

The Creative Genius Within: Learning From Leonardo

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Creative ideas often seem to come out of thin air, but bringing them to life involves a sequence of conscious and controlled steps. Even Leonardo da Vinci, one of the most famous scientists, painters, and inventors of all time, produced more than 500 drawings and 35,000 words on the topic of flight, yet it is doubtful that his ideas for human-powered flying machines would have succeeded, given what we now know about the limitations of human muscle force.

However, da Vinci's extensive documentation of his ideas paved the way for the invention of airplanes and helicopters some 400 years later. Moreover, those notes and drawings could still spark and nurture a great many new creative theories to come. In fact, according to [an article recently published in *Perspectives on Psychological Science*](#), da Vinci's creative process made use of general psychological processes common not only to geniuses like himself, but to every human being.

“Creativity has long been attributed to genius or great talent—characteristics one is believed simply to be born with,” wrote C. Dominik Güss and Sarah Ahmed (University of North Florida) and Dietrich Dörner (Otto-Friedrich Universität Bamberg, Germany). “Although we acknowledge that people differ in the extent of their talent, our assumption is that every human being is capable of creativity and already using some aspects of creative thinking one way or another and that the creative process follows steps similar to those of ordinary motivational and cognitive processes.”

Driven by Curiosity

“How did Leonardo da Vinci come up with these two ideas of flying machines?” Güss and colleagues asked, referring to two prototypes from da Vinci’s notes: the “ornithopter,” meant to mimic the flight of birds or bats, and the helicopter, also called the aerial screw or screw air. On the basis of those notes, they identified nine iterative stages of the creative process according to their interpretation of da Vinci’s own creative process.

The nine nonlinear stages all relate to motivation and cognition, the researchers explained, and provide “clarification and more detailed descriptions of the creative subprocesses” absent from previous models of the creative process, including Wallas’s four-stage model (1926), which comprises preparation, incubation, illumination, and verification.

- **Vision and curiosity as motivation to discover.** “All great inventions have been preceded by great vision or even a consideration of achieving the impossible,” Güss and colleagues wrote. Da Vinci’s intense curiosity and desire to think about “unthinkable” phenomena, they said, are motivational processes inherent in Dörner’s own “PSI-theory” of basic human needs: the need for certainty and the need for competence. “It was most likely curiosity or the high need for certainty, paired with a stable level of competence from preexisting stores of knowledge and the anticipation of enormous success as an imagined source of competence, that allowed da Vinci to continue pursuing the study of flight and of flying machines over a period of several years.”
- **Social recognition as motivation.** In his *Codex on the Flight of Birds*, da Vinci described wanting to test his flying machines on the hillsides of Mount Cecero, north of Florence, “filling all writings with his fame and bringing eternal glory to his birthplace.” Although he was already acclaimed for his genius at the time, these notes suggest that he—like most people—was motivated at least in part by social recognition, according to Güss and colleagues.
- **Asking questions.** Curiosity triggers an important part of the creative thought process, and specific “what,” “why,” and “how” questions can identify gaps in knowledge and provide direction for further thought. The researchers demonstrated da Vinci’s quest for “how” in particular in his notes describing how the movements of birds’ shoulders and wings work together to compress air and sustain motion.
- **Analogical thinking.** The “if-then” analogies that guide everyday decisions also motivated da Vinci, according to Güss and colleagues. His “search for an answer to the question of what else can fly was guided by this analogy: If birds can fly, then a human being imitating a bird can fly as well,” they wrote. Likewise, they posited that he may have used either a screw or a child’s “whirligig” toy as an analogy for his helicopter design.
- **Trial and error.** Even experts use this simple strategy of trying one approach and, if it doesn’t succeed, trying another. In da Vinci’s case, his writings revealed an evolution in his understanding of the dynamics of wind, wings, and flight through his intensive studies—“most likely through mental trial and error,” the researchers wrote.
- **Abductive thinking.** This form of reasoning relies on observing phenomena and introducing new knowledge that might reflect possible explanations. Da Vinci himself wrote, “First I shall do some experiments before I proceed farther, because my intention is to cite experience first and then with reasoning show why experience is bound to operate in such a way. And this is the true rule by which those who speculate about the effects of nature must proceed.”

The other stages identified by Güss and colleagues are **incubation and forgetting; overinclusive thinking, latent inhibition, and illumination/insight**; and **testing and working out details (schema elaboration)**. These involve setting problems aside and allowing the mind to rest, indulging seemingly unrelated distractions that may lead to “aha!” moments of discovery, and working out the messy details of the idea in question—in da Vinci’s case, for instance, the mechanical details of the ornithopter.

“None of us is Leonardo da Vinci, but all of us are a little like him,” the researchers concluded. The creative process “is at the heart of human intelligence, of the ability to invent, solve problems, and adapt to new situations.”

Reference

Güss C. D., Ahmed, S., & Dörner D. (2021). From da Vinci’s flying machines to a theory of the creative process. *Perspectives on Psychological Science*. Advance online publication. <https://doi:10.1177/1745691620966790>