

Mental models versus graphic diagrams: what we know is what we see

© Elzbieta (Elka) Kazmierczak, 2002

We see things as our mental models about them are. I am interested in the relationship between mental images and their graphic translations. First, I will examine visual representations as revealing mental models, rather than as depicting what we see. Second, I will demonstrate that graphic representations are coded as they provide visual cues for decoding mental models and latent codes. They are not imitations of what we see. The degree of discrepancy between mental models, retinal images, and graphic representations varies. These discrepancies are the primary indicators of the mental models being expressed.

1. Mental mapping

People transform external stimuli into objects of consciousness or cognitive objects by means of classification. In other words, people relate themselves dynamically to the world, by means of mental semiosis that is, by creating a sign relation that assigns a category to a stimulus. And that is how mediation or metaphor is born.

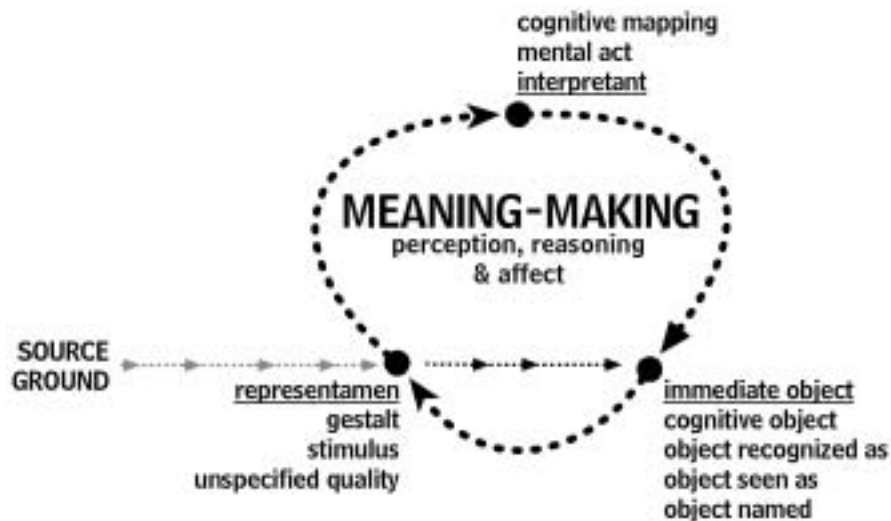


Illustration 1: Sign function as meaning making: a dynamic process of the development of a cognitive object

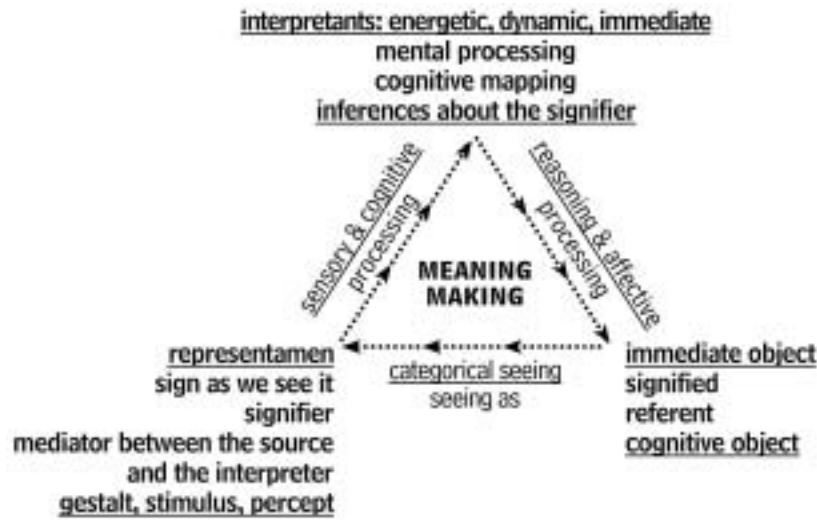


Illustration 2: Triadic sign relation mapped onto cognitive processing

“Nothing can be an object of knowledge without the application of the categories.” (Self 24-25) The meaning-making strategies are largely unconscious processes of mapping sensory experience onto the inner world of cognition. Cognitive processing occurs below the conscious level of symbolically mediated thought. Interactions with the environment and the accumulation and sedimentation of initial stimuli lead us to the development of mental models. These models form networks of relations with are embedded hierarchically and stored in our heads (Kosslyn ?????). Cognitive mapping is a dynamic system that is constantly updated by new interactions and stimulations. In other words, models are the results of the process of taking in and re-forming the information emanating from our sensorial and affective responses to the world. Once such models are connected metaphorically, we come to ‘conceptualize’ them, i.e., to think of them in terms of other models or image schemas.

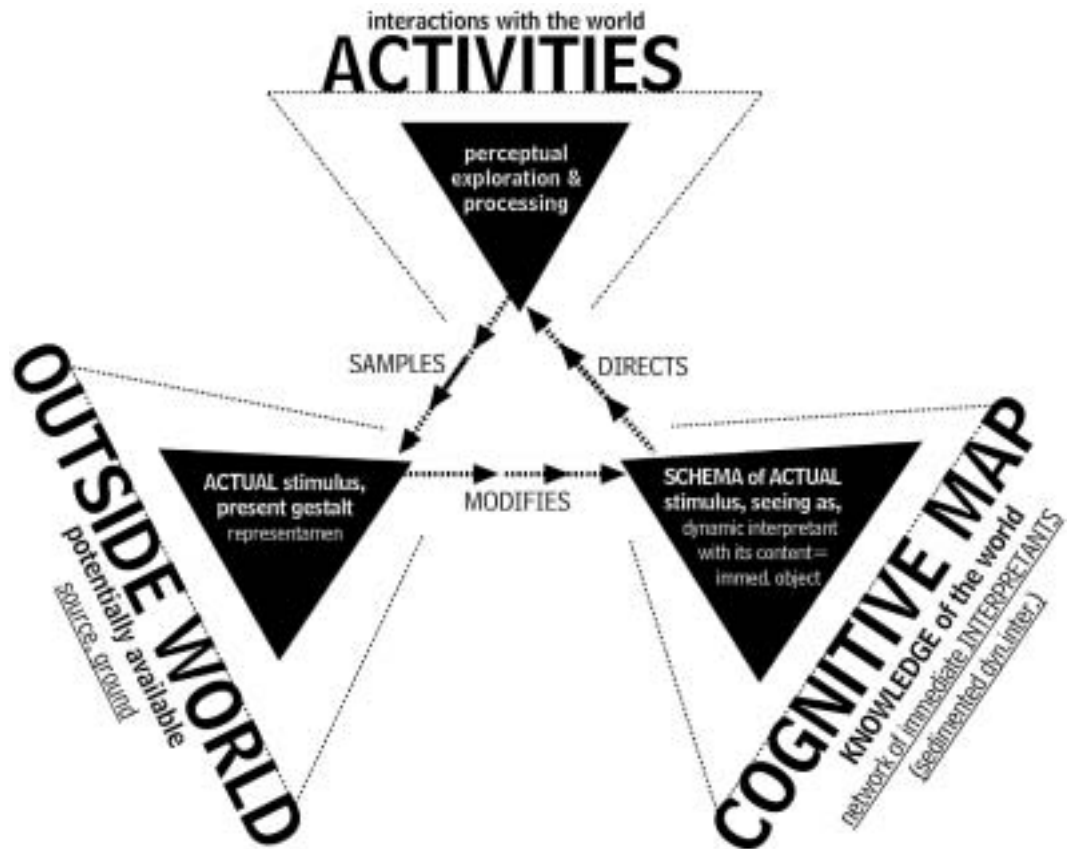


Illustration 3: Mental mapping

Not only that, but Kosslyn and other cognitive psychologists demonstrate that perception and memory are not recording of what happens but of cognitive function. We perceive and remember according to our cognitive schemas. We remember what is essential to schemas and forget what is incidental. We project and enlarge on the schematic patterns we perceive, transforming objects into cognitive objects by our own orderliness.

This process constitutes our re-presentational cognitive model. In order to communicate and to expand those models in some ways, we have developed modes of externalization or external mediation; graphic modeling systems are one of them. Those cognitive maps are expressed through different modeling forms, such as iconicity, indexicality, and symbolicity (Danesi 1993: 121). For instance, the concept map represents and makes available to the viewer the gestalt of which only a small portion is available at any time. For example, knowing where one is entails knowing what is around the corner. Even more to the point, as we look at any large object or scene, we carry a sense of the whole as our eyes wander around perceiving details.

2. Pictures and likeness or mimesis

An iconic relation between a sign and its dynamic object relies on the notions of resemblance and likeness. According to Peirce, iconicity is defined by different modes of semiosis, which relate to resemblance of: abstract relations, structural homologies, symbolic relations, indexical relations, and so forth. In Peircean terms, images, diagrams, and metaphors (§ 2.277) constitute three types of icons given in an order of decreasing degree of iconicity. Images resemble immediate visual qualities, diagrams – structural relations, and metaphors – semantic relations. Diagrams depend on indices and conventions (§ 4.418), unlike images, which are direct notations of visual qualities.

Peirce, by assigning the highest degree of likeness to the directness and immediacy of realistic portraits, expresses his affinity with the Aristotelian tradition of mimetic art. Such an approach implies that conventions other than realistic graphic ones lack the directness of transition between reality and its visual representation. The mimetic concept of art is linked to Plato (427-347 BC) and his conceptualizations about the superior way of understanding as well as to the following issues related to the dichotomy of natural versus conventional ways of cognition. For instance, (1) natural versus conventional aspect of representation; (2) likeness as a matter of natural versus conventional signification, and; (3) degree of conventionality in imitative and schematic visual models. (Hungarian Guy, date:???) In Platonic tradition, images are perceived as natural in opposition to words, which are perceived as conventional forms of representation. In *Cratylus* we read, – representation by likeness, is infinitely better than representation by any chance sign – (Hamilton and Cairns date?: 468).

But there are limitations to this mimetic view. It is very often the case that it is the departure from, or distortion of reality that enables an image to communicate. It is not its representational function but its metaphorical function that is important in communication. That metaphorical function separates it from mimesis by proposing a concept.

As we will see in self-portraits, the expressive structure can be acquired by process of selection and elision, or points of view, or by distortion, or abstraction, or by combination of these.



Illustration 4: Scale of schematization (after J. Doblin)

A scale of degrees of schematization by J. Doblin (date) is largely concerned with abstraction—each experiential characteristic removed from a representation. For instance, 3-dimensionality, color, etc. abstracts it and moves it toward diagrammatization, but that is the subject for my other talk.

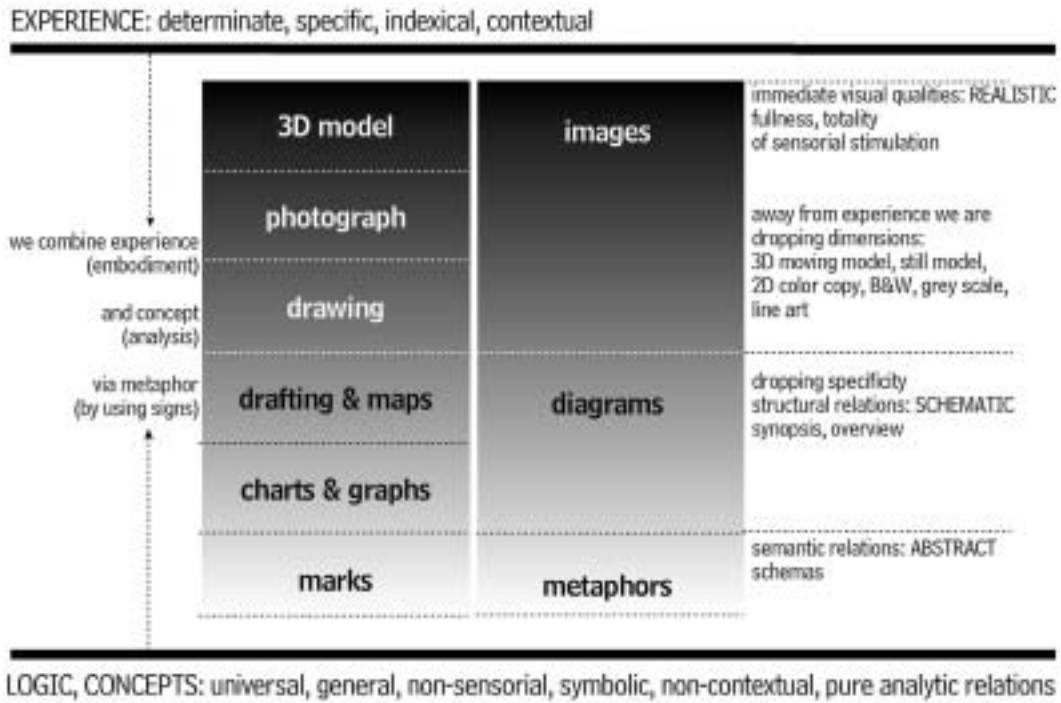


Illustration5: From experience to abstraction: schematization and likeness in the graphic means for mediation.

This table juxtaposing a scale of schematization by J. Doblin and Peirce also demonstrates that in regard to the types of knowledge derived from the contact with the world, images function the best as tool of visual knowledge, while diagrams are most suitable for visualizations of conceptual knowledge. Diagrammatic models carry a potential for revealing not only perceptual relations, but also non-perceptual relations. Images are excellent for demonstration of the richness of sensory and perceptual qualities, the appearances of the sensuous world around us. They show well appearances, while diagrams have a stronger capacity for making the invisibles visible. For the models of visual knowledge we may select images as tools for visualization, while diagrammatic modeling may be chosen for tasks requiring presentations of conceptual knowledge.

Here we have an example of the different results coming from those methods of representation.



Illustration 6: Portrait: photographic, drawn, abstract

3. Representation and distortion in self-portraits

In the world of representative images, we have many choices of distortions and schematizations, which are used —sometimes as deliberate devices but often without awareness— to communicate ideas or emotions. People's representations of the world are themselves projections of the pre-existing beliefs built into their apperceptions.

In a moment, we'll see the evidence that before people decided to employ specific methods to portray themselves they chose to portray themselves in a certain way and not in the sense of recording themselves as they were. They revealed how they view themselves, and not so much as they are physically, but as they perceive or think of themselves. These images reveal a complex cognitive map of their concepts of the selves resulting from the tension between self-images, self-perception acquired through social interactions, and resulting from them self-esteem (MacKinnon, date: ???). Self-images are cognitive component of the concept of self, while self-esteem is an affective component of the self as a whole.

The social identities are defined through social interactions; therefore they have characteristic acts, functions, and moods associated with them. For instance, doctors are expected to be calm, understanding, to counsel, and medicate while patients are supposed to obey and listen and are expected to lack patience (MacKinnon, date: ??).



Illustration 7: A weird fellow (Todd Sullivan, student work)

Here (illustration 7), we have an image of the person who describes oneself as slightly weird. He knows this not because he perceives himself in this way, but because he was told that he is perceived as such. It is through social interactions that he turned other people's impressions into his character trait. He has assimilated their view of him.



Illustration 8: Self-portraits (Rebecca Anderson, Jon Hardy, Steve Janis, Vincent Russo, Katherine Woy, student works)

If anybody walked down the street looking like any of these portraits, we would run away. But, in portraits, the distortions are not offensive or frightening, but expressive. Mimesis is not really a goal.

For instance, cubists were focused on other than likeness correspondence between an image and the object. They were interested in representing the simultaneousness of all relevant viewpoints. They aimed at making pictures that reveal the process of synchronic investigation of the object in time. Thus, each cubist picture is a synopsis of that process in a nutshell. In that respect, cubistic artworks are diagrammatic representations of an event of viewing an object.

4. Children's drawings

It is not that image making begins with either incompetence or reality from which distortions are developed. Rather it is that representations instantiate the cognitive equipment being used. It is not as if we started with reality and distorted it. Reality is always one's conception of it. Children's drawings show their cognitive tools and categories.

Genetically, the contemporary conception of resemblance slowly evolved from early representations, being a result of the parallel development of concepts at three levels: mental, perceptual, and graphic. As a gradual differentiation of graphic form proceeds, the representation of spatial relations and, thus, organization of a plane evolves. Early phases are marked by a different kind of spatial and structural codification. For instance, when the back of an object is to be shown, its elements are drawn on the back of the page. That suggests that the "illusory" consistency of an object is not an issue at the early stages (Arnheim 1974: 185).



Illustration 9: Evolution of signification: from swirls to figures

Children's drawings, according to adults, place buildings and trees at the horizon. Meanwhile, children are placing them on the ground. By placing object on the edge of the page or on a horizon line they are looking for steady support for objects. As if an undifferentiated plane did not provide it. Therefore, if there is not enough room to place all the objects on one line, there may appear another horizontal line to support them. Thus, we may see multiple horizons. That is because people acquire forms from observation of nature. By analogy, horizontal line is referred to as the ground. Due to our experience of walking on the surface, it is perceived as static. Conversely, a diagonal line is active and unstable. We observe

this in both linguistic metaphors describing pictorial arrangements, and in their connotative interpretations.

The next step in evolution of western children drawings is perspective. One-point perspective is a cultural development. Children who grow up in such cultures evolve toward perspective but in other cultures such as ancient China or medieval Europe, they evolved differently. The study on modern children drawings from Egyptian village without exposure to any TV and printed materials showed that those children did not acquire the level of graphic sophistication equal to western children (Egyptian Village, ??).

5. Distortions, narrative, and expectations

In culture where we expect perspective and narrative, we have pictures that function by carefully selecting and schematizing to imply a particular situation or set of events within a convention of perspective to make the narrative clear.



Illustration 10: *Virtual Loneliness* (Rebecca Anderson, student work)

In this picture, we have distortions of scale, a person, perhaps a painter, is sitting on a giant keyboard. The easel is knocked over along with a picture. Presumably, the person (the only actor) was frustrated with it and now is using a computer as a support for creativity. We can also infer that the person is frustrated with the digital medium as implied by the keyboard.



Illustration 11: Scene design for *Rhinoceros* by E. Ionesco (Alonso Araya, student work)

This picture is a transition from linear narrative in a perspectival setting to non-perspectival and non-linear narratives. Here, there is movement of the actors, but the setting is no longer straightforwardly interpretable. It is the setting that is engaged in the narrative rather than an actor. This situation is challenging our knowledge, about walls and interiors, as they usually do not move, wave, or change shapes and patterns. Since events are recognized within a framework of a defined situation, the very situation here is unclear. This image might require cognitive revision as to how to define it.

5.1 Syntactic drawings

Here we have a different non-perspectival, non-linear narrative evolution of image making. These images rely on syntactic juxtapositions of objects, which relate semantically. Here, a woman kept behind three forks is juxtaposed with the bird. The event is not clearly indicated, but must be thought through by the viewer who is specifically challenged by what is presented.

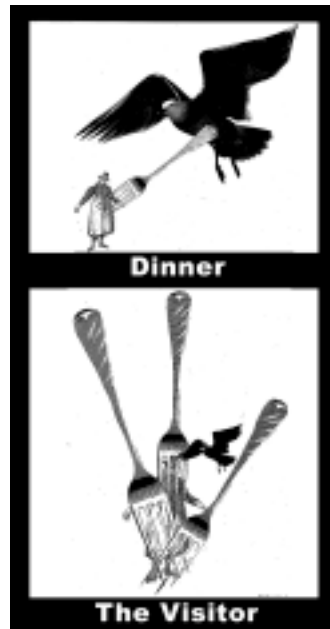


Illustration 12: *Dinner* and *The Visitor*: juxtaposition of elements to create a narrative (Stacy Kurtz, student work)



Illustration 13: Gestalt juxtaposition of elements to create a narrative (Kevin Laubacker, student work).

People look at things and define them through the lenses of what happens. Thus, events not object are the basic units on meaning. In the case of *Dinner* or *The visitor* title does not relate to the event. Thus, the viewer is expected to construct the event mentally. In the next example (ill. 13) the title reflects the events as the units of meaning. The strategy of looking for meaning of the stimuli is embedded in language, which provides and imposes frame of reference for the examination of images. Cognition of events is organized in terms of case grammar, which consists of an actor performing an act on an object in a setting. In a fuller version of the interpretive scheme, the mood, the social status, and character traits of an actor are looked upon, in addition to the frequency of the act (MacKinnon ???). For instance, people ask: Who is this person? What is this person doing? And Where?

5.2 Combining pictures with text

Perception is always guided and filtered by attention and motivation. Depending on the filter or the frame of reference the same object will part in different conceptual relations. Thus, it may acquire different meanings in the receiver. Depending on the situation and expectations defined by the designer, some aspects of the object may be left out unnoticed while others may be emphasized. For instance, Mona Lisa will “read” differently in an art history book, or in a costume design book. When Mona Lisa appears in a magazine for girls as an example of poor makeup, we are forced to notice that she does not have any eyebrows.

Depending on a guide from the text the receiver actually sees object differently. Seeing differently influences the interpretation. The linguistic elements specify referents. The pictorial or graphic elements specify relations. Pictorial elements, especially those with a high degree of generalization, require linguistic support to specify referents. In this sense, semi-realistic or semi-representational pictures are conceived as open to different readings, but those readings are limited by the logical possibilities afforded by visual syntax.



Illustration 14: Titles guide seeing an image differently.

The mixing of the verbal and non-verbal elements has been shown to be the best medium for explanatory representation of conceptual structures, which are non-linear and synchronic. Leonardo da Vinci writes the following – “picturing of anatomic parts of the neck from different viewpoints gives truthful information about the forms of it, and it is impossible that the writer can ever achieve it without enormous, boring, and muddled delaying in writing and in time” (date?: 42). Designing pictures for communication dwells on the dialectic bouncing of the meanings and the lack of resolution between the two elements and between the elements and the whole.

6. Summary

- Visuals reveal our mental models, not what we see.
- Visuals mediate between our conceptualizations, medium, goal, and skills.
- There is a discrepancy between mental model, retinal image, and graphic display.
- Visuals are diagrammatic – they materialize mental relations in a graphic medium.
- All graphic representations are subject to graphic conventions.
- Mental models are constructed the same way as the memory is constructed.
- They are constructed affectively to minimize discrepancy between mental model and what is actually experienced.
- Verbal descriptions are fragmentary and indeterminate.
- Visuals are determinate.