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Creativity

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In cognitive science, creativity is usually defined as the production of a solution, behavior, or outcome that is both novel and effective. Novelty refers to how uncommon, different, or surprising a solution is, whereas effectiveness refers to whether it is task-appropriate or valued. Although there is broad consensus on the relevance of both criteria, what is considered novel and effective—and thus creative—still depends on time, culture, and the background of the evaluator. According to the *4P* model, creativity can be examined at the levels of the creative process, product, person, and environment ("press"). Studies of the creative process aim to understand the (neuro)cognitive mechanisms in creative thinking as well as the dynamics of cognition and behavior underlying creative accomplishments. Research at the product level explores what constitutes a creative outcome in different domains and at different levels of significance, ranging from personally meaningful to publicly recognized contributions. The person level is concerned with how individual differences in cognitive abilities, personality traits, and domain-specific expertise predict whether and how effectively people engage in creative behaviors. Research at the environment level seeks to understand the contextual factors that support versus undermine creativity. Collectively, advances across these levels of examination have fostered an understanding of creative cognition not as a specialized faculty but as a core component of human cognition.

History

Early work on creativity focused on exploring the nature of rare eminent geniuses and anecdotal reports of spontaneous insights. Modern creativity research is often traced back to J. P. Guilford (1950), whose presidential address at the American Psychological Association conference outlined distinct cognitive capacities of creative people such as the ability to generate many, diverse, and original ideas. He further established *divergent thinking*—thinking in different directions—as a central cognitive process underlying creative idea generation (Guilford, 1967). This is opposed to *convergent thinking*, which is a type of thinking leading to correct solutions as captured by intelligence tests. Divergent thinking tasks, which ask people to come up with different original ideas (Torrance, 1974), have since become the dominant approach for assessing creative potential (Saretzki et al., 2026) and served as a central paradigm for studying creative cognition (Runco, 1991).

A second tradition investigates *creative insight*, defined as the sudden realization of a solution accompanied by an "aha!" experience. This approach is rooted in Gestalt theory [see Gestalt Perception], which views insight as the sudden restructuring of a problem's mental representation, and associative theory, which attributes it to the ability to form remote associations between seemingly unrelated concepts (Mednick, 1962).

After work on human creative cognition established that creative thinking is a ubiquitous human capacity rather than a rare gift (Finke et al., 1992), neuroimaging methods such as electroencephalogram and functional magnetic resonance imaging were increasingly used after 2000 to investigate the brain mechanisms in creative thinking (Jung & Vartanian, 2018). The efficient and valid measurement of

individual differences in creativity is a persistent challenge, but the inclusion of creative thinking in the Organisation for Economic Co-operation and Development's 2022 Programme for International Student Assessment represents a significant milestone in the global effort to measure and standardize creative competencies.

Core concepts

Creative ideation

Many problems do not have a single correct solution but instead have many possible solutions. *Creative ideation* is the cognitive process of engaging in divergent thinking to find solutions to these open-ended problems. Once the problem is recognized and defined, people generate ideas, which get evaluated and eventually reported (Mumford et al., 2012). *Idea generation* involves a search of memory to retrieve relevant information and recombining memory elements to construct new representations. *Semantic memory* (general knowledge and conceptual facts) and *episodic memory* (recollections of specific personal experiences) both support creative ideation via forging new conceptual links and episodic reconstruction mechanisms, respectively (Benedek et al., 2023) [see Memory]. *Idea evaluation* involves the examination of candidate ideas for their novelty and effectiveness, as a creative idea should not be common but still have value.

Creative problem-solving

Some problems do have correct solutions, but finding them requires thinking in new, original ways. People here often get stuck trying obvious but inadequate solution approaches (known as an *impasse*). Progress can only be made after reframing the problem or overcoming cognitive fixation, for example, by stepping away from the problem to allow for the relaxation of inappropriate constraints (known as *incubation*). Finding a creative solution sometimes comes with a subjective experience of insight (an *"aha!" moment*), which reflects the sudden realization that the problem has been solved. Insight experiences are especially observed when people have not solved the problem in a goal-directed way or when the solution came to mind while they had not even actively been working on the problem (Salvi et al., 2024).

Metacognition and self-regulation in creativity

Creative thinking involves unique challenges, as creative problems are ill-defined, often cannot be solved analytically, and typically have vague solution criteria. Therefore, creative thinking involves *metacognitive processes* concerned with monitoring and controlling the ongoing process [see Metacognition]. *Metacognitive monitoring* includes the evaluation of the task, performance, and ideas (e.g., am I making progress, or am I stuck? Would others consider this idea creative? Can I find even better ideas?). *Metacognitive control* includes decisions regarding task (dis)engagement, devising and changing task strategies, or deciding to discard, revise, or report candidate ideas (Lebuda & Benedek, 2023). The realization of complex creative accomplishments over a longer time span additionally involves self-

regulation efforts to deal with uncertain outcomes, make long-term plans, adapt goals, and regulate emotions.

The creative person

The creativity of a person can be defined by individual differences in creative potential, behavior, and achievements. *Creative potential* broadly refers to traits, abilities, and expertise that together predict whether and how successfully people engage in creative activities (Benedek, 2024). Important creative traits include openness to experiences as well as surface characteristics such as *creative self-concept* (viewing oneself as creative), *creative centrality* (considering creativity important to the self), *creative self-efficacy* (expecting to perform well in creative activities), and *intrinsic motivation* (enjoying creative activities; Karwowski & Kaufman, 2017). *Creative abilities* include divergent thinking, which is the ability to come up with many, diverse, and original ideas. Professional creative performances further rely on acquired domain-specific expertise (e.g., artists or scientists require knowledge of their respective domains).

Besides creative potential, creativity can also be defined in terms of how often people engage in creative behaviors and what creative accomplishments a person has already achieved. Notably, creativity is not limited to the arts and sciences but extends to all areas of life such as everyday problem-solving, sports, or professional work. It is further common to distinguish creative achievement between people showing everyday levels of creativity (*little-c*), professional levels of creativity (*Pro-c*), or eminent levels of creativity (*Big-C*; Kaufman & Beghetto, 2009).

Questions, controversies, and new developments

Creativity myths

Public conceptions of creativity involve several myths and misconceptions. A common theme is to overestimate the role of chance and spontaneity and thereby underestimate the relevance of effort and expertise in creative work. Examples of this naïve conception of creativity include considering creative accomplishments as the result of sudden inspiration and viewing children as generally more creative than adults (Benedek et al., 2021). This view, however, stands in conflict with empirical research highlighting the relevance of cognitive control and expertise for creative performance and showing clear developmental increases of creative thinking with age. These misconceptions are problematic because they undermine efforts to invest in one's own creativity as well as the appreciation of others' efforts.

Artificial creativity

The advent of generative artificial intelligence (AI) raised fundamental questions about AI creativity in comparison to human creativity (Rafner et al., 2023). AI performs well in tests of creative thinking, shows expertise in many domains, and even has been centrally involved in recent Nobel prize–winning work. Current research suggests that generative AI may be a powerful amplifier of human creativity, with

human ideation, goal setting, and judgment remaining central to creative success (Doshi & Hauser, 2024). As of 2026, however, AI does not possess the psychological motivations to seek meaning or personal expression through its work that drive human creators.

Broader connections

Creativity is increasingly recognized as a central human capacity that complements intelligence [see Intelligence]. Creativity and intelligence are positively correlated with higher correlations for some intelligence facets, especially broad retrieval ability (Miroshnik et al., 2023). Creative cognition is not thought to rely on entirely different cognitive resources but rather to manifest from a specific configuration of memory, attention, and executive control processes (Benedek & Fink, 2019) [see Attention; Memory]. This view is supported by cognitive neuroscience, which shows that creativity does not rely on a unique "creative" brain region but recruits existing cognitive systems that get flexibly reconfigured to the task at hand (Abraham, 2018)**.** Creativity is thus best understood as capacity grounded in, and constrained by, the same cognitive and neural architecture that underlies human cognition more broadly.

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