

## **Let's make the familiar term “imagination” strange: Generating the world not there, or exploring the real world.**

Manuscript for the presentation in International Conference of Imagination and Education 2015, Vancouver, 2015/07/02

Kiyotaka Miyazaki (Waseda University)

This presentation examines the meaning and implication of the term “imagination” in the context of education. Though the term “imagination” is frequently used in the context of education, its meaning is still vague. Now we have some experiences on practices of “imaginative education” so we should and can clarify its meaning.

I will discuss about the imagination, relating it to cognitive psychology. Cognitive psychology does not have much interest in imagination. It focuses on mental imagery and creativity though, and these psychological researches have some influence on the discourse about imagination in education. Influence is, mostly not a good one, from my viewpoint. Mainstream cognitive psychology, sometimes called as the information processing view, characterizes the mental imagery as a kind of picture, and creativity as “separating and combining.” I believe that these views are not appropriate to describe the imagination in education. In this presentation, I will explain why I think so and present the alternative view, in which creativity is thought to be an explorative activity.

### Mainstream view: picture theory

Let me start from discussing about the mainstream cognitive psychological view. This is called as the information processing view of cognition, and its view on mental imagery is sometimes called as “picture theory.” In this view, the production of mental imagery is supposed to the generation of a picture like entity on the “monitor – like” portion in the brain. Of course these are a kind of metaphor, and picture is actually meant to be some unit of information which works as picture, and monitor refers to the function of a portion of brain to “see” the information. Most famous researcher of this school is Kosslyn of Harvard. The diagram (Fig. 1) shows the architecture Kosslyn(Kosslyn, 1980;Kosslyn, Thompson, & Ganis,2009) proposes. This diagram supposes that the image is of visual, but you can apply this to other modalities.

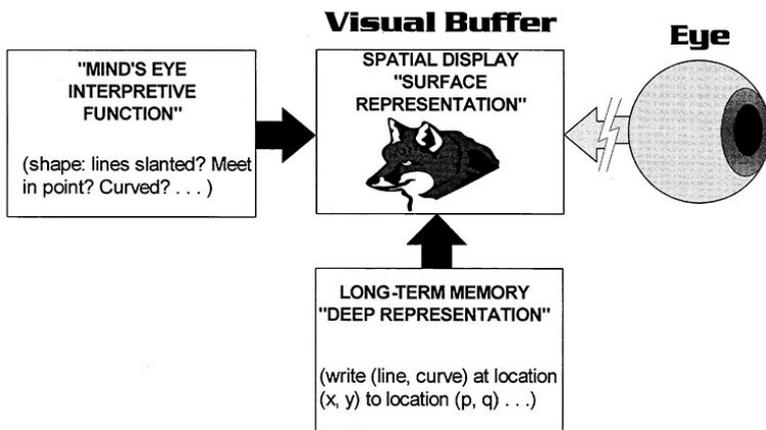


Figure 1 Kosslyn's view of mental imagery (From Thomas 1999)

Visual buffer here is the mind's monitor. Information stored in long-term memory is sent to monitor and an image as a picture is generated on the buffer. Another important function is the mind's eye, which read and interprets the image generated on the visual buffer.

One at upper right of the diagram is the real eye looking at the real world. Flow of information from here to visual buffer is supposed not to be the process of mental imagery but of perception of the real world. Retinal image is formed on the retina of the eye, and converted to an electric signal. It is then sent to visual buffer and interpreted by the mind's eye function. Then the information is sent to the long-term memory, and later used in the generation of new mental imagery. So, in this theory, the production of mental imagery and perception share almost the same functions of the brain.

More generally, and this is very important to note, any theory of mental imagery has a corresponding theory of perception. Different theories of mental imagery correspond to different theory of perception. In the case of picture theory, perception is, on the first stage, the generation of a picture, in other words, some form with some color. Later, a picture is interpreted by mind's eye function and it gets its meaning. The difference between perception and mental imagery is that, in perception, the forms come from the retina, and in mental imagery, they come from the long-term memory. One important point about this view of perception is that the story begins from the retinal image and there is no mention how eye, or human being collects information from outside world. The retinal image is a given and the system beyond the retina just receives and processes the information given. The whole process is very passive.

How is creativity described in this theory? Now think about the information flow of mental imagery. The information comes from long-term memory and is used in visual buffer to generate the image. There are 2 possibilities to generate an image. One case is that the ready made form, or more precisely the information corresponding to that form, is sent to the visual buffer and

generated as that form. This is the reproduction of ready-made, or previously experienced something. Another possibility is that parts are separated from the ready-made form, and sent to the buffer, and parts coming from the different, irrelevant forms are combined on the visual buffer to generate some new form. Then mind's eye read and interprets it. In this process, creation is to separate some part from the ready-made form and to combine them. It can be named as "separate and combine" view.

Finke's view of creativity is a typical one following this schema (Finke, 1990; Finke, Ward, & Smith, 1992). It is called "geneplore" model, in which there are two stages; first, to generate, second, to explore. Generation stage corresponds, in Kosslyn's model, to the process of sending various parts from long-term memory to the visual buffer and generating a new form, and exploration stage corresponds to the function of mind's eye: to read and interpret a newly generated form. Figure 2 shows one example Finke used in his experiment. First, three objects are given to a subject. Actually, subjects choose three from 10 or so given objects. Then, they are asked to combine 3 to generate a new form and finally asked to name it and explain what it is. What do you think? Pizza cutter, maybe.

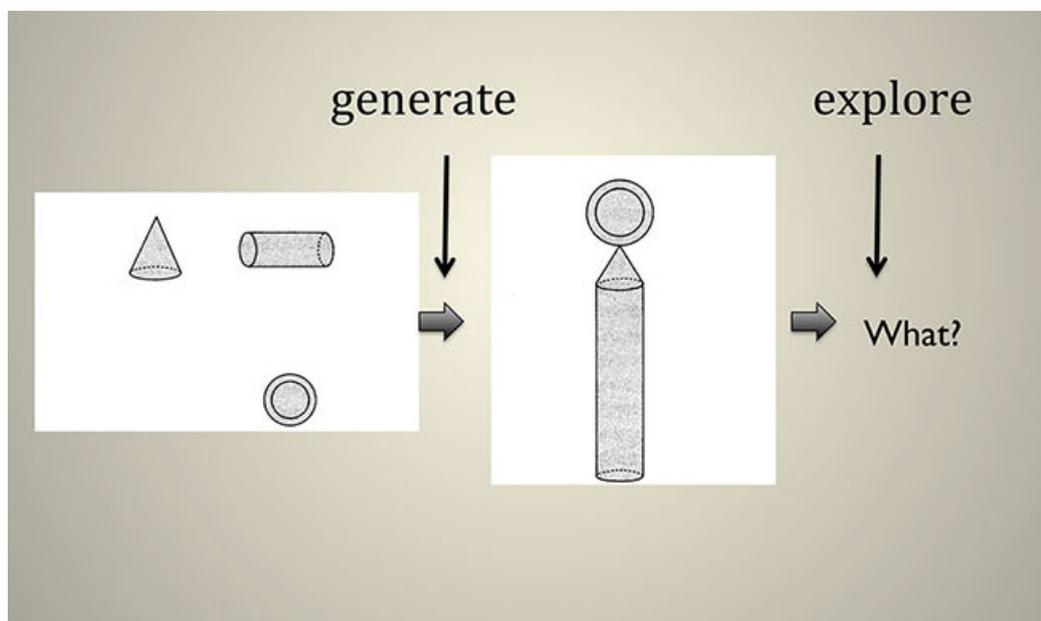


Figure 2 Finke's geneplore model

Now, let me summarize the view on perception, mental imagery and creation from picture theory (Table,1).

Table 1 Perception, mental imagery and creation in “the picture theory”

- Information processing cognitive psychology: picture theory
  - perception
    - reception of the retinal image and its interpretation
  - mental imagery
    - generation of the mental picture
  - creativity
    - separation and recombining of parts

### Imagination in education

Does this theory explain and help to create the activity of imagination we are doing in education? I do not think so. In this theory of perception, the experience of the real world is just a passive reception of the information. But what we do in the imaginative education is active exploration of information. In this theory of creativity, what is done is to separate parts and combine them. Well sometimes we can do it, creating new thing by replacing some part with some other. But what is done here is just the recombination of ready-made information. Is it really creative? Here too, we need more active exploration of something new in the world.

Now let me make more concrete about what I think as the imaginative education. Here I will examine Egan’s view of the imaginative education, though it is not an easy task to define precisely what Egan’s imaginative education means from his vast works. Here I confine myself to examine some of his famous “cognitive tools.” But before that, I will take up the most impressive phrase I read in his books, the one for me represent this view of imaginative education best. That is this: To make the familiar seem strange (Egan, 1989). Though this phrase itself is of Bertland Russel, and Egan used the opposite one, making the strange seem familiar, still this phrase is the best for me to start.

Does the idea behind this phrase fit to the view of creation as “separate and combine?” There might be possible to separate something from the familiar to combine it with some other familiar to generate something strange. Like this (Figure 3).



Figure 3 Example of separating and combining

But is this something strange meaningful? There is no assurance that “separate and combine” create something strange and meaningful. If it is not meaningful, it is not what makes learners and teachers engaging with. Maybe sometime, “separate and combine” might create some thing not only strange but also meaningful and engaging. But that is the result of random trial and the strategy is not essential.

#### cognitive tool

Now go to the cognitive tools. Among many cognitive tools, I first focus on “the limits of reality and the extremes of experience” that belongs to the romantic understanding. It is because this cognitive tool is for me to represent best the strategy to “make the familiar seem strange.”

Take one example from Ierg’s website(IERG ILP 2015). Here, the object of learning is the word, and the distribution of vowels and consonants in the word. For this object of learning, “one can ask what word has most vowels together, or most consonants together, or what word has most consonants with only a single vowel or most vowels with only a single consonant, or what word has most double letters. “ And the examples of answers are; queuing, for the first question, “latchstring” for the second, “strength” for the third, “Eerie” for the fourth, and “Bookkeeper” for the last. These are the extremes cases for the distribution of vowel and consonant in a word, and you must easily think of more familiar or more typical case of them. Maybe, love, meat, and so on.

I want to add my example from one social studies lesson done by my friend Japanese teacher (Miyazaki, 2010). The theme of the lesson was “what is a shop.” Let me to simplify the flow of the class for this presentation short and understandable. He started the lesson by asking “Is a vending machine a shop?” I don’t know the situation in Canada, but in Japan, there is no legal definition of shop in general, so there is no legally correct answer to this question. You can say for sure that a vending machine is not a typical shop. If it is a shop, it is certainly an extreme case. This question is really engaging, even for my students in university classes. I always present this class a

typical example of the imaginative classroom lesson, so I want my students to think about the lesson, but they always start thinking if a vending machine is a shop instead!

Let me generalize this case somehow. The object of learning can be generalized as “category” or “features” of category. And extremes, limits, and familiars are all cases, or instances of the category. And for the effectiveness of the strategy, the webpage says this:

“in any new environment we strive to orient ourselves by establishing the limits of the environment and its most outstanding features. It is a sensible strategy...”

In my words, it says that, to explore the contents of some category, it is better to start by making explicit the boundary of the category. Later, you can explore the inside of the boundary. This explanation is good, but I think there is another reason for the effectiveness of this cognitive tool. Research on category understanding by cognitive psychology, started by Eleanor Rosch (Rosch, 1973), showed that people understand and retain a category not by knowing its definitions but by having its instances, particularly typical instances called prototypes. It is highly probable that the instances we encounter most will be the prototype of the category, so prototypes are familiar ones in most cases. This means that we tend to understand a category with familiar instances. So, when we encountered the strange one, extreme one, our understanding of the category will be shattered and we will start re-building our understanding anew. This situation would happen when you know the word “latchstring.” You feel, “Oh, there is such a word have such a many consonants. I didn’t know that. My understanding of the word construction must have something wrong, at least narrow.” Then you would start looking for similar words, or the opposite case in which there is no or only one consonants. Your understanding on word construction would be changing to new one.

Is there any “separate and combine” in these cases? Definitely not. In place of it, there is an exploration in the category for new, strange instances and/or new features of a category. In the case of words, the questions like “what word has most vowels together” can trigger the new exploration. But not only that. As I said, the answer “latchstring” also stimulates for learners to explore more in the category for similar or contrasting cases. Such exploration will change people’s old understanding of the category into new one. Here lies the effectiveness of this cognitive tool. The important thing is that exploring the extreme and the limit makes possible for learner to produce something new and strange but also meaningful and engaging, so that it can trigger to change learner’s understanding anew.

Egan’s other cognitive tools, at least some of them, can be interpreted in the same way, as a tool for exploring something new and meaningful for changing one’s understanding.

First about “matter of detail.” This one is similar to “extremes and limits” in the sense that it makes possible for learner to explore instances of a category, or features of an object. The difference is that it is an exhaustive search. As it is exhaustive, it will produce new instances, or

features beyond ones learner already knows. As understanding category or object usually depends on familiar instances or features, discovery of new instances or features will make possible for learners to change their understanding.

For other cognitive tools, we need some other explanation. Many of them can be explained as procedures for new ways of exploration.

How about “humanizing knowledge?” In this case, the object is seen through unusual lens; humanizing lens. And just putting new lens is not enough. You have to explore the object with that lens. Which part of object does correspond to the head? Which function of object does correspond the intention of human subject? How about emotion? The cognitive tool works as a lens in the sense that it stimulates new questions, and these questions trigger new explorations. Other cognitive tools, like binary opposition and story, would work in the same way. These cognitive tools provide for learners new lens for the new way of explorations.

Now back to more general issue. My point in this presentation is that exploration is at the central in the imaginative activities in education. This has one important implication. If you think this way, you don’t have to, or rather cannot, restrict the work of imagination about the objects or states of affairs that cannot, and do not exist. You should go to the real world for your imagination work productively, exploring the objects and states of affairs in the real world. To look for the extremes, you have to explore, not in your mind but the real world, if not the real real world, but books, photos, and webs showing the real world.

### Imagination in Perceptual-Activity Theories

Now back to the psychology. The view on imagination laid here does not fit well to the picture theory of imagery. There is, however, another school of psychologists, whose view of perception and mental imagery is totally different from the picture theory, and I think theirs rather fit well to my view of imagination. This view is sometimes called perceptual activity theory, and most famous researcher is the late J.J.Gibson.

First about the perception theory, which provide for the basis of imagery theory. This type of theories is called perceptual activity theory because, in this type of theory, perception or knowing the world, and activity, or acting in the world, are thought to be inseparable and interdependent. Gibson named this interdependence as “perception action coupling.” Gibson(1979) says:

“We must perceive in order to move, but we must also move in order to perceive.”

To perceive to move means that animals (yes, for Gibson, human being is one kind of animal) need information of the world to move safely in it. To move to perceive means that animals need to move and explore the world to get information. One big difference from the information processing approach of the picture theory is their emphasis of active exploration of information.

Another big difference from the information process approach concerns what we perceive.

Information processing cognitive psychology thinks that we sense, first, dots of various colors on the retina, and then integrate them to the perception of figures and colors, and finally apprehend what it is. On the contrary, Gibsonian view supposes that we perceive, directly, object's affordances, that is, what it affords us to do with it. Affordances one object has are infinite. As we explore the object differently, the object shows different affordance.

As for the mental imagery, it is still Neisser(1976) who proposed most articulated theory of mental imagery. Before showing his theory, let me check his theory of perception, which is based Gibson's but more schematized.

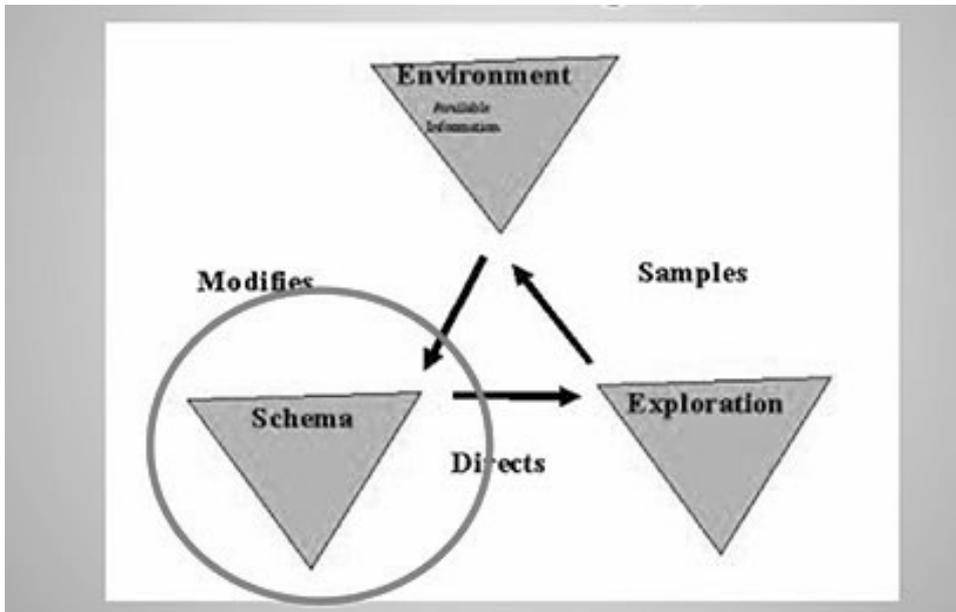


Figure 4 Neisser's Perceptual cycle

This diagram is known as Neisser's perceptual cycle. In this diagram, "schema" is not the schema of object but schema of the procedure of explorative activity for objects. To activate this schema, the perceptual activity to explore the world in some way is prepared; It seems there is a corridor in right hand side, so let's turn right and go ahead. When different information is expected, the different schema is activated. Based on this schema, the actual exploration is executed, and the information is picked up. The picked up information then corrects the schema for the next perception – movement.

How about mental imagery? According to Neisser, we have the subjective experience of mental imagery when only the schema part of the cycle is activated. This view does not suppose that, when people experience mental imagery, they have some "picture like" entity, or the information functionally corresponding to it, in the brain. All people activate is a schema of procedure of exploration. When you have a mental imagery, you activate the readiness, or preparedness for particular way of exploration. And that particular way of exploration corresponds to information you experience as mental imagery.

How is creativity characterized in this view? As far as I know, there is no explicit view on creativity from this theory. There is, however, one interesting twist here. The Finke's case I showed

you before, at least one important part of it, can be explained better by Perceptual activity theories. It is about the stage of interpretation of the combined figures. In his word, about explore stage. One good way to interpret the figure's meaning is not just to see nor to think, rather to move it. So try imaginatively to handle it and move it in various ways. Then, many ideas must appear. Here, trying to handle it and move it in various ways is the activation of many schemata, and corresponding what schema you activate, you will have different meaning about the same figure.

Let me summarize the views on perception, mental imagery, and creativity from 2 schools.

Table 2 Perception, mental imagery and creation in “the picture theory”  
And Perceptual activity theory

<ul style="list-style-type: none"> <li>• Mainstream cognitive psychology: picture theory               <ul style="list-style-type: none"> <li>– perception                   <ul style="list-style-type: none"> <li>• reception of the retinal image and its interpretation</li> </ul> </li> <li>– mental imagery                   <ul style="list-style-type: none"> <li>• generation of the mental picture</li> </ul> </li> <li>– creativity                   <ul style="list-style-type: none"> <li>• separation and recombining of parts</li> </ul> </li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Perceptual activity theory               <ul style="list-style-type: none"> <li>– perception                   <ul style="list-style-type: none"> <li>• pickup of the information by active exploration</li> </ul> </li> <li>– mental imagery                   <ul style="list-style-type: none"> <li>• activation of the schema for exploration</li> </ul> </li> <li>– creativity                   <ul style="list-style-type: none"> <li>• ?</li> </ul> </li> </ul> </li> </ul>

### Finally

Perceptual activity theory seems to have some familiarity to the imagination view in education I proposed here. It can provide for one theoretical basis for the imaginative education. For example, allow me to generalize Neisser's diagram on perception to the diagram of the cognition in general. Then Egan's cognitive tools can be forms of Neisser's schema as both direct ways of information exploration.

However, Perceptual activity theories still remain minority in cognitive psychology, and its view of mental imagery has not developed well as shown by the fact that its most articulated is Neisser's published in 1976. There seem to be some reasons for this. First, though there are some if not large group of researchers for PA theories, their main concern is to construct the objectivistic theory of perception. In particular many Gibsonian scholars focus on defining affordance mathematically to show that perception is essentially veridical. They do not have much interest on subjective phenomena like imagination and creativity.

Another possible reason is about imagination and creativity. There seems not much

interest in psychology on the imaginative activities used in the imaginative educational practice. As I pointed out, productive imagination in education cannot be confined in the brain, and depend the exploration in the real world. However, psychology tends to focus on what happens in the brain, and this tendency would explain their insistence of “separate and combine” view of creativity. Now it is necessary for us educational researchers to provide attractive theories and practices for psychologist by formulating the imagination and creativity in education more clearly and productively.

## References

- Egan, K. (1989) *Teaching as story telling: An alternative approach to teaching and curriculum in the elementary school*. Chicago, ILL: The University of Chicago Press.
- Finke, R. (1990) *Creative imagery: Discoveries and inventions in visualization*. NJ: Lawrence Earlbaum Associates.
- Finke, R. A., Ward, T. B., Smith, S. M.(1992) *Creative cognition*. MA: MIT Press
- Gibson, J. J. (1979) *The ecological approach to visual perception*. Boston, MA: Houghton Mifflin.
- IERG ILP (2015) *Cognitive tools: Extremes and limits*. Retrieved from <http://ierg.ca/ILP/teacher-resources/cognitive-toolkits/cognitive-tools-extremes-and-limits/>
- Kosslyn, S.M. (1980) *Image and mind*. Cambridge, MA: Harvard University Press.
- Kosslyn, S. M., Thompson, W. L., & Ganis, G.(2006) *The case for mental imagery*. NY: Oxford University Press.
- Miyazaki, K. (2010) Teacher as the imaginative learner: Egan, Saitou, and Bakhtin. In K. Egan & K. Madej (Eds.) *Engaging imagination and developing creativity in education*. Cambridge Scholars Publishing.
- Neisser, U. (1976) *Cognition and reality: Principles and implications of cognitive psychology*. NY: Freeman.
- Rosch, E. (1973) Natural categories. *Cognitive psychology*, 4(3), 328-350.
- Thomas, N. J. T. (1999) Are theories of imagery theories of imagination?: An active perception approach to conscious mental content. *Cognitive Science*, 23(2), 207 – 245.