Using External Models

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While the ability to perceive, create, and manipulate images in the mind has long been associated with effective creativity, it may be that the use of sketches and physical models can compensate for lack of this talent, while opening the process up to team members and other collaborators.

Spatial Visualization

Spatial visualization is the ability to picture a physical item in one's mind and to infer what it would look like if rotated in various directions. You may have taken tests in which you were asked to pick out which drawing of an object could be a rotated version of another drawn object.

Many great inventors and artists report picturing their creations in detail before producing them, and early researchers found correlations between this ability and performance on standardized tests of creativity. The quest for deliberate creativity leads to the question: can those of lower skill in this area reach the creative production levels of those who have this talent? There is a hint in some research about testing for the ability.

One effective test for spatial visualization is the solving of anagrams, those scrambled combinations of letters which can be rearranged to form known words. The better your spatial visualization ability, the faster you can solve these problems. Gavurin (1967) did some methodological research on anagrams to determine if there were any problems with allowing test subjects to manipulate the materials. He discovered that when the anagrams were presented with each letter on a separate piece of cardboard which could be moved around on the table, spatial visualization ability did not affect the speed of solving the problem. As a test developer, he learned that if you want to effectively measure this talent, you must not allow the subject to use any external materials which can be manipulated. On the other hand, this research also means that allowing people to move the letters around externally allows those low in spatial visualization to perform as well as those who excelled in it. This is a good thing for deliberate creativity.

The Use of Models

This advantage to using external representation seems to be the same as in mathematics, where most of us can solve far more difficult problems on paper than we can in our heads.

The table below explores in more detail an analogy between creativity and arithmetic. If I want to multiply two numbers, there are several possibilities. I might know the answer already, although most people have only memorized the answers for multiplying pairs of single digit numbers. A few might be able to calculate the answer unconsciously, but this ability is labeled “idiot savant” because it is usually accomplished by severe defects in other areas. This is what the movie “Rainman” was about.

Some have practiced "mental arithmetic" and have learned tricks to handle problems of three, four, or more digits in their minds. Most of us would take paper and pencil to work it out, with our ability limited by our patience, carefulness, and the size of the sheet of paper. And, of course, most folks would simply use a calculator.

Level	Arithmetic	Creativity
Remembered or Known	Memorized multiplication tables	Knowledge
Unconscious process	"Idiot Savant"	Intuition Incubation
Conscious, internal process	"Mental arithmetic"	Thinking about a problem
External model	Paper and pencil, graphing	Journaling, doodling, writing
External and Social	Group problem solving with chalkboard	Group problem solving with paper, model
External processor	Calculator	?

Applying this same structure to creativity, we note that when given a problem, sometimes, we already know an answer, it s part of our knowledge. Other times an answer seems to arise from of our subconscious with no indication of where it came from. We label this process intuition, and

we use the term incubation to label the process of waiting for the answer to emerge.

We also have a certain level of ability to solve problems in our minds, but most of use do better with paper or some other medium for listing and/or sketching our ideas.

Just as with arithmetic, various techniques enable us to handle more complex and extensive problems, both in our heads and on paper. Part of the function of external models may be to hold for reference more information than we can hold in our heads at one time. When we use paper and pencil to multiply large numbers, we carefully write down the intermediate steps and basically solve lots of little single digit problems with those answers we memorized as children. The writing helps us keep track of our progress and remember our sub-answers.

Imagery and Experience

While Gavurin looked at words, at anagrams, but there is other research that indicates that image focused thinking is more effective. Gier Kaufmann (1980) investigated the usefulness of visual images in the solution of concrete problems. He took problems and puzzles which had already been assessed for their difficulty and presented then in different ways. He took easy, moderately difficult, and difficult problems and presented them to different people as: word problems requiring word answers; picture problems requiring sketched answers; or actually putting the subjects in the physical situation described in the problem.

The toughest problems were only solved by people working in the real situation. The easy problems were solved quite effectively when given as word problems, and presenting them as pictures or real world situations just slowed down the solution.

Problems of moderate difficulty were difficult to solve as word problems, but generally well solved as picture problems, while there was little advantage to putting the subjects in the real world.

This seems to indicate that sitting around chatting is only going to work for the easiest of problems. With more difficult problems, there is an advantage to drawing pictures to understand and solve the problem. And for the most difficult problems, it seems that you need to just jump into the situation and muddle around until you get it solved.

Three dimensional prototypes or scale models may also fit this “reality” category. Designers of buildings and products have known for a long time that some people can make sense of blueprints but others really need a physical model to begin reacting to ideas or contributing to a design.

Shared Images

Drawing pictures and manipulating models seems to be very valuable to those working alone, but there also seems to be several advantages for team collaborations. Keeping notes of ideas and facts and work in progress in front of a problem solving group on flip chart sheets around the room seem to help them handle more complexity.

Blueprints of building or product designs give us a similar capability of looking together at various details in the context of the whole.

Charts such as flow charts and PERT charts can represent complex interactions in a form which allows groups to both see the whole interaction and to focus on simpler details and relationships.

The architect and planner Alexander, noted that while there seem to be a limited number of people who can invent new structural patterns, there are many more who can effectively evaluate those structures, their details, and their implications.

So external models may permit people of higher cognitive complexity to present and manipulate their structural ideas while permitting those who operate at lower cognitive complexity to check its implications against their knowledge.

Therefore, it would seem that deliberate creativity will often benefit from external sketches, notes, prototypes, and physical models, and facilitators should know a variety of different techniques to draw on for different problems.

References

Alexander, C. (1964) *Notes on the Synthesis of Form*. Cambridge, MA: Harvard Univ Press.

Gavurin, E. I. 1967. "Anagram Solving and Spatial Aptitude", *Journal of Psychology,* 65, 65-68.

Kaufmann, G. (1980) *Imagery, Language, and Cognition.* New York: Columbia University Press.

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