as was stated earlier, refer more specifically to a limited domain of creative thinking more characteristic of the scientist and technologist. Even so, this entails a factorial study of substantial proportions. Similar studies will need to be made in the domains of

planning abilities, in order to anticipate abilities more characteristic of the economic, the political, and the military leader. Still other restricted domains will need to be investigated to take care of the writer, the graphic artist, and the musical composer.

The question will inevitably arise. "How do you know your tests are valid?" There are two answers to this question. The first is that the factorial study of the tests is in itself one kind of validation. It will determine which tests measure each factor and to what extent. That is a matter of internal validity or factorial validity. It answers the question, "What does the test measure?" The second answer will be in terms of which factors are related to the creative productivity of people in everyday life. That calls for the correlation of labor measures with practical criteria. I feel very strongly that only after we have determined the promising factors and how to measure them are we justified in taking up the time of creative people with tests. If a certain factor we discover turns out not to be related to creative production, we have made a bad guess, but we will have discovered a new factor that may have some other practical validity. If a certain factor is not related to the criteria of creative productivity, the tests which measure it uniquely will also prove to be invalid for predicting these criteria. It is better to fail in the validation of a single factor measure than to fail in the validation of a half-dozen tests. If we make a study of the practical validity of every creative test we can think of before it is analyzed, we are bound to exert considerable wasted effort of our own and of our examiners. This statement, incidentally, applies to the validation study of any test.

Creative productivity in everyday life is undoubtedly dependent upon primary traits other than abilities. Motivational factors (interests and attitudes) as well as temperament factors must be significant contributors. Hypotheses concerning these factors in connection with creative people might be fruitful starting points for factorial investigations. The design of the research would be much the same as that described for creative abilities.

## Summary and Conclusions

By way of summary, it can be said that psychologists have seriously neglected the study of the creative aspects of personality. On the other hand, the social importance of the subject is very great. Many believe that creative talent is to be accounted for in terms of high intelligence or IQ. This conception is not only inadequate but has been largely responsible for the lack of progress in the understanding of creative people.

The factorial conception of personality leads to a new way of thinking about creativity and creative productivity. According to this point of view, creativity represents patterns of primary abilities, patterns which can vary with different spheres of creative activity. Each primary

ability is a variable along which individuals differ in a continuous manner. Consequently, the nature of these abilities can be studied in people who are not necessarily distinguished for creative reasons. Productivity depends upon other primary traits, including interests, attitudes, and temperamental variables.

It is proposed that a fruitful exploratory approach to the domain of creativity is through a complete application of factor analysis, which would begin with carefully constructed hypotheses concerning the primary abilities and their properties. It is suggested that certain kinds of factors will be found, including sensitivity to problems, ideational fluency, flexibility of set, ideational novelty, synthesizing ability, analyzing ability, reorganizing or redefining ability, span of ideational structure, and evaluating ability. Each one of these hypotheses may be found to refer to more than one factor.

Some hypothesized abilities may prove to be identical with others or accounted for in terms of others. At any rate, these hypotheses lead to the construction of tests of quite novel types, which is a promising condition for the discovery of new factors. The relation of such factors to practical criteria of creative performance will need to be established. It is likely that the tests have been aimed in the right direction.

Once the factors have been established as describing the domain of creativity, we have a basis for the means of selecting the individuals with creative potentialities. We also should know enough about the properties of the primary abilities to do something in the way of education to improve them and to increase their utilization. These ends certainly justify our best efforts.

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## PART TWO: A Review of a Quarter Century of Progress (1975)\*

### Introduction

My impression is that on this unique occasion we are expected to survey, each from his own point of view, man's progress in explorations of creativity during the past quarter century, to offer some evaluations, and to make some extrapolations into the future. Having done this sort of thing three times in recent years (Guilford, 1965, 1967b, 1970), I shall find it a bit difficult to avoid redundancy.

### Areas of Development

Taking a broad view of the domain with which we are concerned, I see three areas in which developments can be considered. Probably the most vigorously investigated have been problems of creative disposition, to determine the characteristics of those who exhibit to greater degrees different forms of creative production. It is generally agreed that productions are creative if they have qualities of novelty about them—novelty within the history of the individual's behavior, and prob-

ably also within the social context. So long as we maintain the role of scientist, we are not concerned with whether or not the products are socially valuable. The technologist is likely to add that specification.

Creative dispositions have been studied from different directions. The aspect with which I have been most concerned is that of intellectual abilities or functions. This does not mean that I have not recognized the importance of other qualities, in the form of motivational and temperamental traits. The picture of creativity-related intellectual abilities has pointed directly to another important area, that of creative-thinking processes. As so often happens, technology outruns scientific foundations. As long as forty years ago, special strategies for generating novel ideas had been developed and were being taught. Methods that have been more fruitful have survived, and can now be accounted for in terms of basic psychological principles. What we know now could serve as a basis for other strategies and tactics that could be taught.

The broadest, and most heterogeneous, area to be considered is concerned with determiners of creative disposition and creative production. The role of heredity was first considered almost a hundred years ago by Galton, in his studies of genius. There has been very little attention to this problem in recent times, using experimental approaches. On the other hand, there has been much attention to environmental or biographical factors. The relation of creative disposition to IQ, or academic aptitude, has been extensively investigated. Some efforts have been made to remove some of the pressures for conformity in education and to encourage the employment of general and special educational procedures aimed at development of creative skills

### Consequences of Development

Besides considering progress in these various areas, it is important for us at this time to see the needs for further investigations, and to decide in which directions the more promising and significant progress lies. It is important, also, to note whether what we already know about creativity is being exploited as it should be toward the development of a more creative society.

### Intellectual Basis for Creative Production

The human mental abilities that contribute to potential for creative production, and the mental functions that go with them, consider to be an important part of human intelligence, when that construct is conceived as broadly as it should be. Since much of what follows depends upon features of my structure-of-intellect (SOI) model, for the uninitiated reader, especially, some explanation of that model is in order.

One of the earliest conceptions of intelligence among the Romans equated it to information. To this day, that connection persists in some governmental affairs. In my conception, the connection is also a good

one for psychology, except that intelligence is not the information itself but rather a collection of abilities or functions for processing information. Abilities differ with respect to kinds of information, and to kinds of operations we perform with information. I define information as that which we discriminate. Information comes in chunks or items, and every item is different in some way from all other items. No discrimination, no information.

Items of information differ in two ways: substantive differences, or *content*, and regarding form, or *product*. All items of information are constructed by our brains, and the constructs are products. The content categories are like codes or languages. The individual products are like words within those languages.

*Kinds of Content.* To be more specific, four major kinds of content are recognized. One of them is *figural*, which is generated rather immediately from input from the sense organs as what we call perception, the most important kinds in this category are visual-figural and auditory-figural. It takes different abilities to process these two kinds of information. Perceptions lead to thoughts, and we have another kind of information called *semantic* in the SOI model. It should be said, however, that thoughts in the form of images would be figural, for they more or less duplicate perceptions. This leaves "imageless thoughts" for the semantic category. But there is still a multitude of items of semantic information.

A third kind of content is called *symbolic*. It is composed of signs or labels that commonly stand for items of other kinds of information. Letters, words, and numbers are the most familiar examples. Symbolic information is the language of the mathematician, but, of course, it is shared by anyone who speaks or reads. It is the important medium of communication. The fourth kind of content is given the label *behavioral*, because it is concerned with mental events. We can be aware to some extent of what the other fellow is feeling or thinking, or what he intends to do, by means of cues that we obtain from his behavior. Some writers call this mode of communication "body language." Abilities for dealing with this kind of information determine how well we understand other people and how well we can deal with them. The limited "intelligence" represented by an IQ has no provision for this kind of ability. Abilities concerned with behavioral information may be said to compose a "social intelligence."

*Products of Information.* Within each of the content areas of information we find the same six kinds of products or brain-produced constructs. The basic kind of construct is a *unit*. A unit, like a thing, can stand by itself. It can be analyzed into other units, however, as when the parts of a tree—trunk, branches, twigs, leaves—are constructed as separate units.

Units can be grouped because they are similar, and we have *classes* (or class ideas), another kind of product. Units can be connected in other ways, giving still

other kinds of products. One broad kind of connection is seen when one unit suggests another, as when lightning suggests thunder. This somewhat casual, but logical, kind of connection is called an *implication*. It has commonly been known as an "association," but the term "implication" better suggests its logical nature. Other instances of implications are describable as expectations or as predictions, which takes the concept beyond the idea of association.

A more definitive connection between two units is a *relation*, as when we know that "wet" is the opposite of "dry," and "cornea" is a part of the "eye." When more than two things are connected, we have a *system*, such as an organized sentence, a paragraph, a story, or a scientific theory. Any temporal or spatial sequence or arrangement is a system. One of the most interesting products is a *transformation*, which is any kind of change in an item of information, including redefinitions and substitutions. We shall see that transformations have special significance for creativity.

*Intellectual Operations.* There are five known basic operations that we perform with information. One operation is just knowing it, which means structuring it, and which I have called *cognition*. Technically, we may say that it is a matter coding, within any one of the content areas and in the form of one of the kinds of products.

Information that we obtain can be put into storage, in an operation that can naturally be called *memory*. That is as far as the SOI meaning of "memory" goes. Getting information out of storage involves two kinds of operation—*divergent production* and *convergent production*. These operations mean the retrieval of stored information for

use when it is thought to be needed. The difference between the two is that divergent production is a broad search, usually in an open problem, in which there are a number of possible answers. I also sometimes say that it is the generation of logical alternatives. Fluency of thinking is the name of the game. Convergent production, on the other hand, is a focused search, for, from the nature of the given information or problem, one particular answer is required. I sometimes say that it is the generation of logical imperatives. Actually, the difference between the two productive operations is a relative one, depending upon the degree of restraint or limitation upon the desired answer. One may also indulge in a guessing approach to a convergent problem, which means diver-

gent production on the way to convergent production.

In such a case, especially, there must be decisions as to which answers are best, if not the best. This brings in the fifth kind of operation of *evaluation*, or judging the suitability of information. There is a comparing of the known or produced information in the light of certain logical criteria, such as identity, similarity, and consistency. Information that we have cognized or produced is constantly under evaluative checking for satisfaction of requirements.

*The Structure-of-intellect Model.* From what I have just been saying about kinds of information and of operation, it might be concluded that there should be broad intellectual abilities, each in line with one of the categories. There is some indication that this is true. But research has indicated much more clearly that each ability or function is concerned with only one kind of content, one kind of product, and one kind of operation. Each little cube or cell in *Figure One* represents such a combination. Thus, we can say that there is a certain ability for cognition of semantic units, which is a fancy name for knowing word meanings, an ability measured by a good vocabulary test. Incidentally, this ability dominates common verbal IQ tests. Another ability would be memory for semantic transformation. An example of this activity would be your putting into memory storage a pun you have just heard so that you could tell the joke later. A pun is a good example of a semantic transformation. Still another ability would be convergent production of a symbolic implication, as in answering questions like  $7 \times (4 \times 2) = ?$ , where the answer, 42, is implied by the given information.

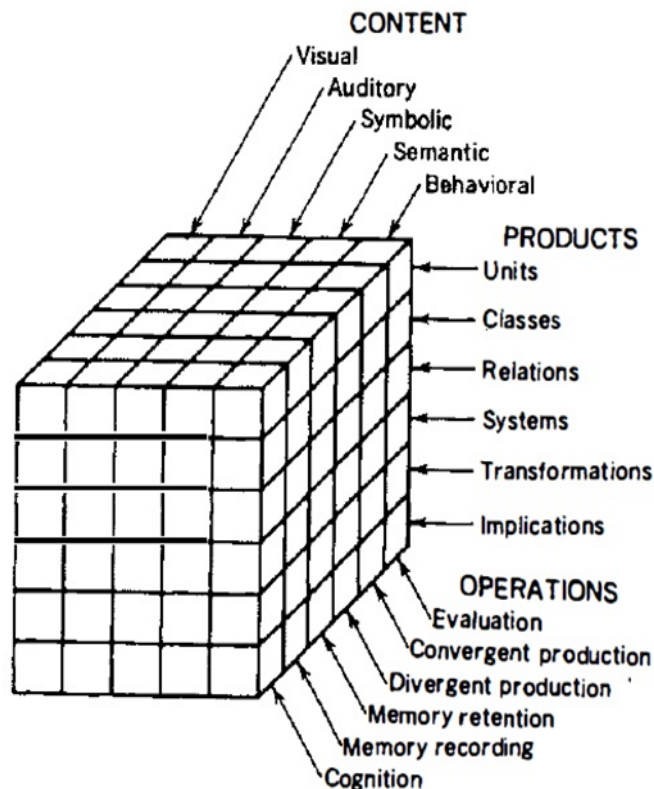


Figure One: The SOI Model

## Relevance of the SOI Model for Creative Potential

AU the intellectual abilities contributing to creative potential should be found represented somewhere in the SOI model. Let us consider the three facets or dimensions of the model in turn.

*Informational Content and Creativeness.* Consideration of the common fields of creative performance will show that they correspond to these categories of content. Creators specializing in visual-figural information include producers of visual art in any form, architects, engineers, and inventors. Creators in auditory-figural information are composers, arrangers, and stylistic performers of music. In the symbolic category we list mathematicians and cryptographers. The semantic list is a bit longer: writers, speakers, teachers, scientists, and planners. Creative performers specializing in behavioral information are salesmen, politicians, teachers, parents, policemen, lawyers, judges, and probation officers, not that all in these groups are necessarily creative.

If a person shines creatively in two or more fields of everyday activity, it may be that those fields all emphasize the same kind of content, or the person is high in abilities in more than one content area. Being high in more than one content category would be desirable especially in science or drama. But the informational-content categories do seem to present some limitations upon the extensiveness of a person's Creativeness.

*SOI Operations and Creativeness.* Of the five kinds of operations, it is apparently generally recognized that divergent production (OP) has the most to do with creative behavior. In order to give more realism to this operation, let us take a few examples, selected from typical tests in the DP category. All examples are from the semantic-content area. The information processed may be in any kind of product.

In a common task for DP of semantic units, we give a problem like the following: Name all the things you can think of that are white and edible. The search is to be made within a class with the two given specifications. It may elicit responses such as: sugar, salt, snow, bread, flour, foam, and milk.

In a task requiring the production of alternative class ideas, we may present a list of perhaps ten familiar words that can be classified in several different ways by regrouping, with at least three words to a class. Some individuals may produce only one set of classes while others produce several.

For a task of producing alternative relations, we may ask in what different ways a father and daughter are related. For example, they are parent and child, of opposite sex, one is older, stronger, and wiser than the other, and so on.

Tasks given as tests for production of systems often require the composition of sentences. We may ask the person to write as many sentences as he can in each of which three different words are all

used, for example, desert, food, and army. He has to interrelate the three concepts in various ways.

A common task for producing alternative transformations asks the examinee to suggest clever titles for a given short story, as if he were writing newspaper headlines. To be clever, a title almost has to involve a transformation, such as by allusion to something well known or by a pun.

A test for producing alternative implications presents a pictorial symbol, such as a bell, and asks for all the possible occupations or kinds of jobs that this symbol might suggest for a person who wears it on his clothing. It should be added that all DP tests are standardized by applying a working-time limit to each problem or set of problems.

As stated earlier, divergent production is the generating of logical alternatives to fit a cognized situation. When I say "logical," in this connection, I mean two things. On the one hand, the information produced is in the form of products, all six kinds of which I regard as logical constructs, basic to a "psychologic." This conception of products is clearest in the cases of the products of classes, relations, and implications, but it can be defended in the cases of units, systems, and transformations (Guilford, 1974). All the SOI products are forms of mental constructs or informational structures that have logical properties.

The other meaning of "logical" here is expressed by using the definitive synonym "relevant." Relevance means that there is some reasonable kind of connection between the stimulus information, or input, and the produced information, or output. In this connection, I must comment on the proposition that is sometimes expressed, to the effect that the creative person is "open to the irrational in himself." If this means being "illogical," I do not accept the proposition, for I believe that all intellectual performance is "logical" in the broad sense I have mentioned and is therefore "rational." When someone says that certain information-processing behavior is "irrational," he is displaying failure to see connections that are relevant to the person in question.

What I think the proposition under question really means is that the more creative person is ready to make and to accept more remotely connected output as being relevant. It is also said of the more creative person that he is *more* ready to take risks; he is not afraid of being wrong; he is willing to try out "long shots."

There is considerable evidence of various kinds to support the alleged relevance of divergent production for successful creative thinking. I have assembled much of that evidence elsewhere (Guilford, 1967a). Evidence has continued to accumulate. Furthermore, differential effects are being demonstrated, showing that different DP abilities or functions are relevant, depending upon the kind of informational content and informational product featured in the immediate task. In the SOI model there are twenty-four places for DP abilities, all of

which have been demonstrated by factor analysis at least once. This statement applies when only the six *visual-figural* abilities are taken into account. Theoretically there should also be six auditory-figural DP abilities. These auditory-DP abilities represent an unexplored area.<sup>1</sup>

When we view the creative performance in the larger context of problem solving, we find that all the other SOI operations play their roles. Cognition is involved in seeing that a problem exists and is structuring the problem so that it is understood. The known structure of the problem serves as a search model, with which one explores his memory file (or pile), and possibly also his immediate environment, to find what is needed for a solution or to produce a solution from the information he retrieves.

Searching the memory store has already been identified in the form of divergent and convergent production. These operations play key roles, for without them there is no solution. The operation of evaluation plays a number of roles throughout problem-solving episodes. There are evaluative checks on conceptions of the problem as well as on solutions that are produced. And throughout the whole process there is at least short-term memory, a recording of informational events that have transpired, so that we need not repeat our errors and we can remember our more promising attempts.

*Contributions of Transformations.* Perhaps fully as important for creativeness as the divergent-production functions is another segment of the SOI model that contains the transformation abilities. Although the horizontal transformation layer of the model intersects with the divergent-production column, most of the transformation abilities involve other kinds of operations—cognition, memory, convergent production, and evaluation. In our processes of problem solving, we can see, or cognize, that transformations occur, as in visualizing changes in perceived figures or in revisiting meanings connected with words. We can remember these changes and later retrieve them, as in divergent and convergent production. And we can reach decisions regarding the adequacy or suitability of the change, in the operation of evaluation. The chief role of transformations in our creative thinking is that they provide needed flexibility. How often do we persist in trying to solve the wrong problem? There is no headway until our conception of the problem is revised. How often do we persist in trying to use an old solution because it worked before but will not work under even slightly altered conditions? Sometimes a very simple transformation is the key to an important invention, as when the eye of the needle was moved from the blunt end where it had always been to the sharp end where it is needed in the sewing machine.

*Other Traits Relevant for Creativeness.* What is true of the multivariate nature of intellectual talents is probably

also true of nonintellectual qualities. No one person possesses all the favorable qualities. His stronger motivational traits direct his interests and determine to some extent his sources of satisfaction. His temperamental characteristics may help to determine his strategies, and, in general, the way in which his talents are employed. The joint effects of intellectual and nonintellectual qualities may well be observable in what have been called "cognitive styles" or "cognitive attitudes."

Unfortunately, there is no well-recognized taxonomy of either motivational or temperamental traits, as there is in the intellectual domain. The best we can do is to note the more characteristic qualities that seem to be related to creative production. The relevant traits have been observed either from the study of socially recognized creative producers or of those who score high in divergent-production tests. The sources of such information are scattered.

In the quick review that follows, the traits are differentiated as motivational and temperamental. The former include needs, interests, and attitudes; and the latter, some qualities describing the manner or style of behavior.

*Motivational Qualities.* Creative people are reported to be generally highly motivated, and to show a high energy level, with effective work habits. The behavioral signs are often described by saying "dedicated to his work" or "persistent in intellectual tasks." But such qualities are likely to be true of all successful people, especially creative or not. In both cases, these qualities are likely to mean that the person has found work that he likes and that gives him satisfaction. As symptoms of creative disposition, therefore, these qualities are ambiguous. Their absence would be more decisive than their presence.

The more creative person is said to have a high level of curiosity. I interpret this quality as a need to know, a desire to learn or to accumulate information. The person with curiosity seeks to have a well-stocked memory store, which he needs in productive thinking. It is no wonder that distinguished creative people often point out the need for a large stock of information.

Along with the need to know, there is likely to be also an interest in reflective thinking, from which satisfaction is derived. Probably most satisfying are the achievements in productive thinking, divergent and convergent. In some of my own research, incidentally, we found that there is a real difference in degree of interest in these two kinds of thinking, and there is a small negative correlation between the two interests.

There are some other qualities that also have intellectual implications, especially where transformations are concerned. The more creative adolescents are said to be less tied to reality, which suggests more readiness to let transformations occur, or even to seek them (Getzels and Jackson, 1962). There is said to be an unusual apprecia-

tion of humor and facility for producing humor. I suggest that this probably refers to the variety of humor that depends upon transformations. We have some evidence that associated with at least one DP ability is the need for adventure. This need may also account for the tendency toward risk-taking. A need for variety can also be tied to the high curiosity level. Often reported is a higher level of tolerance for ambiguity. Sometimes there is said to be a preference for disorder, in visual forms, at least. Both these qualities suggest that ambiguous or disordered situations present welcome challenges to the confident, creative thinker. There is also probably a desire to resolve the ambiguity and to organize the disordered information. In both cases, systems of some degree of complexity are to be produced. Much creative production is involved with the organization of new systems.

Other qualities may be summed up in the word "individuality". The creative person is a self-starting creature, with a strong need for autonomy and self-direction. The adolescent shows interests in unconventional careers. There is need for recognition from others for personal accomplishments, yet the standards of evaluation are likely to be the creator's own: he is said to possess independent judgment. In this same area we may cite the commonly low level of sociability and the high level of self-sufficiency. Unlike his peers, he is unwilling to accept things as they are; he seeks improvements. He commonly says or thinks, "There must be a better way." His showing of self-confidence reflects a high evaluation of himself. This quality may go so far as to include self-assertiveness, if not aggressiveness, but this is by no means universal. Rejecting some conventional standards, the creative boy may show some feminine interests, and the creative girl may show some masculine interests. The creative man shows some aesthetic interests, which, of course, are not commonly regarded as being masculine.

From scattered sources (e.g. Kallick, 1962) we gain impressions that those with higher creative potential differ in various other ways from those with lower potential. Individuals with high potential indulge in reading as a favorite pastime. They are more likely to report that they are frequently surprised or puzzled. They think that children should be taught to be different, those with low potential think that children should be taught to conform. The highs think that daydreaming can be fun; the lows think it can be useful. The highs know that they are bright and think that they can control their own destinies: they feel destined for great things.

One description sometimes applied to the Creative person is that he is exceptionally "aware of his own impulses." I do not know what this means. It has little communication value except for the initiated.

*Temperamental Dualities.* Some temperamental qualities of creative persons

were touched upon in the discussion of interests, above; for example, the higher levels of self-sufficiency and self-confidence. One quality that could be added here is introversion, what have called "thinking introversion," which is probably included within the concept of pleasure in thinking also mentioned above. Creative people are sometimes said to be impulsive, and this may be limited to the sphere of thinking activities. It could be an aspect of risk-taking, which was associated above with the trait of need for adventure.

More broadly speaking, the creative person is said to be neither neurotic nor psychotic. The old saying that linked genius with madness is apparently not true. A neurotic condition tends to retard or inhibit thinking. A psychotic condition, although freeing the person to some extent from reality, also yields socially irrelevant responses.

### Creative-Thinking Processes

The processes of creative thinking were touched upon in the discussion of divergent-production and transformation abilities, particularly, in connection with the intellectual aspects of creative disposition. Although the abilities or functions in those categories appear to be at the heart of operations of creative thinking, many other functions make their contributions, and they can also be described in terms of concepts of the SOI model.

A larger view of the subject gives us a comprehensive picture of problem solving. There is something creative about all genuine problem solving. Although it is easiest to see problem-solving events in the work of the scientist and technologist, they also abound in everyday personal affairs, and we can say that the artist, of whatever kind, also solves problems. In his case, the problems are concerned with self-expression and communication.

For a general picture of problem-solving events, I have presented an operational model, in which all the SOI operations play roles, and any kind of informational content and product may be involved (Guilford, 1966, 1967a). Cognition operates in seeing that a problem exists and in analyzing and structuring the problem, setting up what Dunker called a "search model." Earlier I used the term "search" in defining productive thinking, either divergent or convergent. Both are concerned with searching the memory store for needed information. Along the way, information is evaluated, bringing in another kind of SOI operation—evaluation. Evaluated (and accepted or rejected) are conceptions of the problem as well as the information retrieved from storage, and any transformations or new construction made of it. The SOI operation of memory, which is concerned only with the putting of information into storage and must therefore be distinguished from the memory store, comes into play in keeping a running account of steps in the problem-solving event. Without this record, we should be helpless.

It is sometimes said that the creative person is "in close touch with his unconscious." This is another of those cryptic, ambiguous statements that mean many things to different people. Attributing certain behavioral processes to an "unconscious" has no explanatory value whatsoever, and is like sweeping things under the rug. At its worst, an animistic conception is introduced. If the expression has any meaning at all, I think it should mean facility in retrieving information from memory storage, which implies divergent- and convergent-production operations. Let us fully admit that a considerable part of thinking activity is unconscious, in the sense that the thinker cannot observe all the steps. It is often said that he "sees the tip of the iceberg." To say that something is unconscious does not relieve us of the responsibility of finding out what the processes are. This we must infer from what we *can* observe, mostly as outsiders. The discovery of the SOI functions has enabled us to make a good beginning in this enterprise.

## Determiners of Creative Disposition

### *Heredity*

In considering the question of how creative people "got that way," for other aspects of personality, we look to possible hereditary and environmental sources. Although Galton found that genius tended to "run in families," in his study the hereditary and environmental sources were confounded, and no uncontested conclusions could be drawn. Most studies of hereditary contributions to intellectual abilities have been done with IQ tests. In terms of SOI categories, IQ tests have been much restricted to the operation of cognition, to semantic content, and to the products of units and systems. Because a strong hereditary effect upon IQ is often reported, to the extent that creative performance depends upon IQ, it is accordingly dependent upon heredity. Studies of direct effects of hereditary upon divergent-production abilities have been very rare, as yet. Barron's study, the only one I know of, utilizes twins and seems to show some direct relationship, but it is apparently much weaker than that for IQ (Barron, 1970), and it may vary from one DP ability to another.

We have the common observation that creative persons come from homes of higher socioeconomic levels, which could mean that either the heredity behind the homemakers or the nurture that the home provides is the determiner, or both. The other unknown is whether the effect is directly exerted on DP abilities or indirectly through consequences on IQ.

### *Biographical Circumstances*

Biographical features that are associated with socially recognized genius have been studied by Goertzel and Goertzel (1962). Among the parents of geniuses they found a higher incidence of respect for learning and an encouragement of investigation and independent thinking in their children. Again, some of this may have contributed

indirectly through effects on abilities represented in the IQ. The parents had strong opinions, which might suggest rigidity, but, on the other hand, they supported minority causes. Fathers, often reported to be unrealistic, were inclined to be dreamers and were often either failures economically or had widely fluctuating fortunes. Some mothers were ambitious and domineering, and others were described as "smothering mothers," who showered their sons with love and affection. The child's home was often a troubled one, with conflicts between parents. There were quite a number of children with physical handicaps, thus providing support for Adlerians. There were an unusual number of deaths in the family, with accompanying traumas. In spite of the parents' respect for learning, the children frequently disliked school, and tutoring at home was common.

It seems to me that the general picture is one of families in which the children encountered unusual numbers of problems to be solved. In their efforts to solve the problems, the children had unusual exercises in creative thinking. They thus developed problem-solving skills. There were conditions that otherwise encouraged individualism, and motivation to make better lives for themselves.

## Things Still To Be Done

From this sketchy review of what we know about creativity, what is implied about future needs? In our present-day, enormously complicated human milieu, problems of all kinds arise on every hand. Failure to solve some of them, or postponement of attempts to solve them, may even spell disaster. Are we and our leaders equipped to undertake solutions that does it take to make better problem solvers? As a people who have been "going West" for nearly 400 years, Americans have had unusual numbers of problems to solve, and they have generally risen to the occasion. America is recognized historically as a leader in mechanical inventions, and the founding fathers of the United States were also innovative in bringing into the world new forms of government. But the innovations needed to make our social, economic, and legal systems serve us better have been slower to come than those providing for a superb gadgetry. One reason is that while our patent system has richly rewarded the inventor, there has been no comparable system of rewards for innovative social ideas. As Torrance has often said, to get creative behavior, we must reward it. Can we institute any better assurances of rewards for new and workable social ideas that is comparable to that provided by our patent system?

### *Implications from Knowledge of Creative Dispositions*

Knowledge of the characteristics of the more creative person can start us on several roads. If we are concerned with identifying children and youths who have unusual prom-

ise, we can assess those qualities that appear to be contributory to future success. Because of the multivariate nature of creative dispositions, we should be able, furthermore, to forecast in which areas the person's talents and inclinations are greatest. We would describe him by means of an individual profile with respect to relevant abilities and other traits. We could probably see in which directions his development could be the most roped, and also detect some characteristics that, if not given special educational attention, would become unnecessary handicaps.

*Assessment of Creative Potential.* We are already prepared to do a great deal in the assessment of creative-thinking potential. As elsewhere, I argue strongly against a policy of giving an individual a single value to indicate his level of creative talent, as I have argued against the use of a single score to indicate level of intelligence. In either case, such information is ambiguous. Furthermore, by this approach, much potentially useful information is lost.

Now there will be those who are disappointed in the amount of prediction of a creative-production criterion that can be obtained from a test of any one ability, and they will continue to look for "the philosopher's stone," a single test that will predict at a substantial or high level. They will be doomed to disappointment. The prediction of creative performance of any kind is a multivariate affair, requiring the properly weighted combination of a number of predictors. Jones (1960), Elliott (1964), and others have demonstrated that weighted combinations of only a few DP tests can predict performance criteria as well as academic aptitude tests predict achievement (grade-point averages) of college students.

As is in most areas of trait measurement, we lack all the knowledge and the instruments that we need. In the intellectual domain, all of the divergent-production abilities in the SOI model have been demonstrated by factor analysis, with tests available for many of them. Most of the transformation abilities have also been demonstrated, with tests available for some. There are also tests for abilities in other SOI categories, abilities that are contributory to learning and to problem solving.

Having rejected the use of an overall creativity score, I now retreat a little in saying that there may be some meaningful composite scores, short of an all-inclusive one. Although my associates and I in research have always rotated axes in factor analysis orthogonally, we did not necessarily believe that all the SOI abilities are mutually independent. We didn't have faith in any of the methods of oblique rotation, which are in common use to find correlations between first-order factors. There may well be higher-order divergent-production factors and abilities. If so, my guess is that the second-order factors would be along the lines of the content categories; that is, a visual-figural-divergent-production factor, a semantic-divergent-production ability, and so on. A third-order factor in common to all the DP

abilities might also be a fair hypothesis. Indications for higher-order factors along the lines of the product categories are not so clear.

Theoretically, I should say that the higher-order DP factors would depend upon how much the tested population had generalized its DP abilities. G. W. Ferguson (1956) was probably right when he suggested that aptitude factors arise by generalizations of specific practiced skills. The skill in performing task may be thought to have at least two components. One is a specific affair, unique to the particular task, and there are one or more others of a more general nature, shared with other tasks that are similar to it psychologically.

Limited experimental research has tended to show that drills in certain selected tasks are followed by gains in performance in other tasks that feature the same common-factor ability, but not in tasks for other factors. Generalization in intellectual ability seems limited within operation, content, and product boundaries. One way in which broader generalizations might be effected would be to make the learner aware of the parallels across SOI boundaries, so that he applies what he learns in a task that is salient for one SOI ability to tasks involving parallel abilities. Perhaps some of these parallels are sensed by individuals, without their being taught, and such transfers occur automatically, thus producing high-order factors.

*Assessment of Other Qualities.* It is commonly recognized that, in general, assessment of traits of motivation and temperament is in a less satisfactory state than assessment of intellectual traits. Although there have been factorial definitions of many variables of needs, interests, and attitudes, and also in the domain of temperament (Guilford, 1959), and some definitive instruments of measurement are available, there has been limited information regarding predictive validity against creative-production criteria. Obtained validity indices have generally shown low relationships with criteria of performance for single trait scores. Again, multiple predictions are needed. Much tedious validation effort will be needed in order to determine which traits and their tests are relevant.

### *Promoting Creative Development*

Knowledge of the traits that enter into creative disposition should help not only to identify and locate potential creative talent but also to give us clues to promote development in creative directions. This is more true of abilities than of other traits, for, as pointed out earlier, the abilities directly suggest certain creative processes. It is not so clear how we should go about improving traits of motivation and temperament, and whether, if we succeeded, gains in creative performance would automatically follow.

*Special Training in Creative Thinking.* It has been repeatedly demonstrated that exercises designed to increase success in creative thinking have the effect of raising status in the relevant SOI abilities. Torrance's (1972) recent review of studies of effective-

ness of various methods of training for creative thinking gives the palm to Alex Osborn's procedures, as described in his book *Applied Imagination* (Osborn, 1963). These procedures have a solid foundation of theory in the creative aspects of the SOI model. This is another instance of technology outrunning basic knowledge, in this case, owing to the rare insights of Alex Osborn.

Results of training experiments also support the multivariate view of creative potential. For any given type of training, certain SOI abilities show improvements while others do not. In a grand educational experiment at the college level, Parnes and Roller (1972) have found that abilities, some outside the divergent-production and transformation categories as well as some within those categories, are affected, much as one should expect, knowing the kinds of exercises given the students.

From this it should follow that in the educational setting, one should give due regard to the SOI abilities probably involved in the behavior skills to be achieved, and he should select his pre- and post-test instruments accordingly. If there is to be evaluation of the generalized effects of the training. There is evidence (Forehand and Libby, 1962) that perhaps even more important than drill in thinking exercises is the step of imparting knowledge of the nature of creative thinking. Information concerning the SOI model and the problem-solving model that is based upon it (Guilford, 1967a) should be useful in this situation.

Considering the special creative-thinking courses known to me, I should say that they fall short of offering a full curriculum. Use of the two models just mentioned would help to evaluate courses as to comprehensiveness. When the goal is aimed at better problem solving, the range of SOI abilities involved is much greater. It is quite natural that the courses should stress semantic content, for that is the kind of information in most common use in our verbal civilization. But I suspect that there is an unexpressed expectation that training in this area will transfer automatically to other areas of information. From what we know about transfer effects, that training would do little for the visual artist or the creative musician, for the mathematician or the politician, unless the analogies are pointed out, and some exercise is given in transfer.

Of all the content categories, that of behavioral information is probably most neglected in exercises in creative thinking, yet in that area are some of the most significant everyday problems. They are encountered not only by politicians, whom I have mentioned, but also by all those who need to influence or control people—parents, teachers, policemen, attorneys, judges, probation officers, social workers—the list is a long one. If these are the kinds of people we are to make more creative thinkers, we should do better by giving attention to solving behavioral problems.

It is not clear, but I am sure that not all the SOI informational products are given due attention. Brainstorming sessions may emphasize units of information unduly. Solutions to problems in daily life may call for new relations or implications, as when a scientist is attempting to decide what the connection is between two things or two variables, or when generating alternative hypotheses to account for some phenomenon. A detective also needs the generation of such products. The need to produce systems is obvious in much creative work, systems such as melodies, story plots, or scientific theories. The unique importance of transformations was emphasized earlier.

In the larger context of problem solving, we need to consider functions outside the category of divergent production. Some attention is given to evaluation, in some instances, but probably not enough. Some attention is given to seeing problems, but the nature of that step is not often realized. Analytical studies have led to the conclusion that seeing that a problem exists is a matter of cognition of implications. We size up an object or a situation and we are aware of a shortcoming of some kind. I once addressed an organization of engineers, who wanted to know how they could more readily translate discoveries in basic science into useful inventions. I pointed out that they must improve their skills in seeing implications. They could start with the nature of the scientific finding and its properties and ask themselves, how, by virtue of these attributes, it leads to new uses. Or they could start with a collection of human needs, needs that could possibly be collected in public polling; they should define those needs in terms of specific requirements, which might lead to things that fit those specifications.

Remembering that productive thinking depends very heavily upon stored information, in a course on problem solving we might give some attention to memory training. This should emphasize how information is put into storage, for how it is stored will make a difference in how efficient the retrieval can be. Things can be retrieved more readily if they are properly organized and labeled, for we get at them by using appropriate cues. The activity is analogous to looking for a book in a library. Organization of the memory store depends upon how items of information are put into storage, and this means the manner in which the information is learned. In order to tag information in a useful way, full advantage must be taken of the logical constructs of classes, relations, implications, and systems—the SOI products. But to be left with flexibility, information needs to be in cross classifications, hierarchies, and other alternative systems. The simple moral for education is that attention should go well beyond the teaching of isolated units.

*Creative Education in General.* The special approaches to development of creative thinking have never been known to achieve miracles. But, if by any approach we could lift the population's problem-

solving skills by a small amount on the average, the summative effect would be incalculable. The special methods of training have been usually applied outside the academic setting. To have any widespread effect on the population, they would need to be utilized within the academic world. But in that connection, the somewhat specialized procedures should be expanded, as suggested earlier. Educational practices should be revamped from the bottom to the top, giving attention to creative problem-solving skills. For this purpose, many suggestions can be made. Many of these ideas have already been recommended and have been put into effect in places, but this reorganization should become more nearly universal.

Some general principles are agreed upon. The student's role must be a more active one. He should be given not only opportunity to pursue learning as a goal, but also personal responsibility for learning. The teacher's role should be to stimulate and to guide, providing a favorable climate and the necessary tools. As much as possible, the student should discover what he learns; he should not just wait for the teacher to tell him the information. Education must be more individualized, each child progressing at his own rate, his goal being to make progress, and when he puts forth the effort, progress should be forthcoming. He should have immediate and adequate feedback information, as the basis for reinforcement that rests on intrinsic, rather than extrinsic motivation.

In the past, the goal of education has been too much directed toward the stockpiling of information. A well-stocked memory store is, of course, a necessary asset in Creative problem solving. But information is by no means sufficient. Viewed in one way, stockpiling of information contributes to exercise of the SOI operations of cognition and memory. This emphasis neglects the productive-thinking and evaluative functions that are so important for creativity. Skills must be developed for using information as well as for *storing* it. Instruction should be problem-centered. The student should encounter many problems; problems that are difficult enough to be challenging to him, but not so difficult as to discourage effort. Creative behavior should be rewarded. Intrinsic rewards are best. Skills in evaluation should not be overlooked, but personal criticism should be kept at a minimum. If special weaknesses appear, special exercises should be prescribed. Students should be taught to be flexible in their thinking. In a fast-moving, fast-changing world, the individual must be ready to alter information and habits. Requirements of new problems render both information and skills rapidly out of date.

The setting and the climate for creativity in schools must be favorable. The school administration must be for it, the teachers must be for it, and parents must at least acquiesce. The school housing should be adapted to creative learning. The curriculum should be designed to offer different

kinds of problems. The teacher's lesson plans should be adapted to this kind of learning—programming teaching operations with enough flexibility to take advantage of student-initiated trends.

While I am on the subject of education, I cannot refrain from adding some unique suggestions. Using the structure-of-intellect model as the frame of reference, I recommend that every student be given the chance to show what he can do with respect to all the intellectual functions. Each child is thus likely to find areas in which he can do relatively well, and in which learning can be more rapid and more rewarding. He is thus also likely to find areas of stronger interests. Assessments of the status of the student in various SOI abilities would also be informing for teachers and counselors.

I also frequently recommend that as early as the child is ready for it, he be given information regarding the nature of his own intellectual resources. As suggested earlier, this step should be an important basis for effecting transfers of learning, and the broadening of skills. Incidentally, I have been told by a teacher who has tried it, that his group of Negro Children in grades four to six could be given some degree of understanding of the SOI model and could apply it effectively in their own learning. As related by Robert Rose, of the San Bernardino, California Schools, after such treatment, the children showed very unusual gains in achievement tests and in IQ.

#### *Needed Basic Research*

We know something about what the creative problem solver does in the act of thinking, but we need to know more. We know that a key activity in productive thinking, divergent or convergent, is retrieval of information from memory storage, but we do not know as much as we should about the process of retrieval itself, and the conditions that are favorable or unfavorable. Psychologists have lavishly investigated learning, including the putting of information into storage, while neglecting the process of recall. And when recall has been investigated, it has usually been what I call "reproductive" recall rather than "transfer" recall, which is so likely to be needed in productive thinking (Guilford, 1967a). In transfer recall, an item of information is retrieved in connection with some new cue, not the one in connection with which it was learned.

We need to know more about transformations which have been almost entirely neglected except incidentally by Gestalt psychologists. Why are some people more ready than others to revise their conceptions? The answer is not to be found in a general personality trait of flexibility versus rigidity. Our research has found that even within the realm of thinking, there is more than one trait of this nature. Even each of the 20 transformation abilities in the SOI model has its measure of independence. We may ask some general questions, however. Are there principles to be found to account for particular kinds of changes in information? Can trans-

formations take place in information while it is in storage, or only when it is retrieved? Progress in making fruitful investigations, as usual, depends upon our ability to ask significant questions about the phenomenon.

The last question asked regarding transformations leads to the more general question about the role of *incubation* in problem solving. I doubt that any recognized creative person would deny the fact that incubation occurs and is frequently helpful. This phenomenon, of course, is an observed progress during times when one is not actively pursuing solutions. In experimental studies of the matter over long periods of time, it would be difficult to exert the controls one should desire. A study of short-term incubation (over a period of minutes) has been done (Fulgosi and Guilford, 1968), using a divergent-production task (Consequences). Positive effects upon performance in the task were found to increase during the first 20 minutes. In a second study, it was found that the effects decreased during the next 40 minutes. The possibility of experimental investigation of incubation has thus been demonstrated.

#### *The Use of Biographical Information*

One use that has been made of biographical features found to be associated with creative performance in later life is found in Calvin W. Taylor's (IBRIC, 1968). Alpha Biographical Inventory. This purely empirical method has value in identifying youth and adults who have higher probabilities of exhibiting creative behavior. It is useful in selection of personnel in industrial/ settings and in spotting students with talents that are overlooked by ordinary academic-aptitude tests. It is a "shotgun" approach, lacking basic psychological theory, however, and hence would not be very useful in research where well-defined variables are needed.

Can use be made of any particular biographical features, such as those mentioned by Goertzel and Goertzel (1962)? I doubt that anyone would be heartless enough to recommend the institution of precarious and troubled homes in order to make a child more creative. Nor would one recommend the infliction of physical handicap. We could tell a mother, perhaps, to be either dominating or loving. But if my interpretation of the effects of the troubled homes is correct, all we would need to do is to see to it that the child has numerous problems to solve. The problems should be paced at a level appropriate for the child at his level of development—problems neither too easy nor too difficult. This would take considerable attention and ingenuity on the part of the parents, who should not only contrive natural problems but also arrange for appropriate rewards for successful solutions. In more general terms, we need to train parents how to be teachers and how to take advantage of situations for teaching as events arise. The right kind of teaching parents would be the most important key to the development of a creative, problem-solving society. A problem-solving society should also be high in status with respect to



mental health.

*Expectations from Drugs.* Probably because of its alleged “mind-stretching” effects and its production of bizarre hallucinations, LSD has received the most attention as a possible augmentor of creative thinking, with lasting as well as temporary consequences. A well-controlled experiment designed to test lasting effects (at least to six months) was conducted by the McGlothlins and Cohen (1967). A large number of different kinds of tests of creative-thinking abilities, of attitudes, and of behavior of different kinds were used in this connection. There was no significant gain in any creative-thinking test, either short-term or long-term in duration. There was a significant increase in self-observed aesthetic interests, and more incidence of attention to art and music, but no improvement in productive performances in those areas. Perhaps the aesthetic interest came front the startling sensory effects of the drug.

*Effects of Psychotherapy.* There may have been some experimental studies of effects of psychotherapy upon creative production, but I do not happen to be acquainted with any of them. As in studies of other effects of therapy, it may be very difficult to demonstrate positive results experimentally. It is known that individuals who score high on divergent-production tests are inclined to have slightly lower scores on neurotic tendency or emotional immaturity, consistent with the common observation that neurotics are less creative.

Probably the most that can be expected is that therapy would remove some of the blocks that may exist in the way of creative production. An anecdotal bit of evidence comes from E. G. Boring, one of our distinguished psychologists, who underwent psychoanalysis with the hope of performing more creatively as a scientist. From his own evaluation, the results were very disappointing (Boring, 1940). In such an instance, one may conclude either that there were to blocking impediments, or that therapy did not succeed in removing them.

## Summary

A survey of psychological research on creativity, with new theory and new methods, during the past quarter century shows substantial progress in several areas—dispositions of the more creative individuals and some of the apparent determiners, the basic nature of creative thinking, and procedures for improving creative performances. The multivariate nature of the contributing qualities of creative persons has been well established, and it involves both intellectual and nonintellectual traits.

Episodes of creative problem solving involve a great many different intellectual functions that are represented in the structure-of-intellect model. Thus, creative abilities are a part of intelligence, not something apart from it. Most critically involved, particularly at the stage of generating ideas, are the divergent-production abilities or functions and those involving trans- formations

of information. The former provide an abundance of alternative ideas: the latter a flexibility in the structuring of information so that alterations and adaptations can occur.

Various procedures for improvement of potential for creative thinking have been tried experimentally. The most successful methods can lay claim to theoretical bases in structure-of-intellect concepts. Teaching individuals the nature of those concepts has also been found to be effective. There is insufficient scientific evidence as yet to lead us to expect much in the way of creative benefits from psychotherapy or the use of drugs.

Further research is needed on basic problems, especially on the process of retrieval of information (recall) from memory storage, which is at the head of creative thinking. More should be learned regarding the phenomena of transformations, their nature, and their determiners. Experimental investigation of the phenomenon of incubation has been barely started.

\* Guilford, J.P. (1950) Creativity Research: A Review of a Quarter Century of Progress. In I.A. Taylor & J.W. Getzels (Eds), *Perspectives in creativity*, New York: Aldine Publishing Company (reprinted with permission).

## Note

1. For a condensed history of the research on discoveries of divergent-production abilities, and other abilities, see Guilford and Hoepfner (1971).

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## PART THREE: A Vista of Future Research on Creativity

After a review of past research on creativity, what can be said regarding the future of that kind of activity? From the standpoint of one who has been active along these lines, some projections can be made. The following discussion will not attempt to list all particular problems needing attention, but to mention some general shortcomings, with some suggestions on research procedures and on areas of research.

### Some Needs in Research

Perhaps the greatest need in investigations involving aptitude for creative performance is to remember that creativity is not just one comprehensible variable. This is the same kind of error that was made regarding "intelligence," of which creative aptitude is a part. Apparently, many of those who do research on creativity still think that if we have found a word for something we are dealing with one unanalyzable thing.

Many of my readers know that my helpers and I have analyzed intelligence, including its creative components, into a very large number of different abilities or functions, and that creative aptitudes occupy two categories of my structure-of-intellect (SOI) model, as shown on page 48 (Guilford, 1977, 1986). One is the operation category of *divergent production*—abilities concerned with a broad search of the memory store for alternative items of information to fulfill a need and the other is the product category of transformation of items of information—a recognition or a production of a *change* in an item of information. It is noteworthy that Alex F. Osborn recognized these two categories and emphasized them in connection with his brainstorming sessions before they were discovered by factor analysis (Osborn, 1963).

Creative aptitude is indeed a multivariate affair, and in terms of the two categories that I mentioned it includes 30 divergent-production abilities or functions and 25 transformation variables. The former provide for fertility of thinking, offering quantities of ideas, and the latter contribute flexibility or quality of ideas. The five abilities where the two categories intersect in the SOI model have double reason for claim to membership among creative talents. And when we broaden the picture to include problem solving, many more SOI abilities come into the picture; those involved in seeing that a problem exists, in seeing the nature of the problem, evaluating the steps taken, and in remembering those steps.

As I have pointed out (Guilford, 1982), a serious sin of cognitive psychology has been the ambiguity of so many of its terms, such as "reasoning," and even "verbal". The basic factors of the SOI model provide concepts that are free from ambiguity, each being defined in terms of three

specifications, each of which is operationally defined. Thus, experimental results based upon measures of any one SOI function are uniquely labeled. The extent to which conclusions may be generalized will depend upon the SOI categories that two variables have in common: an operation, a content, a product or two such features in common.

This kind of situation suggests that some pairs of SOI variables have some degree of correlation between them, and my recent investigations have borne this out (Guilford, 1981). Experience has shown, however, that such correlations are very small. For example, I found that the estimated correlations among measures of 23 divergent-production abilities ranged below .50. Variables having a correlation of .50 can be represented by vectors that are 60 degrees apart. Smaller correlations indicate larger angles of separation and even less support for generalizing from one variable to another. Thus, generalizing conclusions from one SOI variable to others should be made with appropriate restraint.

I can cite two important pieces of research on creativity that demonstrate the value of working in terms of SOI variables. One was the study by Jones (1960), who found that tests of divergent production with visual content were strongly predictive of success of children in making novel drawings, while semantic tests in the same category predicted success in producing novel stories. The other is the large study using a large number of various tests in predicting success from taking a four-semester sequence of courses on Creative Problem Solving at the State University College at Buffalo (Parnes & Noller, 1972). The results were very much in line with what one would expect from the nature of the course. For example, semantic divergent-production tests tended to be predictive where visual tests of the same sort were not valid. A test for memory ability' was not valid.

### Basic Research Needed on the SOI Model

Basic research for demonstrating the existence of many SOI abilities is by no means complete. As matters now stand, of the 150 abilities or functions projected by the model, only about two-thirds have been demonstrated (Guilford, 1977). Most in need of attention are the auditory abilities, including the ones most relevant for creative production. The latter should be most important for the musical composer, the arranger, and the performing artists, as well as those concerned with effects in speech—orators and actors.

I have often suggested that the SOI model might be extended, with a slab for kinesthetic abilities, parallel with the visual and auditory ones, although the relevance for such abilities for creativity is not so clear. But there is a glimmer of evidence that there are relevant psychomotor abilities. Two such abilities were found incidentally in our analysis of divergent-production abilities

in the behavioral-content area (Hendricks, Guilford, and Hoepfner, 1968). We included a few tests that, instead of calling for the usual written responses, asked the examinees to respond to described emotional situations by producing expressions that were recorded. There were some tests for facial expressions and others for vocal expressions. Each set of expressions determined a new factor, both distinguished from all the factors that called for written responses.

Quite a number of factors had previously been found from tests calling for voluntary movements of different kinds (Guilford, 1958). In one respect, these, too, depended upon the part of the body concerned, suggesting a motor-content category. Finding psychomotor factorial abilities is not surprising, since voluntary movements are organized by our brains, as they organize items of information. The relevance of such abilities for creativity can be seen for acting, choreography, and athletics.

### Use of the SOI Variables in Research

An important implication of the SOI model in experimental research is that great care should be taken in the nature of the tasks assigned to subjects who are being employed, in order to control conditions, as we painfully learned in constructing new tests for hypothesized factors. The SOI model pointed clearly at expected abilities in a factor analysis. A well-planned analysis could tell us whether controls were successful. Sample test items for the different abilities may be found in *The Analysis of Intelligence* (Guilford & Hoepfner, 1971). Information is also given as to their factor affiliations; the ability that the test most strongly represents, and how strongly. The tests could serve as models for tasks to be used in research.

### Other Areas of Research

In addition to the abilities that prepare a person for creative performance there is an area of traits known as "cognitive styles" to be considered. In intellectual functioning there are a number of traits concerned with which of the many talents the person will favor or apply. My survey of the reports of research on this subject showed that there seem to be two kinds of such variables (Guilford, 1980). They, too, have been determined by factor analysis, when tests are scored in terms of *manners* in which examinees work on them rather than how well they perform, as a rule.

I concluded that those variables lie along the categories of the SOI model, as if the brain has some awareness of the SOI categories. One type of style seems more compulsive than the other. I have referred to them as "intellectual executive functions." A good example, which must be quite relevant for creativity, is Witkin's "field independence versus field dependence" (Witkin, et al., 1962). He first discovered this trait in tasks requiring a person

to locate the correct vertical position, either of a line or of his own body, under illusory conditions. He has to change his perception of the vertical position. The same trait has been found to play a role in hidden-figures tests. The examinee has to change the use of certain lines as parts of the larger, inclusive, figure to make them into lines of the smaller figure. This *change* feature gave me the cue to suggest that the trait is a general urge to utilize transformations, hence to apply SOI transformation abilities. The generality of the trait has been shown by evidence for its effects in other kinds of activities. Its relevance for creativity has been mentioned.

The other kind of cognitive styles seems less compulsive. Such styles can be regarded as preferences for, or interests in, different kinds of intellectual activity. These traits also lie along the lines of the SOI categories. There are preferences for applying different kinds of informational content—visual, semantic, or behavioral, for example. These interests have effects in the direction of art, writing, or management.

There seem to be interests along the lines of different kinds of SOI products—classes, relations, or systems, for example. And as to kinds of operations, we found an interest in divergent thinking and an interest in convergent thinking. Interestingly, we found a correlation of  $-.30$  between scores for these two traits. There is a noteworthy interest in evaluation in the hypercritical person. This trait can have a depressing effect on divergent production, as Osborn pointed out in connection with his brainstorming sessions. But it can be of value to the creator who decides which of his ideas are best.

It is quite reasonable that the intellectual interests should lie along the lines of the SOI categories, for a person likes to do what he can do well. He therefore gets more practice in the same functions, improving them, in circular fashion. One implication might be that to increase an individual's ability, encourage him to get more practice in it. I would also recommend that the person be informed as to the nature of his abilities and their role in problem solving as soon as he is ready to comprehend such information.

### Development of Creative Dispositions

The mention of development leads to some other directions of thinking. There have been numerous studies of the effects of different kinds of efforts to increase skills in creative thinking, as it should be. But sometimes the objective in development is broadened to include skills in problem solving. This involves much more than the unique creative-thinking skills. All problem solving does include creative elements, for the problem solver must arrive at a solution that is novel to him or her and must therefore be creative. But many more SOI functions are involved, depending upon the nature of the problem and the thinking habits of the individual.

The solver must be aware that a problem exists, and we have shown that the main SOI activity involved is cognition of implications, the kind of content depending on the situation. The solver is aware that objects or conditions are not as they should be; something new is needed. Thus, items of information are suggested by things as they are; in other words, implications. Tasks involving cognition of implications should be applied as training exercises.

Next the problem solver must see the *nature* of the problem. The SOI operation is again cognition, the SOI content depending upon the situation. Having grasped the nature of the problem, the solver thinks of possible solutions, involving divergent production, or possibly convergent production if the problem is conceived in mathematical terms, for example. Along the way, from the beginning the solver guides his own activity by evaluating results at the various stages. If the solution takes much time he does well to keep in memory storage the steps he has taken, so as to avoid making the same mistakes more than once. If the evaluations show that something is seriously wrong he may take a new start at some point along the way.

The moral of all this is that quite a number of SOI functions need to be exercised in order to gain in skills in problem solving. There are so many skills needed that one answer could be to apply what the Japanese call "intelligence education." For more than 20 years their Learned Society of Intelligence Education has taken the SOI model as a map of intellectual functioning. They have constructed and used exercises and tests for almost all the SOI abilities and have applied them in many of their schools (Chiba, 1985). Their report is that the average child gains 20 points per year in his or her IQ based on their own SOI tests. Similar exercises and tests have been developed in the USA by the SOI Institute of El Segundo, California. Here they are used more to diagnose learning difficulties of children and prescribing remedies.

In the development of problem-solving abilities, presumably abilities involving semantic content would be most usefully developed, followed by those with visual content. There is a general reason for developing the visual-thinking abilities because of greater efficiency. As an old Chinese saying goes, a picture can be as good as a thousand words.

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### Note

This paper is reprinted, with permission, from *Frontiers of creativity research: Beyond the basics*. S. G. Isaksen (Ed), Buffalo, NY: Bearly Limited. It is believed to be the last published work of Dr Guilford before his passing on 26th November 1987.

### Full reference:

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# The Evergreen Future of Creativity Research

## POSTFACE

*The neglect of this subject [creativity] by psychologists is appalling. The evidences of neglect are so obvious that I need not give proof. But the extent of the neglect I had not realized until recently. To obtain a more tangible idea of the situation, I examined the index of the Psychological Abstracts for each year since its origin. Of approximately 121,000 titles listed in the past 23 years, only 186 were indexed as definitely bearing on the subject of creativity.*

– J.P. Guilford (1950)

If the former British Prime Minister Harold Wilson was right in saying that ‘a week is a long time in politics’, 70 years is probably more than a life time in creativity research.

It has been 70 years since Joy Paul Guilford challenged his colleagues in the psychology community to explore creativity research to improve empirical understanding of the subject. Never mind Guilford’s disappointment at what he called ‘the neglect of the subject [creativity] by psychologists’ (Guilford, 1950, p.444), there is a general consensus that his speech at the 58th American Psychological Association Presidential Address literally set ablaze contemporary research interests in creativity.

From the humble past, when interest in creativity was passing and sporadic, championed arguably by the likes of the ‘father of brainstorming’ Alex Faickney Osborn (see Osborn, 1948; 1953)—as encapsulated by Guilford (1987)—to the pioneering, longitudinal work of Ellis Paul Torrance resulting in *Torrance Tests of Creative Thinking* (1962, 1974, 1993) to Robert Jeffrey Sternberg’s three-element theory of intelligence—analytical, creative, and practical intelligences (Sternberg, 1988), or Howard Earl Gardner’s earlier major work on the theory of multiple intelligences (Gardner, 1983); or to the James Kaufman’s and Ronald Beghetto’s four-level developmental creativity (Kaufman & Beghetto; 2009; Beghetto & Kaufman, 2007), which aligned broadly with Anna Craft’s conception of ‘little c Creativity’ or ‘ordinary creativity’ (Craft, 2001; see also Gardner (1993a, b). It really has been 70 years of deep, broad, yet very diverse understanding and practical applications of creativity research. I’m not sure if anyone could have asked for me.

Yet, as a phenomenon, creativity is complex, multifaceted and multidimensional (Reisman, 2013, 2014), and generally lacks a shared language for definition. But creativity is evergreen; and there is every reason to be confident that creativity research will blossom well into the future.

Of course, more research is needed—in fact, the more robust and quality crea-

tivity research the merrier. Wider topic areas such as creative thinking and performance under different contexts—especially under intensely unfamiliar situations and circumstances; dimensionality, and aspects of cognitive styles and intellectual functioning (Guilford, 1987), need deeper and longitudinal empirical understanding, for example.

But new issues and challenges are emerging; they are current, present and pressing. These are issues and challenges presented by the Covid-19 global pandemic which has claimed the lives of 3 million people and counting (WHO, 2021), and has ruin people’s lives and devastated communities all over the world.

The good news is that, as a response, we have seen how creativity research is increasingly brought to bear to explore, examine, assess or evaluate the impact of Covid-19 on peoples and communities. One example is Hod Orkibi who, at the height of the Covid-19 pandemic in Israel, examined participants’ creative adaptability and how it was used to respond, adapt and cope with personal situations. Creative adaptability, in this context, is defined as an individual capacity ‘to generate new and effective cognitive-behavioral-emotional responses to stressful situations’ (Orkibi, 2021, p.1).

Another example is Maciej Karwowski along with his colleagues, who examined 313 first-year university student participants’ self-reported data about their emotions and creativity before the pandemic, and about their ‘emotions, creativity, and the intensity of thinking and talking about Covid-19’ during the lockdown in Poland (Karwowski, et al., 2021). They reported a statistically significant difference in students’ learning engagement during the lockdown compared with pre-pandemic. And that students exhibited a high level of creativity—and ‘mixed emotions’—when ‘discussing or searching for information’ relating to Covid-19.

Of course it is early days yet; but as Karwowski, et al. (2021) noted, what is unclear are the ramifications of Covid-19 on creative activity and behaviour in the medium to long term. And therein lies the rub.

But one thing is clear right now: creativity is evergreen and the future of creativity research is blossoming.

James Ogunleye, PhD  
Convener, E. Paul Torrance International Roundtable on Creative Thinking.

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