SOLDO, B.; WOLF, D.; and AGREE, E. "Family, Households, and Care Arrangements of Frail Older Women: A Structural Analysis." *Journal of Gerontology: Social Sciences* 45 (1990): S238–S249.

SPEARE, A., JR.; AVERY, R.; and LAWTON, L. "Disability, Residential Mobility, and Changes in Living Arrangements." *Journal of Gerontology: Social Sciences* 46, no. 3 (1990). 133–142.

SZINOVACZ, M. "Grandparenthood in the United States." In *Handbook on Grandparenthood*. Edited by Maximiliane Szinovacz. Westport, Conn.: Greenwood Press, 1998.

UHLENBERG, P., and KIRBY, J. B. "Grandparenthood Over Time: Historical and Demographic Trends." In *Handbook on Grandparenthood*. Edited by Maximiliane Szinovacz. Westport, Conn.: Greenwood Press, 1998. Pages 23–39.

U.S. Bureau of the Census. *Current Population Reports, 1998*. Washington, D.C.: U.S. Government Printing Office.

U.S. Bureau of the Census. "Household and Family Characteristics: March 1998 (Update) and Earlier Reports." *Current Population Reports*. 2001: P20–515.

WILMOTH, J. M. "Living Arrangement Transitions among America's Older Adults." *Gerontologist* 38, no. 4 (1998): 434–444.

WILMOTH, J. M. "Unbalanced Social Exchanges and Living Arrangement Transitions among Older Adults." *Gerontologist* 40, no. 1 (2000): 64–74.

CORONARY BYPASS

See REVASCULARIZATION: BYPASS SURGERY AND ANGIOPLASTY

COST OF LIVING

See CONSUMER PRICE INDEX AND COLAS

CREATIVITY

Creativity is most often defined as the individual capacity to generate ideas that are both original and useful. Thus, those who have highly novel but clearly maladaptive ideas are not considered creative. An example would be paranoid psychotics whose delusions of grandeur and persecution prevent them from leading normal lives. By the same token, in everyday life there are numerous solutions to problems that work just fine but are totally routine, such as a motorist's decision to take an alternate route to the grocery store when an automobile accident blocks the habitual route. Of course, the two defining components of creativity—originality and utility—are not discrete characteristics—there are varying degrees of these elements in a creative idea. Hence, a measure of originality can vary from utterly conventional ideas (the zero point) to ideas that can be considered extremely surprising or even revolutionary. Similarly, a measure of utility can range from an idea that proves completely impractical or unworkable (the zero point) to an idea that solves a problem perfectly. As a necessary consequence, their joint product, creativity, can also vary along some implicit scale. At the lower end of this scale is everyday creativity. This category includes successful and novel solutions to the problems that people often encounter during the course of their lives. At a higher level on this scale is creativity that actually results in some discrete product, such as a poem published in a regional literary magazine or a painting displayed at a local gallery or exhibit. Higher still are those products so creative that they exert a more lasting and pervasive impact on a discipline, culture, society, or civilization. At this extreme it is common to speak of "creative genius."

Yet it is critical to stress that genius-grade creativity is not necessarily superior to more ordinary forms of creativity. Although the influence of an artistic or scientific masterpiece is more impressive in the long run, such masterworks are also relatively rare. In contrast, ideas that appear at the middle levels of creativity, because of their frequency, play a bigger role in daily affairs, whether in the home, school, or workplace. Indeed, everyday creativity often plays a crucial role in making life more enjoyable. The amateur cooks who delight in devising and testing new recipes, the do-it-yourselfers who enjoy designing and building furniture for their homes, and the "Sunday painters" who derive joy from expressing their feelings and images on canvas all illustrate some of these commonplace forms of creative activity.

From the standpoint of aging, there are two fundamental questions that must be addressed. The first question concerns how creativity changes across the life span, particularly in the final years of a person's life. The second question regards the best explanations for any developmental changes. In short, the first question is empirical, the second theoretical.

Empirical findings

The first task in assessing longitudinal trends is to decide on an appropriate measure of creativity. For the most part, researchers have adopted one of two assessment methods: psychometric tests and productivity indicators.

Psychometric tests. A large number of psychometric instruments exist that purport to assess creativity. Some measures assess personality characteristics, others cognitive style, and yet others biographical background factors. Nonetheless, research on the relation between age and creativity has been almost exclusively confined to one particular set of tests, namely, those that purport to assess a person's capacity for "divergent thinking." Such measures determine whether an individual can generate an impressive number of novel responses to test stimuli. Typical is the *unusual uses* test that requires the respondent to conceive all of the potential uses for a paper clip. These tests can 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). Moreover, some divergent-thinking tests use verbal stimuli, whereas other tests use visual stimuli. The underlying assumption behind these measures is that they tap the cognitive processes that are essential to creative thought. In any case, investigators who have applied such divergent-thinking tests have consistently found that divergent thinking tends to exhibit an inverted-U shape with regard to age over the life course, with a clear tendency for scores to drop off in the latter half of life. Optimum creativity usually appears around the fortieth year of life.

Even so, caution must be exercised in interpreting these findings. It cannot be confidently inferred from these results that creativity must decline after a person attains middle age. First of all, most of these empirical investigations depend exclusively on cross-sectional data, a methodological tactic that conflates the effects of aging with those of birth year (i.e., age versus cohort effects). Hence, special care must be taken to gauge aging effects from truly longitudinal data (within, rather than across, individuals). In addition, the specific shape of the longitudinal trajectory is contingent on the particular types of tests that are used. Because divergent-thinking tests constitute only one possible type of creativity assessment, different age curves can emerge when different measures are applied. Most tellingly, instruments that assess problem-solving abilities in more practical situations can actually yield scores that fail to decline with age, and may even increase. Lastly, not all experts in the area of creativity assessment accept the validity of so-called creativity tests. Most validation studies reveal that such tests exhibit small correlations with direct behavioral measures of creativity, such as achieved eminence in a creative domain.

Productivity indicators. The best single predictor of achieved eminence as a creator is lifetime creative output. Therefore, it appears reasonable to adopt productivity as a behavioral measure of creativity. Because scientific inquiries into age changes in creative productivity began in 1835, with the work of Adolphe Quételet (1796–1874), this topic can be considered the oldest in life-span developmental psychology. Yet the first truly important figure in this area was Harvey C. Lehman, whose work was summarized in his 1953 book *Age and Achievement.* Although Lehman's research was plagued with many methodological problems, later investigations that introduced more advanced methods have confirmed his central conclusion: the generation of products tends to increase with age until a maximum output level is attained, with productivity declining thereafter. Indeed, the age where output peaks corresponds approximately with the age where performance on divergent-thinking tests usually maximizes.

Nevertheless, research using productivity measures also have positive implications for the expected level of creativity in the later years of life. This optimism follows from seven empirical results:

1. The age-curve specific form—especially the placement of the peak and the slope of the postpeak decline—depends on the domain in which creativity takes place. In some domains the optimum will occur much later in life, and the drop will be very slow, or even negligible.
2. Creative productivity seldom declines to zero. On the contrary, in most creative domains, persons in their seventies will display higher output rates than they did in their twenties. Furthermore, those in their seventies will usually be generating ideas at a rate only 50 percent below what they achieved during their productive peaks.
3. Individual differences in lifetime productivity are far more substantial than longitudinal

changes in productivity within any particular creator's career. In other words, cross-sectional variation in output accounts for more variance than does age. Accordingly, highly prolific creators in their seventies and eighties are more productive than are less prolific creators during their career acme.

4. Longitudinal fluctuations in creative output are a function of career age, not chronological age. Hence, "late bloomers" who begin their careers much later in life will not reach their career optima until much later in life. The same pattern holds for those who switch fields, thereby resetting the longitudinal clock.
5. A respectable amount of the productivity loss in the last half of life is not necessarily inevitable, insofar as it can be ascribed to various extrinsic factors, such as declining health or increased professional or personal responsibilities. By the same token, certain settings can sustain creativity well into the later years. In the sciences, for instance, those creators who are enmeshed in a rich network of colleagues and students are prone to exhibit longer creative careers.
6. If one looks at the *quality ratio* of successful works relative to total works produced in consecutive age periods, one discovers that this ratio does not change systematically over the course of a creative career. Most notably, this success rate does not diminish as a creator ages. As a result, although creative elders may produce fewer masterpieces in their final years, they also generate fewer inferior works. On a work-for-work basis, there is absolutely no reason to speak of any age-related decrement.
7. Quantitative declines in creative productivity across the life span are often accompanied by qualitative changes in the nature of the output—changes that frequently operate in a compensatory manner. For instance, as creators mature, they will tend to focus on more ambitious products, such as epics, operas, novels, and monographs. More critically, creators in their concluding years often greatly alter their approach to their creative endeavors. In the visual arts, this longitudinal shift is called the *old-age style,* while in music this change is styled the *swan-song* phenomenon.

The foregoing considerations imply that psychometric measures may underestimate the creativity of older persons.

Theoretical explanations

Several researchers in several disciplines have attempted to explain the observed declines in creativity. These explanations can be assigned to the following four categories:

Psychobiological theories. These strive to explicate developmental changes in terms of the physical and neurological changes that attend the aging process. For instance, individuals entering the latter part of life may exhibit declines in sensory acuity, reaction time, and memory retrieval. To the extent that these perceptual and cognitive functions underlie the creative process, such decrements can have negative consequences for creativity.

Psychological theories. In contrast to psychobiological theories, psychological theories attempt to explain any age declines in terms of cognitive processes more directly tied to the creative process. According to one information-processing theory, for example, the career trajectory is a function of an underlying two-step cognitive process by which potential creativity is converted to actual creativity. The theory obtains a postpeak decline without assuming the intrusion of any psychobiological decrements.

Economic theories. These theories treat creativity as another form of productive behavior. As a consequence, economists will speak of creativity as the consequence of sufficient investment in "human capital" and the existence of incentives that give output high utility. Thus, any age decrements in creativity will be ascribed to the obsolescence in the accumulated capitol or to the decreased incentive to maintain productivity in the final years.

Sociological theories. These place the causal locus of any developmental changes outside the individual. In particular, longitudinal changes in creativity may result from corresponding shifts in the norms and role expectations that a society associates with distinct age groups. For instance, poets may produce their best works at younger ages than philosophers because that is most consistent with societal expectations about the romanticism of youth versus the wisdom of maturity. In addition, declines in creativity in the later years might simply reflect shifts in the number and kinds of roles that people are expected to occupy as they get older.

Each of these theoretical accounts can be shown to be inconsistent with certain empirical facts about how creativity changes in the later years. For instance, psychobiological explanations predict that creative productivity should vary according to chronological age, whereas the research shows that career age accounts for more longitudinal variance. Likewise, economic interpretations predict that creativity must decline in the last years, due to the higher cost-benefit ratio, in contradiction to the observation that creativity can resuscitate in the final years. Such empirical inadequacies imply that creativity in the latter part of life is probably the complex function of numerous distinct factors, some beneficial and others detrimental to continued creative activity.

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See also INTELLIGENCE; WISDOM.

BIBLIOGRAPHY

ADAMS-PRICE, C. E., ed. *Creativity and Successful Aging: Theoretical and Empirical Approaches*. New York: Springer, 1998.

COHEN, G. D. *The Creative Age: Awakening Human Potential in the Second Half of Life*. New York: William Morrow, 2000.

LEHMAN, H. C. *Age and Achievement*. Princeton, N.J.: Princeton University Press, 1953.

LEVY, B., and LANGER, E. "Aging." In *Encyclopedia of Creativity*, Vol. 1. Edited by M. A. Runco and S. Pritzker. San Diego: Academic Press, 1999. Pages 45–52.

LINDAUER, M. S. "Old Age Style." In *Encyclopedia of Creativity*, Vol. 2. Edited by M. A. Runco and S. Pritzker. San Diego: Academic Press, 1999. Pages 311–318.

SIMONTON, D. K. "Age and Outstanding Achievement: What Do We Know After a Century of Research?" *Psychological Bulletin* 104 (1988): 251–267.

SIMONTON, D. K. "Creative Productivity: A Predictive and Explanatory Model of Career Trajectories and Landmarks." *Psychological Review* 104 (1997): 66–89.

SIMONTON, D. K. "Creativity and Wisdom in Aging." In *Handbook of the Psychology of Aging*, 3d ed. Edited by J. E. Birren and K. W. Schaie. New York: Academic Press, 1990. Pages 320–329.

CREUTZFELDT-JAKOB DISEASE

Creutzfeldt-Jakob disease is one of the transmissible spongiform encephalopathies, a family of diseases affecting humans and animals (see Table 1). They are transmissible, in that susceptible animals inoculated with diseased tissue will develop a similar disease; spongiform, in that, under a microscope, small spaces (vacuoles) in brain tissue are invisible, giving the appearance of a sponge; and encephalopathies, in that they affect the brain.

The disease was first reported by Hans Creutzfeldt in 1920 and Alfons Jakob in 1921. A related, exclusively familial disease, Gerstmann-Sträussler-Scheinker syndrome, was reported in 1928. Creutzfeldt-Jakob disease is a dementia characterized by a rapid progression and a multitude of varying cognitive and motor deficits.

The first advance in understanding the diseases occurred with the recognition that kuru, a disease afflicting only the Fore people of New Guinea, caused similar changes in brain tissue. Kuru is a rapidly progressive dementia (over months) characterized by cerebellar degeneration, causing clumsiness and difficulty walking (ataxia), tremor, and slurred speech. It has been linked to the Fore's practice of eating the brains of deceased relatives. Dr. D. C. Gadjusek, of the National Institutes of Health, hypothesized that ingestion of brain tissue caused the disease, and demonstrated in 1966 that inoculation of brain tissue from kuru patients into chimpanzees' brains caused the disease. Shortly afterward transmissibility was also demonstrated for Creutzfeldt-Jakob disease and Gerstmann-Str;äussler-Scheinker syndrome. Gadjusek and a colleague, Baruch S. Blumberg, were awarded the 1976 Nobel Prize in Medicine for this work.

Prions

The demonstration of transmissibility produced a search for the infectious agent. Initially researchers believed that a virus must be involved, but by the early 1980s the prion hypothesis had been proposed. "Prion" is a term coined by Dr. Stanley Prusiner in 1982 to indicate that the agent is both a protein and infectious. Prusiner, a University of California neurologist, received the 1997 Nobel Prize in medicine for his work on this new class of infectious agent.

The prion protein is a normal constituent of the human body, and although the exact func-