The Psychology of Creativity:

A Historical Perspective

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Psychologists usually define creativity as the capacity to produce ideas that are both original and adaptive. In other words, the ideas must be both new and workable or functional. Thus, creativity enables a person to adjust to novel circumstances and to solve problems that unexpectedly arise. Obviously, such a capacity is often very valuable in everyday life. Yet creativity can also result in major contributions to human civilization. Examples include Michelangelo's Sistine Chapel, Beethoven's Fifth Symphony, Tolstoy's *War and Peace*, and Darwin's *Origin of Species*. One might conclude from these observations that creativity has always been one of the central topics in the field. But that is not the case. Although psychology became a formal discipline in the last few decades of the 19th century, it took several generations before the creativity attracted the attention it deserves. This neglect was even indicated in the 1950 Presidential Address that J. P. Guilford delivered before the American Psychological Association. Nevertheless, in the following half century the field could claim two professional journals – the *Journal of Creative Behavior* and the *Creativity Research Journal* – several handbooks (e.g., Sternberg, 1999), and even a two-volume *Handbook of Creativity* (Runco & Pritzker, 1999). Although some psychologists might argue that the creativity still deserves more research than it currently receives (Sternberg & Lubart, 1996), the fact remains that its status in the discipline has risen immensely in the latter half of the 20th century.

The above should not be mistaken as saying that creativity had no place in psychology until the past 50 years. From time to time various notable psychologists took up the subject, albeit usually as a peripheral interest. In addition, psychologists often addressed substantive issues directly relevant to the understanding of creativity, such as problem solving, insight, intelligence, talent, and genius. Hence, it is possible to write a more extensive narrative of research on this subject, so long as I adopt an inclusive rather than exclusive perspective. That in mind, I begin with a brief discussion of the status of the concepts of creativity and genius in the early history of Western civilization. I then turn to the 19th-century scientific developments that provided much of the foundations of more recent work. The account of the subsequent 20th-century movements will fall naturally in two parts, the first treating the period prior to World War II and the second discussing the period after that watershed event. The narrative closes by discussing the directions creativity research may take in the 21st century.

The Early History of Creativity and Genius

Historians of psychology are fond of quoting the claim made by Ebbinghaus (1903), the great German psychologist, that "psychology has a long past, yet its real history is short" (p. 3). The discipline's history was short because psychology did not become a formal discipline until the 1870s. That was when the field's "father," Wilhelm Wundt, published his first books on "physiological psychology" and founded the first laboratory devoted to psychological research. On the other hand, the field has a long past because certain psychological issues – like the mind-body problem, the nature-nurture issue, the status of abstract ideas, and the origins of knowledge – form part of the European intellectual tradition stretching all the way back to the ancient Greeks. In fact, Aristotle is often credited with authoring the first purely psychological treatises, such as his *On the Soul* and *On Memory and Reminiscence.* The philosopher Alfred North Whitehead (1929/1978) once observed that the "the safest general characterization of the European philosophical tradition is that it consists of a series of footnotes to Plato" (p. 63). To a lesser extent, a similar statement might describe Aristotle's status in psychology's past, even if not in its history. It was not until the philosophical revolution launched by Francis Bacon and René Descartes in the 17th that Aristotle's influence on psychological thought was severely compromised.

Yet, strangely, the psychology of creativity cannot have its own past projected back to Greek antiquity. Neither Plato nor Aristotle nor anyone else of those times had anything useful to say about the phenomenon. Although many natural phenomena were exposed to logical analysis and empirical inquiry, creativity was not generally included among them. This neglect probably reflects the strong association of creativity with divinity. Virtually all of the world's religious systems possess "creation myths" in which one or more gods or divine beings demonstrate superlative creative powers. The Greeks had their fare share of such myths. Especially intriguing from the standpoint of this essay is the doctrine of the Muses. According to the story, Zeus, the reigning god in the Greek pantheon, fathered nine daughters, each of whom presided over a different domain of human achievement. In particular, these Muses were responsible for heroic or epic poetry, lyric and love poetry, sacred poetry, tragedy, comedy, music, dance, astronomy, and history. Each Muse was thought to provide a guiding spirit or source of inspiration for the mortal creator. This usage underlies several commonplace expressions, such as to say that one has lost one's Muse when one has run out of creative ideas. Given this conception, human creativity remained subordinate to divine creativity.

The religious roots of creativity is also apparent in the concept of genius, a notion that would later become

closely identified with creativity (Murray, 1989). According to Roman mythology, each individual was born with a guardian spirit who watched out for the person's fate and distinctive individuality. With time, the term was taken to indicate the person's special talents or aptitudes. Although in the beginning everybody could be said to "have a genius," at least in the sense of possessing a unique capacity, the term eventually began to be confined to those whose gifts set them well apart from the average. The expression "creative genius" thus unites two concepts with Greek and Roman roots pertaining to how the spiritual world permeates human affairs. Outstanding creativity was the gift of the gods or spirits, not a human act. Even during the Italian Renaissance, when European civilization was becoming secularized by the advent of Humanism, rudiments of this ascription remained. Vasari's (cerca 1550/1968, p. 347) biography of Michelangelo rhapsodized accordingly about how "the great Ruler of Heaven looked down" and decided "to send to earth a genius universal in each art." This genius would be endowed with such extraordinary qualities that his works would seem "rather divine than earthly."

Curiously, the rise of modern science seemed to "throw out the baby with the bath water." The divine nature of creativity was replaced by the application of strict logic to mundane data. According to the new philosophies of science, discovery was reduced to some kind of "method," such as Baconian induction, Cartesian deduction, or the Newtonian hypothetico-deductive approach. The scientific method ensured that one might contribute to science without having to boast creative genius. In the words of Spanish philosopher Ortega y Gasset (1932/1957), "it is necessary to insist upon this extraordinary but undeniable fact: experimental sciences has progressed thanks in great part to the work of men astoundingly mediocre, and even less than mediocre. That is to say, modern science, the root and symbol of our actual civilization, finds a place for the intellectually commonplace man allows him to work therein with success" (pp. 110-111). Nor were artistic endeavors off limits to this exaltation of technique over creativity, especially after the arrival of the Age of Reason in philosophy and Neo-Classicism in the arts. The English dramatist John Dryden (1693/1885, p. 60) may have said "Genius must be born, and never can be taught," but other artistic creators were not so sure. Academies of art emerged that trained their students how to be creative. An example is the British Royal Academy of Art, whose artist-teacher Sir Joshua Reynolds (1769-1790/1966) would advise his students:

> You must have no dependence on your own genius. If you have great talents, industry will improve them; if you have but moderate abilities, industry will supply their deficiency. Nothing is denied to well directed labour; nothing is to obtained without it. Not to enter into metaphysical discussions on the nature or

> essence of genius, I will venture to assert, that assiduity unabated by difficulty, and a disposition eagerly directed to the object of its pursuit, will produce effects similar to those which some call the result of *natural powers*. (p. 37)

If creative genius can be acquired simply through disciplined training and practice, then creativity does not seem to represent a phenomenon to be explained. This situation was to change in the 19th century.

The Nineteenth Century

The most obvious prerequisite for the psychological analysis of creativity the arrival of psychology as a bona fide scientific discipline. But this event is necessary, not sufficient. Other circumstances are required if psychological science is to direct its attention to the phenomenon of creativity. Three major movements may be credited for pushing psychology in that direction: the advent of Darwin's theory of evolution, the emergence of statistical methods, and the establishment of clinical science.

Evolutionary Theory

I have implied the psychological research on creativity cannot exist until creativity is first recognized as a natural phenomenon that needs explanation. If creativity is a gift from the gods, or if it merely a technique to learned and applied, then nothing remains to be explained, at least not scientifically. This situation had an analogue in pre-evolutionary views of life. If all the life forms on this planet were truly placed here by a divine Creator as described in the Book of Genesis, then scientists also have nothing to explain. Instead, scientists are confined to describing God's work, as in Buffon's *Natural History*, and classifying its diverse life forms, as in the Linnaean taxonomic system. To be sure, scientists eventually appeared who would offer theories of biological evolution, Erasmus Darwin and Lamarck perhaps the most notable among them. Yet none of these individuals managed to shake the deep faith in the Creationist account.

Charles Darwin's 1859 *Origin of Species* changed all that. Inspired by his experiences in the Beagle voyage, and especially by his encounters with the life that had evolved on the Galapagos Islands, Darwin firmly believed that a genuine phenomenon that required scientific explanation (Darwin, 1860/1952). The biblical account just would not do. Furthermore, Darwin proposed a purely naturalistic explanatory system, the theory of natural selection. Recognizing that each species spontaneously generates variation that that these variants differ in their adaptiveness to a given environment, new species could emerge by the survival of the fittest variants. Not only was a divine being left out of the picture, but also the process had no direction or purpose, no grand plan or ultimate goal.

The creativity of nature resulted from each organism's individualistic struggle to survive and reproduce, nothing more.

Creativity was thus granted a completely scientific explanation, albeit it was natural rather than human creativity that was being explained. Nevertheless, Darwin's landmark work provided a potential model for the psychology of creativity. Perhaps original and adaptive ideas in the human mind arise out of an analogous variation-selection process. This very possibility was expressed by William James (1880), the U.S. psychologist and philosopher, when he said "social evolution is a resultant of the interaction of two wholly distinct factors: the individual, deriving his peculiar gifts from the play of psychological and infra-social forces, but bearing all the power of initiative and origination in his hands; and, second, the social environment, with its power of adopting or rejecting both him and his gifts" (p. 448). As will be seen later, this suggestion did not completely bare fruit until nearly a century had elapsed (Simonton, 1999a).

Even so, Darwin introduced another idea that was eventually to enhance our scientific understanding of human creativity. In the *Origin* avoided controversy by not dealing with the evolution of *Homo sapiens*, a particularly taboo subject from the Creationist viewpoint. But a dozen years later he dared to venture into this territory by publishing the book *The Descent of Man and Selection in Relation to Sex* (Darwin, 1871/1952). The title seems to combine two very different topics, yet in Darwin's mind they had a crucial link. Darwin found it difficult to account for the human mind on the basis of natural selection alone. Human creativity, in particular, seemed to reach heights that go well beyond meeting the basic requirements of survival. But so do the peacock's magnificent tail feathers. It was Darwin's genius to realize that (a) animals do not just have to survive but also to reproduce and (b) for those organisms that have the capacity to choose their mates the need to reproduce evokes the process of sexual selection. Darwin speculated that the music, art, poetry, and other artistic creations that are the hallmark of our species evolved as courtship behaviors by the same selection process that produced peacock's brilliant plumage display. This speculation did not also did not receive full attention until the advent of evolutionary psychology more than a century later (Miller, 2000).

Besides the concepts of natural and sexual selection, Darwin introduced other ideas that were to have a powerful impact on psychological inquiries into creativity. But these contributions are associated with the appearance of mathematical techniques to which I now turn.

Statistical Methods

Ever since the scientific revolution, the advance of science has often been linked with the introduction of quantitative methods, whether precise numerical measurements or rigorous mathematical analyses of the data produced by those measurements. Unfortunately, many of the early quantitative methods were more suited to the analysis of deterministic systems, such as those treated in Newtonian mechanics. Eventually, methods emerged that were more appropriate for the kinds of data that psychologists would need to study creativity. Two innovators played a key role in this emergence, Quételet and Galton.

Adolphe Quételet. A Belgian student of the great French mathematician and astronomer Pierre Simon Laplace, Quételet became a notable physicist, astronomer, and mathematician. But he moved beyond the scientific analysis of natural phenomena to pioneer the application of probability and statistics to the study of human phenomena. In *A Treatise on Man and the Development of His Faculties*, Quéletet (1835/1968) made two contributions that have an important place in the history of creativity research.

To begin with, Quételet conducted the first scientific study of the relation between age and creativity. This he accomplished by scrutinizing the complete output of French and English dramatists. The dramas were then tabulated into consecutive 5-year age periods to detect if the probability of producing a great play varies as a function of chronological age. He also partitioned the plays according to impact, separating the truly great plays from the lesser ones, to determine whether the age curves for quality have the same form as those for mere quantity of output. Quételet even introduced a statistical correction for artifacts caused by the differential life spans of the dramatists he studied (Simonton, 1988). In fact, this empirical investigation was methodologically superior to studies that psychologists published more than a century later (e.g., Lehman, 1953), and its data could still support useful secondary analyses toward the close of the 20th century (Simonton, 1997a). It is not only the first longitudinal study of creativity but in addition the first such study to stand the test of time. But aside from this contribution, Quételet offered the first operational definition of creativity that is still used today in psychological research. Specifically, he defined creativity according to observable behavior, as gauged by the products generated by the creative process. In short, creativity was objectively quantified in terms of productivity.

Unfortunately, the above investigation had no immediate intellectual offspring, and the contribution was forgotten for more a century. However, another contribution proved much more influential and timely: the mathematical form of the distribution of individual differences. After analyzing a great deal of data on human

measurements, such as height or chest size, Quételet (1835/1986) showed that the variation in any physical trait could be described in terms of the normal, "bell-shaped" curve, or what is sometimes called the Gaussian distribution. The "average person" had a value on a trait that placed him or her at the center of the distribution, where the probability for that value was highest. Any departure from the mean became increasingly improbable to the degree of the departure, with the probabilities approaching zero in either direction. The normal distribution has now become such a integral part of psychology that the concept is discussed in virtually every introductory psychology textbook, and it provides the foundation for most of the statistical methods that psychologists use to study creativity or any other phenomenon. Creativity itself is often treated as if it were a normally distributed trait (Nicholls, 1972; cf. Simonton, 1999c). The person primarily responsible for this turn of events is Galton.

Francis Galton. Trained as a mathematician, Galton began his career as a geographer and inventor who exhibited a remarkable predilection for quantification. Reading Darwin's *Origin* inspired Galton to turn his attention to human behavior. Two implications were paramount in Galton's mind. First, if Darwin's evolutionary principles apply to *Homo sapiens*, then human beings must vary in the degree to which they are adapted to the environment. This led Galton to examine individual differences in human abilities. Second, for natural selection to work, adaptive traits must be passed down to offspring. This motivated Galton to investigate the extent that individual differences were subject to biological inheritance. The first product of these new interests was a 1865 magazine article titled "Hereditary Talent and Character." Four years later this 20-page article was expanded into an extensive monograph that has become the first genuine classic in the history of creativity research: *Hereditary Genius: An Inquiry into Its Laws and Consequences* (Galton, 1869).

Galton began by demonstrating that individuals vary immensely in what he styled "natural ability." This was achieved by investigating the distribution of test scores. Significantly, not only were the individual differences substantial, but also the scores displayed a distribution that was closely approximated by Quételet's normal curve. Galton then used the latter, theoretical definition to conceive of genius as someone whose natural ability places him or her at the extreme right portion ("tail") of the bell-shaped curve. According to Galton, those with genius-level abilities would be so well adapted to the environment that they would necessarily attain eminence in any chosen domain, including those involving creativity. This tight causal connection between exceptional natural ability and achieved eminence provided the basis for his attempt to prove that natural ability was inherited. If the latter holds, then parents with genius-level in natural ability will have offspring with comparable levels of natural ability, and so

eminence, or genius, will run in families. Hence, to test this prediction, Galton devised the pedigree method, a technique still important in behavioral genetics. In particular, he collected distinguished achievers in a diversity of domains and then calculated that notable pedigrees occurred with a probability far exceeding the chance baseline. Because Galton's calculations included illustrious poets, composers, painters, and scientists, creative genius seems to be born, not made.

Needless to say, not everyone believed that Galton (1869) had made a totally convincing case. For instance, Alphonse de Candolle (1873) countered Galton's genetic determinism by publishing an empirical study of the political, social, economic, and cultural environments that best support the emergence of great scientists. Galton responded at once with the 1874 book *English Men of Science: Their Nature and Nurture* (Hilts, 1975). For four reasons, this constitutes another masterpiece in creativity studies. First, this is the first investigation that attempted to study highly creative individuals directly, in this case scientists of sufficient stature to be elected Fellows of the Royal Society. The eminent creators in *Hereditary Genius* had been studied indirectly, using published biographical and historical materials. Second, Galton asked these notables to respond to a questionnaire, thereby introducing a new technique in psychology. Third, to investigate the developmental factors underlying scientific creativity, the questionnaire included many variables for the first time, such as the birth order and educational experiences. Fourth, and as is apparent from the book's subtitle, Galton inaugurated the "nature-nurture issue" as one of the central empirical and theoretical problems not only in the study of creativity, but in developmental psychology in general. To what extent are individual differences, whether in creativity or otherwise, a function of genetic endowment and to what extent are they the upshot of environmental influences?

After this second book, Galton's place in the history of creativity research fades in the background. He became preoccupied with other problems. For instance, he tried to gauge individual differences in natural ability directly, devising instruments that ended up being totally useless (Galton, 1883). After *English Men of Science* his main contributions to the creativity research were methodological. Most notably, Galton initiated statistical analyses that led to the development of the correlation coefficient, and he introduced the use of identical twins to assess the heritability of various traits. Yet it was left to others to apply these methodological advances to creativity studies.

Clinical Science

Aristotle is reputed to have claimed, "those who have become eminent in philosophy, politics, poetry, and the arts have all had tendencies toward melancholia" (quoted in Andreasen & Canter, 1974, p. 123). This claim has

been echoed many times since, from Seneca's (n.d./1932) "no great genius has ever existed without some touch of madness" (p. 285) to Shakespeare's "The lunatic, the lover, and the poet/ Are of imagination all compact" (quoted in Browning, 1986, p. 77). Two events enhanced the popularity of this mad-genius hypothesis. The first was the advent of the Romantic movement at the end of the 17th century and the beginning of the 18th. The Romantics exalted creative genius, giving it something of the mystery it had lost. However, rather than return to the religious or spiritual conception of creativity, the Romantics viewed it in more psychopathological terms. This conception is most conspicuous in the place that psychoactive drugs had in creative inspiration. For instance, Coleridge's Preface to "Kubla Khan" claimed that he conceived this poetic masterpiece in an opium stupor. Yet the evidence from surviving manuscripts indicate quite the contrary (Schneider, 1953). Coleridge presumably distorted the poem's origins because it would enhance its stature as a creative product, not detract from its apparent merits.

Almost simultaneous with the Romantic movement was a second, totally unrelated event: Philippe Pinel initiated a total reform of French mental institutions. This reform affected not just therapeutic techniques but the theory of mental disease besides. Rather than being perceived as a form of demonic possession, mental illness would become attributed to naturalistic causes, whether biological or psychological. During the course of the 19th century, psychiatry would develop as a formal discipline, following upon the footsteps of such French pioneers as Jean Martin Charcot and Pierre Janet. Psychiatry combined an interest in the abnormal mind with expertise in neurology, including pathologies of the nervous system. Increasingly, certain neurological disorders were lined with both positive outcomes, like genius, and negative outcomes, like crime. For example, the Italian criminologist Cesare Lombroso (1891) proposed in his *The Man of Genius* exceptional achievement was based on a "degenerative psychosis" of the "epileptic group." Because nervous pathologies were often ascribed to genetic deficiencies, madness and genius would sometimes be seen as having a common genetic foundation. Thus, an article published in the reputable *Journal of Nervous and Mental Disease* listed the four possible repercussions of a single congenital defect:

> *First*, and most prominent in the order of frequency is an early death. *Second*, he may help swell the criminal ranks. *Third*, he may become mentally deranged and ultimately find his way into a hospital for the insane. *Fourth*, and least frequently, he startles the world by an invention or discovery in science or by an original composition of great merit in art, music or literature. He is then styled a genius. (Babcock, 1895, p. 752)

Admittedly, not everyone believed that creative geniuses were necessarily mad. Instead, many held a position closer to Dryden's (1681) lines "Great Wits are sure to Madness near ally'd,/ And thin Partitions do their Bounds divide" (p. 6). A case in point is William James (1902) who, in his *The Varieties of Religious Experience*, remarked:

> The nature of genius has been illuminated by the attempts … to class it with psychopathological phenomena. Borderline insanity, crankiness, insane temperament, less of mental balance, psychopathic degeneration (to use a few of the many synonyms by which it has been called), has certain peculiarities and liabilities which, when combined with a superior quality of intellect in an individual, make it more probable that he will make his mark and affect his age, than if his temperament were less neurotic. (pp. 22-23)

But given the date of this quotation, we now find ourselves in the next century of this historical narrative.

The 20th Century Prior to World War II:

Creativity as a Peripheral Topic

Creativity seems to have declined as a core research topic in the early years of the 20th century. The subject of genius did a little better, in part because of the continuing tradition established by Francis Galton. For instance, Lewis Terman (1925), after replacing Galton's "anthropometric" instruments with Alfred Binet's psychometric measures, was able to give natural ability, or intelligence, a stronger scientific basis. This shift also allowed Terman to define genius in terms of a specific score on an "IQ test" in a very Galtonian manner (see also Cox, 1926; Hollingworth, 1942). Terman's IQ-based operational definition even made it into the English dictionaries. Thus, according to the *American Heritage Electronic Dictionary* (1992), a genius is "a person who has an exceptionally high intelligence quotient, typically above 140." Only much later was it realized that the IQ definition of genius rendered the concept almost entirely irrelevant to the understanding of creativity (Gardner, 1983; Simonton, 1999a; Sternberg & Lubart, 1995).

Why was creativity neglected in the early part of the 20th century? I suspect the reason was the rise of schools in the history of psychology. Each school began with distinct tenets, and fought to secure the allegiance of all psychologists. Unfortunately, the focus of each school seemed to be placed on highly prominent phenomena that seem most fundamental to the young science. And creativity was not on anyone's list of basic phenomena. Nonetheless, major figures active in some of the rival schools would sometimes touch upon creativity or related

subjects. This tangential participation in creativity research is evident in the psychoanalytic, Gestalt, and behaviorist schools.

Psychoanalysis

Of the three schools just mentioned, the psychoanalytic is the most distinctive. It was the only one founded in the tradition of clinical science that arose at the end of the 19th century, and it was the only one that developed outside the research universities that provided the main venue for scientific inquiry. The central figure in this school, naturally, is its founder, Sigmund Freud. Despite the pride Freud had in his originality, his ideas did not spring up sans intellectual antecedents. Instead, he was firmly rooted in his times (Sulloway, 1979). From our standpoint, the most conspicuous circumstance is the fact that he was trained in the tradition just discussed. As a neurological pathologist, he had actually studied under Charcot, among others. It should not surprise us, therefore, that he viewed creativity and genius in a similar vein. This perspective is seen in the development of psychobiography, an endeavor that he played a major role in developing. Indeed, Freud's (1910/1964) psychoanalysis of Leonardo da Vinci is often seen as one of the seminal works in the field, notwithstanding its major flaws (Elms, 1988). The principal problem with psychobiographies of creative personalities is that they too frequently become "pathographies" (Runyan, 1982). That is, like Lombroso and James, creativity comes out of some "sick soul" who is merely trying to cope with his or her psychological demons.

Happily, psychobiography does not represent the only psychoanalytic input in creativity research (Gedo, 1997). A more influential and perhaps more important contribution is the concept of "primary process" thinking. Primary process thought is more primitive than "secondary process" thought. Where the latter is devoted to conscious, logical, and realistic reasoning, the former is replete with fantasy, imagination, irrationality, and unconscious motives. Freud (1908/1959) explicitly compared creativity with daydreaming. In a sense, creators dream out loud, whether the dreams take place on a piece of paper, a canvas, or a block of stone. Although many psychologists felt uncomfortable with Freud's emphasis on infantile desires, it remains true that the cognitive process he described has some significant role in the creative act (Suler, 1980). Later investigators would simply call the process by a different name to avoid the Freudian connotations. Examples might include primordial cognition (Martindale, 1990), remote association (Mednick, 1962), and autistic thinking (Berlyne, 1965).

Gestalt

The Gestalt school emerged as a typical Hegelian reaction to the psychological systems that dominated the times. In general, the latter tended to be highly atomistic in orientation, and focused on extremely minuscule phenomena, such as the perception of relatively simple stimuli. The Gestalt psychologists, in contrast, believed that "the whole was greater than the sum of its parts," and as a result they showed an interest in higher mental processes that could not be reduced to simplistic mental operations. Among those processes was insight in problem-solving situations. Two Gestaltists who were on the ground floor when the school was founded devoted a considerable amount of thought to understanding insight. The first was Wolfgang Köhler (1925), who investigated the phenomenon from an unlikely perspective – chimpanzees. He presented chimps with novel problems involving the placement of tasty bananas just out of reach, and then observed how the chimps exhibited insightful behaviors that were a far cry from the blind trial-and-error procedures so often attributed to animals. Naturally, a chimpanzee trying to grab a piece of fruit may not be in the same league as a human discovering an element or a composing a symphony, but according to the Gestalt school the same basic principles apply. Specifically, creativity requires the restructuring of the given problem so that it is perceived in an entirely different light. This theoretical position received additional development by Max Wertheimer (1945/1982) in his posthumously published book on *Productive Thinking*. Unlike Köhler, Wertheimer scrutinized human problem solving. Moreover, he was able to take full advantage conversations he had with Albert Einstein, a former colleague of his at the University of Berlin. In some ways the book provides a Gestalt framework for comprehending Einstein's creative genius.

Gestalt psychology did not long survive the Second World War. The last notable Gestalt psychologist to study creativity systematically was Rudolf Arnheim (1962, 1971). Even so, many of the experimental findings that form the bedrock of the Gestalt tradition have become incorporated as part of mainstream cognitive psychology (see, e.g., Sternberg & Davidson, 1995). This point shall be returned to shortly.

Behaviorism

The third and last school of psychology has the most ambivalent relation to creativity research. As the school's name suggests, behaviorists emphasize the empirical study of overt behaviors, most often in animals such as the laboratory rat, and almost invariably in relatively learning situations involving the reinforcement of simple responses. Creativity is not a phenomenon that seems very amenable to such an approach. Yet, ironically, the behaviorist who had the most interest in creativity was one who took such an extreme position on behaviorism that he is often referred to as a "radical" behaviorist. That person is B. F. Skinner. Skinner had originally aspired to a

literary career, an remnants of that aspiration would sometimes crop up in his publications. Besides publishing a utopian novel *Walden Two* in 1948, he had previously written articles on literary creativity and aesthetics (e.g., Skinner, 1939, 1941). Even after the Second World War he would occasionally write something on creativity, whether in the arts (Skinner, 1972) or the sciences (Skinner, 1956).

This output notwithstanding, Skinner's writings on creativity was peripheral to his main line of research on operant condition. Consequently, his ideas, unlike those offered by the psychoanalytic and Gestalt schools, did not penetrate into the creativity literature. The only exceptions can be found in the generativity theory of creative insight by Epstein (1990, 1991) and in the experimental work by Eisenberger and his colleagues showing that creative behavior can be increased through reinforcement (e.g., Eisenberger & Cameron, 1996). But these extensions take us well into the Post-World War II period.

The 20th Century After Post-WW II:

Creativity Goes Mainstream

As noted at the beginning of this chapter, creativity did not really become a significant topic of psychological research until after the Second World War. There are probably several reasons why this was so. In the first place, despite sporadic military conflicts and economic recessions, the post-war era become an unprecedented period of "peace and prosperity." In contrast to the preceding era of the Great Depression and World War II, such conditions supported a less dogmatic and open approach to understanding human psychology (Doty, Peterson, & Winter, 1991; Sales, 1972, 1973). The time was definitely over when psychology was dominated by behaviorists investigating rats running mazes or pigeons pecking at disks. The human mind again became a legitimate topic of investigation, a legitimacy that could be extended to creativity as well. In addition, psychology expanded rapidly as a discipline, increasing the number of subfields and venturing into applied areas. Many of these new subdisciplines were highly appreciative of creativity as a phenomenon worth serious psychological inquiry. Finally, psychologists were able to create new measurement strategies and statistical analyses that greatly enhanced the ability to investigate phenomena as complex and elusive as creativity.

So important were these quantitative advances that I will discuss them first. After that, I will treat three other movements that made major contributions to creativity research, namely, humanistic psychology, cognitive science, and evolutionary psychology.

Quantitative Methods

Both measurement and statistics had come a long way since Galton's first attempts at making psychology a quantitative science. Powerful statistical techniques like multiple regression analysis, factor analysis, path analysis, structural equation modeling, and time-series analysis enabled psychologists to fathom aspects of creativity that were inaccessible at the beginning of the 20th century. But even more significant, in my view, was the development of new measurement approaches. No statistical analysis, no matter how sophisticated, can do anything if certain variables are unmeasured or measured poorly. These measurement advances fall into two categories: the psychometric and the historiometric.

Psychometrics. The prototype of psychometric assessment is the intelligence test. Yet as already mentioned, intelligence has very little to do with creativity. It seems that the cognitive processes that underlie creativity are not the kind tapped in the typical "IQ test." This has led several psychologists to introduce measures that directly assess the mental processes involved in creative thought. For example, Mednick (1962) theorized that creativity requires the capacity to generate remote associations that can connect hitherto disparate ideas. He implemented this theory by devising the Remote Association Test, or RAT, that has seen considerable use in subsequent research. A person taking the RAT must identify a word that has an associative linkage with three separate stimulus words (e.g., associating the word "chair" with the given words "wheel, electric, high").

Even more popular are the measures that Guilford (1967) devised to assess various kinds of *divergent thinking*. Divergent thinking is the capacity to generate a great variety of responses to a given set of stimuli. Unlike *convergent thinking*, which aims at the single most correct response, ideational productivity is emphasized. A specific instance is the Unusual Uses test, which asks research participants to come up with as many uses as possible for ordinary objects, such as a toothpick or paperclip. The participants' responses can then be scored for fluency (number of responses), flexibility (number of distinct categories to which the responses belong), and originality (how rare the response is relative to others taking the test).

Process measures of creativity operate under the assumption that creativity requires the capacity to engage in somewhat distinctive cognitive processes. Not all psychologists agree with this position. Instead, some have argued that creative individuals appear to have distinctive non-cognitive characteristics that set them apart from persons who fail to display creativity. This has led some researchers to propose that creativity be assessed by personality-based measures. The most frequently used instruments assess creativity via the personality

characteristics that are strongly correlated with creative behavior. These personality assessments are of three kinds. First, the assessment may simply depend on already established scales of standard tests, such as the Minnesota Multiphasic Personality Inventory or Eysenck's Personality Questionnaire (e.g., Barron, 1969; Cattell & Butcher, 1968; Eysenck, 1993). Second, the assessment may be based on the construction of a specialized subscale of an already established personality test. For instance, Gough (1979) devised a Creative Personality Scale from his more general Adjective Check List. Third, the assessment may rely on a measure that is specially constructed to gauge individual differences in creative personality. An example is the How Do You Think questionnaire that gauges whether a person has the interests, values, energy, self-confidence, humor, flexibility, playfulness, unconventionality, and openness associated with creativity (Davis, 1976).

An alternative approach dates back to Galton's (1874) study of eminent scientists: the biographical inventory. This technique is predicated on the assumption that creative potential emerges by means of a particular set of developmental experiences. These experiences may either reflect genetic predilections (nature) or acquired inclinations (nurture). For example, Schaefer and Anastasi (1968) designed a biographical inventory that identifies creativity in adolescent boys. The items tap such factors as family background, school activities, and extracurricular interests. Moreover, the inventory discriminates not only creative from non-creative adolescents but also between scientific and artistic creativity.

I hasten to that psychologists do not have to confine themselves to a single type of psychometric instrument. On the contrary, many researchers administer whole test batteries in order to investigate the creative person from as many different angles as possible. For instance, Roe (1953) examined 64 eminent scientists by having them take a large variety of different tests, including cognitive, personality, and biographical assessments. Another example is the research carried out at the Institute for Personality Assessment and Research (IPAR) at the University of California at Berkeley (Helson, 1999). Here distinguished architects, writers, and other creators were subjected to extensive and intensive psychometric assessments, yielding major insights into the complexities of the creative personality (e.g., Barron, 1963; MacKinnon, 1978).

Historiometrics. Because this method dates back to Quételet's (1835/1968) inquiry, it can be considered the oldest quantitative approach in the study of creativity. Even so, it was very slow to develop. In the century since Quételet's work, the number of significant historiometric investigations can be counted on one hand (viz., Cox, 1926; Galton, 1869; Raskin, 1936). The methodology did not provide the basis for an entire research program until

Lehman (1953) returned to the same subject that Quételet had addressed, namely the relation between age and creative productivity. Probably the technique's slow development can be ascribed to its highly distinctive approach. Rather than apply quantitative assessments to college students or clinical populations – ordinary, contemporary people – the psychologist quantifies the measures from historic personalities, many of whom may have died centuries ago. Yet this very distinctive line of attack makes historiometry especially well suited to the scientific study of creative geniuses (Simonton, 1999b). Historical data about world-famous creators can be quantified in much the same fashion as in psychometrics to discern the cognitive, personality, and biographical foundations of truly exceptional creativity (see, e.g., Simonton, 1997b).

Like psychometrics, historiometrics actually consists of an impressive diversity of measurement strategies (Simonton, 1990b). Of the inventory of available techniques, one has proven especially valuable: the content analysis of creative products. Creative geniuses stake their reputations on the products they leave behind (Albert, 1975; Simonton, 1991). Accordingly, one route to comprehending their genius is to scrutinize the consequences of that creativity, whether the product be a poem, play, painting, symphony, or scientific journal article. An especially exciting development in the application of content analysis to creative products has been the introduction of computer programs. Computerized content analysis allows the researcher to study hundreds, even thousands of creative products in an entirely objective manner. Colin Martindale (1975, 1990), for example, has content analyzed English and French poetry to discern the psychological basis for stylistic changes in the arts. Likewise, I have applied computerized content analysis to music (Simonton, 1980, 1989b) and literature (Simonton, 1989a, 1990a) to decipher the factors that cause a work to be deemed a masterpiece. The computer has even been used to determine the characteristics of high-impact research programs by analyzing the titles of scientific journal articles (Feist, 1993; Simonton, 1992).

Humanistic Psychology

The 1960s saw the appearance of a major new movement in psychology, the humanistic. Humanistic psychologists viewed themselves as a "Third Force" reacting against the excesses of behaviorist and psychoanalytic psychologies. The movement's proponents placed more emphasis on what makes healthy human beings distinct from the animals studied by the behaviorists and from the neurotic humans analyzed by the psychoanalysts. As a result, humanistic psychologists judged creativity to be a significant individual asset (May, 1975; Rogers, 1954). This virtue is evident in Abraham Maslow's (1959) description of the self-actualizing person. The typical profile

includes spontaneity, an efficient perception of reality, an appreciation of the beautiful and the sublime, autonomy and independence, an acceptance of self, others, and of nature, a focus on social and universal problems rather than the personal, an identification with and sympathy for humanity, a democratic character structure with corresponding freedom from prejudice, mystic experiences or oceanic feelings, and, last but not least, creativity. Maslow based this profile largely on the study of creative geniuses like George Washington Carver, Albert Einstein, Baruch Spinoza, Martin Buber, Johann Wolfgang von Goethe, John Keats, Ralph Waldo Emerson, Robert Browning, Walt Whitman, Aldous Huxley, Pierre Renoir, and Franz Joseph Haydn.

The humanistic psychologists aligned themselves more with the "human sciences" than with the "natural sciences." Consequently, their work and views on creativity did not inspire very much empirical research on the subject (cf. Harrington, Block, & Block, 1987). In fact, it may be fair to say that the movement has moved toward the periphery of the discipline. Even so, the stress that humanistic psychology placed on creativity as a human virtue underwent something of a renaissance toward the close of the century. But this revival took place under a different designation, the positive psychology movement (Simonton, 2000b). Although the latter movement shares with humanistic psychology the focus on healthy human lives, positive psychologists also have greater affinity for the natural sciences. In other words, they wish to approach the subject matter of humanistic psychology with more scientific methodology and theory. It is still early to say whether this movement will take creativity research off into new directions.

Cognitive Science

Cognitive psychology appeared about the same time as humanistic psychology. Like the latter, it was in part a reaction to the excesses of behaviorism (but not psychoanalysis, which was considered scientifically irrelevant). Yet unlike humanistic psychology, this movement is often described as a "cognitive revolution" (Gardner, 1983). Although reintroducing the mind as the proper subject of psychological inquiry, the cognitive psychologists did so from an explicitly natural science orientation. Furthermore, cognitive psychology formed intimate relationships with kindred disciplines, such as the neurosciences and computer science, to create a broad-based cognitive science. Fortunately, very early on these cognitive scientists included creativity among their favorite topics, albeit most often under the more scientifically neutral term of problem solving (Newell, Shaw, & Simon, 1958). Besides conducting laboratory experiments on this phenomenon, some investigators devised computer programs that purported to simulate the creative process. Both the laboratory experiments and the

computer simulations also inspired case studies of creative episodes in the lives of historic geniuses. Each of these developments deserve at least a brief look.

Problem-solving experiments. I already noted that Gestalt psychologists introduced the insight process into the experimental study of creativity. Cognitive psychologists have built upon this early tradition by developing new experimental methodologies and theoretical models (Sternberg & Davidson, 1995). By manipulating priming stimuli, assessing "feeling-of-knowing" states, and applying other techniques, psychologists have obtained a better appreciation for how creative insights emerge during the incubation period. Especially provocative is the empirical demonstration of intuitive information processing as a regular manifestation of the "cognitive unconscious" (e.g., Bowers, Farvolden, & Mermigis, 1995; Schooler & Melcher, 1995). The magic behind the sudden, unexpected, and seemingly unprepared inspiration has now been replaced by the lawful operation of basic processes like "subliminal stimulation" and "spreading activation."

The last decade of the 20th century saw the emergence of the "creative cognition approach" (Smith, Ward, & Finke, 1995). According to this research program, creativity is a mental phenomenon that results from the application of ordinary cognitive processes (see also Ward, Smith, & Vaid, 1997). In addition, just as laboratory experiments have provided tremendous insights into human cognition, so can the same methodology be applied to the study of creative thought. Particularly fascinating are the experimental studies showing how visual imagery can function in the origination of creative ideas (Finke, Ward, & Smith, 1992). Another exciting feature of these experiments is the use of open-ended problems that demand genuine creativity, in contrast to much laboratory research that relies on problems that have fixed solutions. Nevertheless, these investigations concur with those on insightful problem-solving in one fundamental message: To a very large extent, creativity entails ordinary cognitive processes. Indeed, some cognitive psychologists would go so far as to say that outstanding creators, even an outright creative genius, has done nothing more than acquire exceptional expertise in a given domain (Ericsson, 1996; but see Simonton, 2000a).

Computer simulations. The computer metaphor is pervasive in cognitive psychology, so much so that theories are often expressed as computer rather than mathematical models. Given this trend, it should come as no surprise that computers have become increasingly used to test cognitive models of the creative process (Boden, 1991; Johnson-Laird, 1993). For instance, Newell and Simon's (1972) influential theory of human problem solving has inspired the emergence of several "discovery programs" that purport to uncover laws and principles from

empirical data – often using the same raw data to make the same discoveries made by eminent scientists (Langley, Simon, Bradshaw, & Zythow, 1987; Shrager & Langley, 1990). Other computer programs have endeavored to reproduce creative behavior in art, literature, and music, sometimes with remarkable success (Boden, 1991). These computer simulations again suggest that psychologists may have captured the basic mental processes behind the creative act (cf. Simonton, 1999a).

Case studies. By introducing the mind back into psychological research, cognitive psychologists devised methods to determine the internal mental operations behind problem solving. Among these techniques is "protocol analysis" (Ericsson & Simon, 1984). Here the participants in problem-solving experiments verbalize their thought processes as they transpire, from the time the problem is first presented to the moment of the insightful solution. Transcripts of these verbal reports can then undergo detailed analysis to discern the cognitive processes involved. A natural extension of protocol analysis is to scrutinize the laboratory notebooks of eminent scientists to determine cognitive mechanisms behind genuine scientific discoveries (Gruber, 1974; Tweney, 1989). Such inquiries can enter into an iterative process with both laboratory experiments and computer simulations until cognitive psychologists converge on a single coherent account of creative thought (e.g., Kulkarni & Simon, 1988; Qin & Simon, 1990). Furthermore, these case studies can go beyond notebooks and sketchbooks to incorporate biographical materials (e.g., Gardner, 1993; Wallace & Gruber, 1989). The cognitive aspects of creativity can thereby be placed in a more comprehensive context – the creative product embedded in the creative life.

Evolutionary Psychology

I said earlier that creativity research received a major boost with the coming of evolutionary theory. Not only did Darwin treat biological creativity in a naturalistic manner, but also he conjectured an evolutionary explanation for human creativity. Evolutionary theory provided the foundation for Galton's path-breaking inquiries into creative genius. In the latter part of the 20th century, evolutionary thinking returned to creativity research. This revival was largely associated with the advent of evolutionary psychology, a movement that aims to explicate human cognition and behavior in terms of Darwinian principles. Applications of these principles to creativity have taken one of two courses (Simonton, 1999a). The first is to try to identify the selection pressures that, during the course of human evolution, might have favored the emergence of creativity as an adaptive behavior. In other words, creative behavior originated by the same evolutionary processes that produced other distinctive features of our species, such

as bipedalism and language use. One striking example is Geoffrey Miller's (1997, 1998, 2000) elaboration of Darwin's sexual-selection theory into a full-fledged explanation of human creativity and closely related behaviors.

The second direction taken is to use Darwin's evolutionary mechanism – variation and selection – as a model for how human creativity takes place. Put differently, new ideas emerge in the head by means of a process analogous to that by which new species originated on this planet. Although this application dates back to William James (1880), it did not receive full development until after Donald Campbell (1960) published his classic paper on his "blind-variation and selective-retention" model of creative thought. Since then, Campbell's model has been progressively expanded and extended into a complex explanatory and predictive theory (e.g., Eysenck, 1993; Martindale, 1990; Simonton, 1999a). What makes this theory especially promising is its conceptual compatibility with the recent development within computer science of genetic algorithms and genetic programming (Martindale, 1995). These programs apply explicitly Darwinian principles to produce bona fide creative products (Koza, 1992, 1994). In short, this variation-selection theory of creativity has the potential of providing a comprehensive theoretical account of human creative behavior (see also Sulloway, 1996).

Past Achievements and Future Prospects

The above narrative has been necessarily selective. In a single chapter is impossible to provide an exhaustive history of creativity research. Certainly another author might make contrary decisions about what should and should not be narrated (see, e.g., Albert & Runco, 1999). Still, the history I gave should suffice to indicate how far we have progressed in our understanding of creativity. A great deal has been learned about the creative process, the persons who engage in creative thought, and the products that result from that engagement. Furthermore, after a period in which creativity was considered a peripheral topic, it has now entered the mainstream of psychological research. This status is reflected in the diversity of subdisciplines that consider creativity a worthy subject for empirical and theoretical inquiry. A short list would have to include cognitive, developmental, personality, and social psychologies. Also to be considered a good indication of the health of creativity research is the fact that two recent movements within the field – evolutionary psychology and positive psychology – have both adopted creativity among their topics. All told, creativity research not only has a history, but also will continue to produce a history.

But what will that future history be like? How will the narrative be written by a psychologist at the beginning of the 22nd century? It may be dangerous to indulge in prophecy, yet I do believe that the past does

provide some insight into the future. One can examine what researchers have accomplished so far, discern trends, or notice gaps that need filling. Therefore, it is permissible to speculate a little about future directions that creativity research *ought* to take, whether or not it actually does so. From that modest standpoint, I offer the following four observations:

1. We need to know more about creativity as a biological phenomenon. Human psychology is rooted in biology, and therefore a complete appreciation of creativity demands knowledge of its biological roots. This biological context takes two primary forms. First, investigators have only just begun to decipher the behavior genetics of creativity (Lykken, 1998; Waller et al., 1993). More work on the role of genetic endowment is clearly crucial to resolving the old nature-nurture issue. Second, with recent advances in the cognitive neurosciences, it should become possible to identify the brain processes that provide the substrate of creative thought (Jau✶ovec, 1999; Martindale, 1999). Insofar as drugs influence brain functioning, this line of inquiry might also examine whether creativity is enhanced or inhibited by psychoactive chemicals (Plucker & Dana, 1999; Ten Berge, 1999). Given what is already known about neurotransmitters, such inquiries might even shed additional light on the mad-genius controversy (Eysenck, 1995).

2. We need to know more about creativity as a social phenomenon. For obvious reasons, psychologists are strongly inclined toward viewing creativity as an entirely individual behavior. Yet such a perspective is woefully inadequate. In the first place, creativity often takes place in a social context, such as the work environment, which may or may not be conducive to optimal performance (Amabile, 1996). In addition, creativity will often not be individualistic at all, but rather it will originate in small-group processes, such as research laboratories or industrial teams (Dunbar, 1995; West & Farr, 1990). Lastly, but perhaps most critically, both individual- and group-level creativity take place in a larger disciplinary and sociocultural environment that shapes both quality and quantity of the results (Csikszentmihalyi & Sawyer, 1995; Harrington, 1990). Work in this area would let us learn how much of creative achievement is a matter of being the "right person" and how much can be attributed to being merely at the "right place and time." This ancient Genius-versus-Zeitgeist debate is long overdue for resolution (Simonton, 1984, in press).

3. We need to develop better theories of creativity. This improvement should take place on two fronts. First, our theories must boast more explanatory scope. Too often psychologists rest content explaining just one facet of this complex phenomenon. So one theorist will deal with the creative process, another with the creative person,

and yet another with the creative product. But a complete theory will handle process, person, and product – plus the sociocultural environments that affect all three aspects. I personally believe that evolutionary psychology has the best opportunity to provide such comprehensiveness, but later developments may prove me wrong (Simonton, 1999a). The second front concerns predictive precision. It is one matter to explicate a phenomenon, quite another to make precise predictions that can be subjected to empirical tests. For good reasons the maturity of any science is gauged by predictive power, not just explanatory utility. It is for this reason that I have several times proposed mathematical models that predict certain key features of creativity (Simonton, 1979, 1985, 1997, 1999c). Yet I am almost alone in doing so. To be sure, it is conceivable that psychology can never be an exact science, or at least not with respect to elusive phenomena like human creativity. Still, it is worth a try.

4. We need to develop better practical applications. After all, creativity can be considered among the most important of all human activities. Our homes and offices are filled with furniture, appliances, and other conveniences that are the products of human inventiveness. We amuse ourselves with the comics in the daily paper, take novels with us to while away the hours on the plane or at the beach, go to movie theaters to see the latest blockbuster, watch television shows and commercials, play games on the computer, attend concerts from classical and jazz to rock and soul, visit museums that display the artistic artifacts of cultures and civilizations – again all implicitly bearing ample testimony to the consequences of the creative mind. The buildings we enter, the cars we drive, the clothes we wear – even the music we hear in the elevators – are all exemplars of some form of creativity. Given these consequences for everyday lives, psychologists must learn how to promote creative development and expression (see, e.g., Nickerson, 1999). It is probably especially urgent to discover how to encourage creativity in those who have tended to be underrepresented among creators, such as women, minorities, older persons, and denizens of the developing world.

If psychologists pursue the directions just indicated, I prophesy not only that creativity will continue to have a history, but also that creativity research will make history.

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