

## On Diagrammatic Nature of Representation: Art and Design as Modeling Forms of Thinking

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By giving shape to our experiences we make sense of them. Making sense of something means to comprehend it. Such a comprehension is made possible by virtue of linking new information (=sign) with an old and familiar one. The process of linking, that is, a process of semiotic modeling requires connectivity and interconnectedness of our conceptualizations, which form thought patterns. That sense of interconnectedness ever present in the shaping and comprehension of experience leads to the examination of diagrams. This presentation is geared toward a discussion of relationships between diagrammatic reasoning, cognitive psychology, sensory perception, and the process of visual representation.

For both an artist and a communication designer, it is essential to acknowledge, that changes in design affect the meaning in such a way, that it becomes a different meaning altogether. This presentation reveals the relationship between the meaning and the sensory characteristics of graphic diagrams. This relationship is rooted in the semiotic nature of modeling devices, such as concept development and its representation. As modeling devices, they shape not only experiences, but also conceptualizations about things and events in the world.

### Modeling Instinct<sup>1</sup>

All humans are sign makers, and thus, meaning makers. The signs humans make are expressions of the modeling instinct, which is a human way of knowing (Danesi 1998). Anything we, as humans, know is comprehended as a mental model of relations among our conceptualizations about something. In order to communicate and to expand those models in some ways, we have developed external modes of representation; graphic modeling systems are among them. The two modeling principles of **dimensionality** and **interconnectedness** apply to all modes of representation, whether mental, acoustic, or graphic. Mental models are relations, of which representations are also relations, therefore they are **diagrammatic**. They correspond to the internal mutual translatability of sign systems. As tools for communication, modeling systems are acts or interfaces of semiosis. The semiosis, as presented by Marcel

Danesi, is an innate process of cognizing that leads from recognition to representation.

“ 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. This process constitutes our re-presentational cognitive mode” (Danesi 1993: 121).

The meaning-making strategies are largely unconscious processes of mapping “ sensory experience onto the inner world of cognition via metaphor” (ibid.) For artists and designers, who are professionally producing meanings via graphic diagrams, the semiotic entailments of this mapping in literal and metaphoric sense are intimately known. The challenge is to turn this intuitive knowing into the analytical and rational knowledge of the visualization process to enhance its effectiveness.

The metaphoric nature of semiosis, that is, of the model-making process, refers to the “ understanding and experiencing one kind of thing in terms of another” (Lakoff and Johnson 1980: 5). It describes the parallel (metaphoric) nature of the modeling process as such. As described by Marcel Danesi (1998), metaphoric models can be expressed through different modeling forms, such as iconicity, indexicality, and symbolcity. Thus, works of art may undertake any modeling form, which is founded upon their otherwise metaphorical nature.

## **Two Planes of Design<sup>2</sup>**

The Peirean concept of diagrammatic reasoning, via icons representing structural relations (Peirce § 4.418) corresponds to the design process. We think through thought-signs and arrange them into a network of relationships, and those interconnected thought-signs are icons of a specific type. They are mental or **internal diagrams**. Mental diagrams as thought-icons “ pattern the qualia of Firstness into patterns of concepts” (C. W. Spinks 1991: 446). They are not yet actualized potentialities of concepts unless they come to exist in Secondness. They are **mental schemas of our conceptualizations** about things and not of things themselves. Mental icons form **patterns of relations** among thought-signs. As such, they are diagrams or **mental maps of our thinking**. They are visualized in the form of **graphic or external diagrams**, which continue to be models of our conceptualizations of objects. Whether internal or external, the diagrams, which are always iconic<sup>3</sup> are models created to represent

conceptualizations of an object in relation to already existing network of mental and graphic signs.

Depending on the degree of iconicity, graphic diagrams vary on the scale of degrees of diagrammatic schematization. That schematization varies depending on the design purpose, medium, and the subject matter. It also varies in regard to the taxonomy of semiotic space in which they participate. For instance, geographic maps are indices. (Spinks 2000). As indexical diagrams they are designated by the correspondence between proximities of actual geographic locations and their graphic signifiers. Geographic maps are embedded more in Secondness in relation to models representing scientific theories, which participate in Thirdness. “The more the iconic model participates in Thirdness, the more the model will seek to articulate the nature of law – be it natural, logical, or whatever” (Spinks 1991: 446).

I argue that artifacts develop mental diagrams rather than reproduce reality as we see it. By the same token, the creative process is fueled not by the urge to copy the original, but by the modeling instinct. Artifacts are models of our thought-patterns and not of a reality as of an original. It is an original thought about something that is actualized in a graphic medium. Thus, an original is a thought, which serves as a source of graphic diagram. It is the correspondence between the thought pattern (=internal diagram) and its graphic representation (external diagram) that defines different forms of expression, including different degrees of schematization and abstraction, such as “pictorial, hieroglyphic, alphabetic, schematic, and ultimately algebraic” (Merrell 1991: 263).

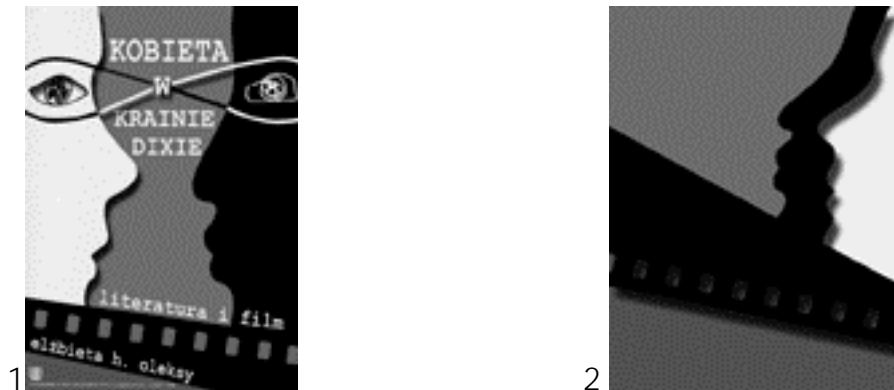
Consequently, the design process is the process of graphic actualization of mental (internal) diagrams that takes place on two planes: on a **mental plane** of thought shaping and on the **pictorial plane** of its material (external) counterpart. In other words, it brings to existence the mental diagram of our conceptualizations about objects and events. These planes constitute the two modes of the diagrammatic modeling of thought. They define the two modes of semiosis, that is, the meaning-making process. According to C. W. Spinks, a process of portraying conceptual relations by spatial means “is ‘mapping’ in its hypothetical sense” (Spinks 1991: 446). Correspondingly, the design process is the **mapping** in its actual sense. In other words, it is a process of representing conceptual relations by spatial means in a graphic medium. It is a process of visualizing mental diagrams. For instance, in Figure 1, a concept of social contrast, opposition, and race is mapped onto a material plane of the design as a juxtaposition of silhouettes.

## Designs as Shortcuts to Meaning<sup>4</sup>

The design process is defined as an intellectual effort that “manifests itself in drawings or plans, including schemes and specifications” (Simlinger 1996: 4). In a so defined process of design, there is room for originality and creativity, which are the sensitive points of the creators’ consideration. Diagrams “require a certain detachment of the representational sign from the primary artifact, which provides for a degree of arbitrariness” (Merrell 1991: 263). Thus, depending on the degree of arbitrariness, the designer can exhibit more or less individualistic tendencies in his/her designs.

All artifacts are representations of mental models conceived by their originators and are defined by their knowledge in a given point in time and space (Saint-Martin 1987: 111). Not only due to the confinement of the existential dimension of a sign maker, but also due to the creative process, conceptualizations are selective and schematic. Consequently, the main premises of the design whatever they might be require **selectiveness** and **abstractization** of characteristics of reality as we see it. To communicate effectively by inducing a desired response in viewers, designers/artists select and organize visual characteristics of graphic diagrams. Even realistic painters select details to be included in the image. By virtue of selectiveness and correspondence between mental models and external models all artifacts are diagrammatic. They serve as diagrammatic guides for the receiver for the reconstruction of a meaning, that is, concept or entity.

For example, in Figure 1, the relationship between two genders was reduced to a partial representation of the faces. This synecdochical substitution of a part for a whole conveys almost intimate closeness of the modeled relationship. As such, it represents all that was needed to convey the dichotomy between the two opposite elements. In other words, the designer has developed a schematic picture of the face, to provide a diagrammatic model of the female-to-female relationship. As a matter of fact, there is also an overtone of possible reading that the two profiles might be male ones as well. That does not impair the design to the contrary, it supports it, as a male counterpart also plays a role in the text of the book. Thus, the front cover shows the two women, reduced to the visual representation of significant parts of schematic profiles. On the other hand, the differences in the placement of the profiles define their relationship. On the front cover (Figure 1), the two profiles are in opposition, perhaps, even in confrontational opposition, while on the back cover (Figure 2) they are placed right next to each other. The change of placement from polarized and adversarial to the same side of the composition is geared toward inducing the response in the viewer. He or she is to infer that the significant change of the relationship between heroines has occurred during the course of the book.



Figures 1 and 2. Illustrative diagram: E. Kazmierczak (1999). Front and the back of the book cover.

Designs are graphic shortcuts through and to the meaning. They do not provide lengthy descriptions or specifications of a specific object, as do linguistic descriptions. Instead, they only provide pictorial cues necessary for the immediate grasping of an adequate interpretant. In other words, they provide an overview of relationships among corresponding relevant concepts. Thus, they provide schemata for comprehension of conceptual relations. As the overviews and the schemata, diagrams provide pictorial form by showing the complex conceptual structures in a nutshell.

The development of the diagrammatic model to make it function successfully as a graphic shortcut requires that the creator employs strategic thinking and planning. It is frequently overlooked that the very selectiveness that leads to abstractization requires intellectual discipline and reasoning. Consequently, viewing design process as diagrammatic reasoning allows us to emphasize the importance of the rational foundations of that process. It is not only the construction of the meaning by the designer that requires the use of logic, but also its re-construction by the viewer. The design lends itself to the viewer's participation in the meaning making process as he/she "reads" the diagram. The viewer navigates through the arrangement being guided by its visual hierarchy. The viewer's reading of the diagram is always non-linear, associative and abductive, which makes it different from the linguistic comprehension. It is the dynamic relation of mutual determination between the syntactic rules for assembling points, lines, and figures and their linguistic discourse, that determines reading of diagrams. Of course, the diagram is always to some extent open to different readings, but they are limited by the designer's strategy to make it "an intentional organization of its field of possibilities" (Eco 1962: 100).

Graphic diagrams, in conventional use of the term, have a blend of pictorial and linguistic elements. For a traditional semiotician, the distinction between linguistic and pictorial components of graphic diagrams is not of significance at the top level of the diagrammatic reasoning. Both modes of expression are constituted by the same category of signs, that is, thought-signs. For a cognitive semiotician, this distinction provides a fascinating field of study of cognitive differentiation between processing of different types of sensory information, which results in different learning styles.

Pictorial elements, especially those with a high degree of generalization, require linguistic support to gain a context to allocate the meaning of the otherwise abstract and arbitrary formation of shapes with shifting differentiation values. Points, lines, angles, and open and closed figures may signify anything, since there are many ways to represent a given conceptual structure. The linguistic discourse, as a highly standardized and common means of communication, conveniently helps to determine the meanings of pictorial elements (Turkovic 1995: 335). For instance, the range of possible meanings of an arrangement with an arrow is narrowed down to those situations in which the syntax of an arrow is applicable. In short, an arrow always contains information about (a) the relational nature of a situation, (b) its motion, and (c) its direction.

There are studies conducted as to what aspects and to what degree language of diagrams is universal. It seems that it is cross-culturally and developmentally uniform to the degree of universality of sensory perception, the process of form differentiation, geometry, and language acquisition.

## **Perception and Thinking Through Diagrams**

Artifacts are objects produced for communication. As physical entities, they provide sensory stimuli for cognition. Artists create objects of aesthetic contemplation, while designers create objects of a certain functional value. Those cognitive objects create configurations, which operate semiotically to communicate conceptual relations. The construction and perception of external diagrams is determined by the rules of human perception as described by Gestalt psychology, which explains that the whole of the visual arrangement determines perception and comprehension of its components. Graphic diagrams are holistic and synoptic, like any other sensory arrangement, in a sense that they are perceived always as wholes or gestalts.

There are two aspects of graphic diagrams that are important to visualization of conceptual structures: first, logic of visual syntax (formal relations); second, synoptic (gestalt) presentation. Once we grasp a configuration, that comprehension encompasses and specifies the structural relations inside it. We perceive gestalts top-down or general to specific. Thus, diagrams enable top-down comprehension of unfamiliar content and they support remembering of complex relations. When applied as teaching or learning aids, diagrams are excellent tools facilitating meaningful learning and remembering of the material (Holley and Dansereau 1984: 14). Studies show that graphic diagrams facilitate understanding and remembering of otherwise difficult to grasp conceptual structures. They do so by providing spatial models of conceptual structures.

Graphic diagrams accomplish so much, because they materialize the spatial and temporal ways we think. Spatial-temporal relations operate through visual cognition: a perceptual and intuitive process. While linguistic elements specify external referents, visual relations specify cognitive patterns. In Figure 3, we see the most rudimentary diagrammatic notations of basic conceptual relations: connection, overlap, mutual causation, clustering, and inclusion.



Figure 3. Concept diagram of mental relations: connection, overlap, mutual causation, clustering, and inclusion.

It is important for a creator, especially for a communication designer, who is responsible for the graphic shape of diagrams, to be acutely aware of the semantic entailments of such shaping. Namely, he/she must keep in mind that the changes in the sensory organization of gestalts, create different patterns for recognition. Different sensory patterns are recognized as different signs, which may involve different interpretations, or inferences.

Diagrams can be studied not only in terms of the pattern recognition and diagrammatic reasoning, but also as **mental schemas of cognition**. Cognitive theory enables us to view mental schemas as plans for conceptualization of past experience, which determine rational entailments described propositionally, and provide cognitive plans for interaction with the environment.

Our comprehension of external diagrams via sensory perception is grounded in corporeality. We observe this in both linguistic metaphors describing pictorial

arrangements, and in their connotative interpretations. For instance: a vertical line is linked with motion “up” or “down”. The upward movement is positive, while down is negative. The former is linked with organic growth and advancement, the latter with organic decay and decline. A 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.

## Examples of Graphic Diagrams

To examine different expressions of diagrammatic models, such as indexical, illustrative, flow chart, and concept, let us recall the main aspects of diagrammatic modeling. Graphic diagrams vary depending on the design purpose, the subject matter, and the medium. They also vary in regard to the taxonomy of semiotic space in which they participate. In a reductive, condensed, and synoptic way, they show only those features and aspects of objects or events, which support the designer’s intent.

Graphic diagrams (1) depict structural relations & schemas, not appearances, (2) reveal underlying conceptual relations and behaviors, (3) provide new conclusions or statements that convey points of view, and (4) represent conceptual relations by spatial and temporal means. Graphic diagrams provide schemata for comprehension by providing visual cues necessary for the immediate grasping of an adequate interpretation.

Figure 3 is a concept diagram. It uses the code of symbolic representation by integrating text with image. Here the viewer is making conclusions about conceptual relations using cues from visual syntax. Figure 4 is also a concept diagram, which mixes abstract and realistic forms with icons and text.



Figure 4. Concept diagram of the process of meaning construction, Lou Rera (2000).

Figure 5 is an **indexical diagram**. This diagram is indexical by virtue of having a one-to-one mapping with referents: road crossings. The value of this diagram is not in its resemblance to the appearance of the urban landscape, but as a guide to the schematic patterns of connections among streets and routes that can be inferred. Figure 6 is another indexical diagram. It mixes different projections, which show different points of view. These polar projections are developed for different purposes. Both are accurate, but from different frames of reference. Thus, what looks distant in one projection looks adjacent in another. It is a concise synopsis, which provides two different points of view simultaneously.



Figure 5. Indexical diagram: Map of downtown Buffalo.



Figure 6. Indexical diagram of the South Pole in a global context.

Illustrations are diagrams in disguise. They may not look like diagrams, but they work diagrammatically. Figure 7 is an **illustrative diagram**. It uses the

convention/code of realistic representation of mechanical projection of photography. This is not a portrait of a man. This is a diagram in which certain aspects are emphasized to make clear the structural relationship between the top of the plastic bag and the smile. It is a depiction of structural relations informing about conceptual relation between the man's desire and the cake.

Illustrative diagrams frequently use the code of realistic depiction to bring together mutually excluding viewpoints, such as in polar projections in Figure 4. Once again, illustrative diagrams do not arrive with portraying anything we see in reality. They use a "lifelike" way to communicate diagrammatically.

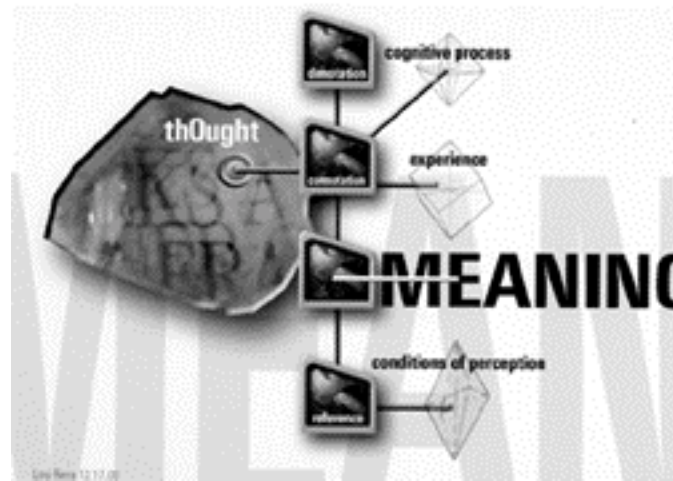


Figure 7. Illustrative diagram: Man's Desire, Peter Storkerson (2002).

## NOTES

<sup>1</sup> Parts of this section appeared in "Portrait of a Woman, or Diagrammatic Modeling in Art", in *Semiotics 1999: Proceedings of the Semiotic Society of America*, Eds.: Scott Simpkins, John Deely, and C.W. Spinks, New York: Peter Lang Publishing, pp. 360–373.

<sup>2</sup> Parts of this section appeared in "Shortcuts to Meaning, or Diagrams and Making Sense Out of Image-text De-signs", in *Semiotics 2000: Proceedings of the Semiotic Society of America*, Eds.: Scott Simpkins, John Deely, and C.W. Spinks, New York: Peter Lang Publishing, pp.142–159.

<sup>3</sup> For thorough explanations of the iconic nature of mental representations of thoughts see writings of C. S. Peirce (§ 2.247; 2.281; 2.282; 2.314; 3.363; 4.448; 4.544).

<sup>4</sup> Parts of this section appeared in “Shortcuts to Meaning, or Diagrams and Making Sense Out of Image-text De-signs”, in *Semiotics 2000: Proceedings of the Semiotic Society of America*, Eds.: Scott Simpkins, John Deely, and C.W. Spinks, New York: Peter Lang Publishing, pp.142–159.

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