Design as Meaning Making: From Making Things to the Design of Thinking
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Overview

This paper redefines design based on the realization that communication design, first and foremost, concerns meaning. It distinguishes between intended, constructed, and received or re-constructed meaning. Design is the activity that directs the process, and enables the correspondence between the three. By focusing on received meaning, it shifts design paradigm, from a preoccupation with designing objects for certain uses to focusing on the cognitive processes that underlie the reception of those designs. It defines designs as cognitive interfaces that enable reconstruction of intended meanings. Its approach stresses the semiotic relations between perception and meaning construction to explain the perceptual and cultural codes involved in communication.

The position presented here redirects the perceived ground for design away from objects themselves, as independent from mind, toward the conceptual characteristics these objects embody as a means of communication. It redefines designs from finite, fixed objects of aesthetic and practical consideration to semiotic interfaces enabling the reconstruction of meaning by receivers. It challenges the fixation of designs on aesthetic justification by shifting attention to the semiotic functions of cognitive interfaces. Thus, design is approached as a semiotic phenomenon, which is dependent on cognitive and developmental processes, and which coexists with cultural codifications comprising collective and individual environments.

Design draws upon the concept of diagrammatic reasoning, and proposes that all designs be regarded as diagrams of mental maps of individual and collective cultures. Its focus on the diagrammatic nature of knowledge presentation necessitates the emergence of intelligent design as informed by a rational selection and a combining of visual syntax to induce specific inferences followed by subsequent behaviors. Communication designers historically have not had adequate rational tools to bridge the gap between meaning and design decisions at the level of design form manipulation. The reliance on aesthetics and style is symptomatic of this gap. This paper demonstrates the possibility of bridging that gap.
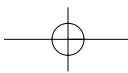
From Data to Information
Such statisticians as Tufte, Tukey, Karsten, and Bertin brought statistical terminology to design. As a result, the notion of data has come to the core of graphic presentation. It generally has been accepted that "graphics reveal data."[1] Such a view implies that the data has a meaning, and that the task of design is merely to make it available. Indeed, this view is shared by a majority of design community. However, this judgment must be reexamined by addressing the distinction between data and information. Data per se is meaningless. It merely is a collection of symbols/interfaces, which have been acquired as a result of an inquiry. To answer specific queries and become meaningful information, data must be organized.

The core of design or graphic presentation is not data per se, but information, that is, "what the graphics are doing or saying."[2] This distinction stresses the fact that the essence of graphics lies not somewhere outside design, that is in data, but in the design itself. What designers do is to create relationships among singular symbols. They define and interpret conceptual relations by virtue of selecting and organizing data. It is these conceptual relations that the data is being used to communicate, which are the core of graphic presentation. Namely, it is information.

So what is information? How can we define "what the graphics are doing or saying"? Is it the same as the content of a design? Is the content of a design the same as the meaning of a design? In design literature, content is interchangeably referred to as "information," "data," "message," "subject," and "meaning." The differences in names are the result of differences between terminologies specific to the domains from which these terms were borrowed. Although the names might differ, the approach to them remains the same. They all share the same implication: content is viewed as static and predetermined. The designer's role is to provide the form needed to make a predefined content/ information/data/meaning, and message perceptually accessible in other words, to translate from one form to another.

The content is thought of as separate from form, and multiple designs are seen as equivalent in terms of content. In this view, any design of content is considered an expression of the designer's "creativity." Designers and clients often share this view. That is why designers commonly are perceived as form providers, or incarnates of contents. Although designers feel that their role in the communication process entails more than mere shaping, they lack both the vocabulary and theoretical guidance to justify that claim. Therefore, we continue our inadequate discourses about clients providing contents and designers providing appearances.

For instance, the International Institute for Information Design describes information design as "the defining, planning, and shaping of the contents of a message, and the environments in which it is presented, with the intention of achieving particular

1   Edward R. Tufte, *The Visual Display of Quantitative Information* (Cheshire, UK: Graphics Press, 1983), 14.
2   Peter Storkerson, *Diagrams and Narrative* (A lecture delivered at the Institute of Design, Chicago, IL: Illinois Institute of Technology, 1996), online publication (http://home.tiac.net/~pstork).
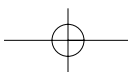
objectives in relation to the needs of users."[3] This definition, as well others using the same approach, does not consider the essential influence of the designer on the content. In other words, by not dealing with the relationship between form and content, it over-looks the impact of formal or sensory dimension on semantics. Design needs to be freed from the preoccupation with appearances, and advance to an alternative theoretical model, which relates physical form to cognition and comprehension.

Design as Meaning-Making
This paper proposes such a model for design by borrowing from cognitive semiotics. There are two reasons why cognitive semiotics offers potentially good results. First, it is focused on bridging the gap between form and meaning making or comprehension. Thus, its method of inquiry makes it well equipped for a discussion of symbolic-cognitive human phenomena such as communication. Second, it is compatible with the concerns of design regarding the construction of communications. Cognitive semiotics is a study of signs, which are considered mental activities, or the essential units of thought and meaning. The notion of "semiotic" (function or aspect) is defined here as a cognitive phenomenon operating symbolically to generate meaning. It may be a matter of preferences to define communication in semiotic terms "by force of being constituted and regulated by systems of signs,"[4] while the broadly respected approach to design is based on rhetoric, by virtue of persuasiveness of speech and apparent effectiveness of tropes. We apply the cognitive-semiotic model because it not only allows for a corporeal and cognitively grounded intelligibility of form, but it also embraces rhetoric. "The whole of human experience, without exception, is an interpretive structure mediated and sustained by signs."[5] Signs are designs are cognitive interfaces. So defined designs imply and require the participation of the receiver. By stressing the cognitive nature of the design's mediating function, we are bridging physical form and comprehension. In the extreme, this position implies that designs are not designs unless there is a receiver.

Having said that, let us conceive of design as a trigger, and not as an object. Let us approach design as an interface for meaning making, or simply the design of meaning. "Meaning" stands for a thought induced in the receiver, which is originated by the contact with a design. Designs can be simple or complex in their material and conceptual structure but, as wholes, they are interfaces. Why is this so? Let us look at what actually happens when the receiver infers meaning from the design. When the receiver faces a reasoning task, such as the reconstruction of the meaning of a design, she/he organizes—consciously or not—the physical patterns into patterns of relations. So it is in the patterns of relations, or in "gestalts," that the receiver finds the meaning, and not in individual signs for and in themselves.

3   Peter Simlinger, ed., "IIID News, Newsletter of the International Institute for Information Design" (No. 3, March 1996, Vienna): 4.

4   Richard Lanigan, *Phenomenology of Communication: Merleau-Ponty's Thematics in Communicology and Semiology* (Pittsburgh, PA: Duquesne University Press, 1988), 176.

5   John Deely, "A Context for Narrative Universals, or Semiology as a Pars Semiotica," *American Journal of Semiotics,* 4: 3–4 (1986): 57.
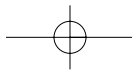
The consequences of defining design as the receiver's meaning- making are enormous. It forces a paradigm shift from focusing on designing things to focusing on designing thoughts or inferences. Those thoughts are interpretive, and they result in subsequent behavior. This behavior can be empirically tested to provide insights about the effectiveness of designs. For example, empirical studies can be conducted to measure the meaning of designs, and thus build a body of knowledge that supports the practice of design. In this model, which is geared toward understanding the cognitive processes that drive meaning making, comprehension and remembering of designs is measured and evaluated. The concept formation model of communication[6] has been shown to be successful in testing cognitive processes involved in communication design. It is based on the premise that, by testing what receivers remember about the designs, we can gain insight into how receivers comprehend them.

The content of a design no is longer sought in the artifact itself. It becomes a receiver's thought, which is constructed through the receiver's contact with a design. As such, it is created and owned by the receiver. Without the receiver's inferring the meaning, there would be no content, nor a design. This meaning owned by the receiver is not necessarily equivalent to the content as sent. The design becomes an interface, which triggers the emergence of such content in the receiver's mind. This model empowers the role of the receiver by acknowledging her/his essential participation in a communication process. Once again, it defines design through the receiver's (cognitive and intellectual) act of reasoning.

We can think of a meaning as the product of a dynamic and a dialectic process, which interrelates and binds three agents: a designer, a design, and a receiver, as an individual and a collective. Meaning undergoes three stages of development. At the first stage, there is an intended meaning, which is encoded into the design itself. The designer defines intended meaning. The received meaning is not developed until the receiver comes into play. Technically speaking, there are as many proper meanings of the design as there are reconstructions of it, but they share a certain denominator common to all receivers. That holds true for effective designs. The reconstructed meaning is developed at this final stage of the semiotic-cognitive sequence. This mental construct in a receiver's mind is what we call the meaning or content of design. It is created and owned by the receiver and is multiplied with every interpretation of the design.

But the receiver is not in full or arbitrary control of meaning. It is induced in the receiver, by the design and specified by its structure. The more strategically successful the design is, the more accurately and consistently does it trigger similar thoughts in different receivers. These thoughts, in turn, cause the receiver to respond to the design in a certain way, and thus define its effectiveness. Unless the receiver comprehends the design as projected, the design is

6   Peter Storkerson, *Information and Concept Formation,* IIID Expert Forum for Financial Services, (New York, April 2002), online article (http://home.tiac.net/~pstork).
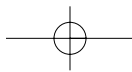
unsuccessful or ineffective. Therefore, the designer shares responsibility with the receiver for the proper meaning, although it is created and owned by the receiver.
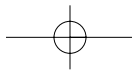
Thus, the static notion of a content that is literally and explicitly expressed in the design is replaced by the dynamic notion of design as inducing and guiding cognitive processes in the receiver. Content, as conceived within the frame of the static paradigm, becomes a dynamic result of mental processes. It is as dynamic as is the dialectic mutuality of the exchange between a design and a receiver. In this semiotic-cognitive model, the design content changes from an object to a cognitive process. That is exactly what must happen if design is to succeed as a profession in the service of human communication. Building a meaning-based model of design removes the fixation on produced things, and focuses attention on the human cognitive processes of communication. Consequently, the physical products of design such as mailers, books, packages, manuals, diagrams, and machine or computer interfaces all can be seen as interfaces that enable and guide the receiver in creating his/her own inferences and subsequent behaviors, as triggered by contact with the design.

The concept of design as an interface has gained prominence in the multimedia and virtual reality fields, but has not been accepted yet by the rest of the design world. In a semiotic-cognitive model, designers are enablers providing interfaces, no matter what material shape they may take. Anything that is designed is a semiotic interface, because it is a sign that triggers responses in receivers. Designers' design interfaces as bridges enabling the receiver's transition from one or any of a number of mental states into other ones. The designer takes responsibility for the effectiveness of the design when she/he employs strategic thinking and planning to construct cues to its meaning in the receiver. This model stresses the importance of the rational and cognitive foundations of the design. It seeks verifiable answers to the following questions: What sensory-cognitive mechanisms enable transitions from the physical to the mental, and from the mental to the physical? What can serve as guides for the designer in choosing the sensory cues for triggering the appropriate mental states in a receiver? And finally, what kind of a semiotic structure does the design produce?

Design as Diagrammatic Modeling
Our connection with the environment is cognitive, therefore it is determined by the capacities of cognitive faculties, corporeality, and the interactive nature of the relation. During the evolutionary and developmental process of individuation, humans have developed models for cognitive and functional connection with the world. That is to say, the mapping of the sensory experience develops in accord to perceptual, intellectual, and operational schemas. They are "schematic structures that constantly are operating in our percep-

tion, bodily movement through space, and physical manipulation of objects."[7] *Those schemas, including image-schemas, are preconceptual plans or patterns of our expectations, anticipations, and conceptualizations of our interaction with environment. We can think of them as dynamic models for our organizing of perception and experience, which allows us to make the world intelligible. The modeling entails relating otherwise unrelated things, events, or states. 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.*

"A schema consists of a small number of parts and relations, by virtue of which it can structure indefinitely many perceptions, images, and events."[8] *That is to say, there are basic units of information/meaning which are constituted by relations. These schemas operate diagrammatically. They are internal or mental diagrams that are general and abstract enough to allow us to make connections among the richness and the variety of particular and concrete things, events, and states in the world. They are mental maps of our thinking. In order to communicate and to expand these models in some ways, we have developed external diagrams as modes of representation such as mental, acoustic, graphic, or mixed.*

The meaning-making strategies, or the ways that we make sense of our experiences, largely are unconscious processes of mapping "sensory experience onto the inner world of cognition via metaphor."[9] *The metaphoric nature of that process refers to the "understanding and experiencing one kind of thing in terms of another."*[10] *It describes the parallel (metaphoric) nature of the modeling process. For designers, the entailments of this mapping are intimately, if only intuitively, known. For example, the metaphor of navigation through the virtual space is taken from our experience of sailing. Going through the pages of what actually are screen presentations derives from the experience with printed books. High or low impact of a design on a client is marked by experience of throwing objects. "Mood is an environmental state (as in 'I'm feeling under the weather')."*[11] *The challenge is to turn intuitive knowing into the analytical and rational knowledge of visualization and meaning-making in order to produce predictable results, and thus to ensure the effectiveness of design.*

Mental models can undertake different forms, such as iconicity, indexicality, and symbolicity. For instance, "perfumes are artificial icons of animal smells indicating sexual arousal or interest."[12] *Perfumes symbolize elegance and femininity as well. Designs as external diagrams may acquire any modeling form. Consequently, designs vary on the scale of degrees of diagrammatic schematization. That schematization varies depending on the design purpose,*

7   Mark Johnson, *The Body in the Mind: The Bodily Basis of Meaning, Imagination, and Reason* (Chicago: The University of Chicago Press, 1987), 23.
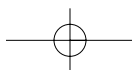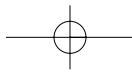
8   Ibid., 29.

9   Marcel Danesi, *Messages and Meanings: An Introduction to Semiotics* (Toronto: Canadian Scholars' Press Inc., 1993), 121.

10 George Lakoff and Mark Johnson, *Metaphors We Live By* (Chicago: University of Chicago Press, 1980), 5.

11 Marcel Danesi, *Messages and Meanings*, 121.

12 Ibid., 26

medium, and the subject matter. It also varies with regard to the taxonomy of semiotic space in which they participate. For instance, geographic maps are indices. As indexical diagrams, they are designated by the correspondence between the proximities of actual geographic locations and their graphic signifiers.

In Neisser's view, the origin of concept maps is in orientation:[13] the concept map represents a gestalt of which only a fraction is perceived at any one time. For instance, knowing where one is entails a sense of what is around the corner. Cognitive mapping applies equally to concrete or spatial-temporal, and abstract realms. Thus, the correspondence between the mental pattern or a cognitive map (internal diagram) and its representation (external diagram) defines different forms of expression, including different degrees of schematization and abstraction, such as "pictorial, hieroglyphic, alphabetic, schematic and, ultimately, algebraic."[14]

Artifacts express mental models. They reflect knowledge in a given point in time and space.[15] Namely, they were created and shaped by designers to communicate specific ideas and/or to perform specific functions. To no small extent, they are limited by the historicity of designers, and of the design goals and technologies with which they were intended as interface. Design relies on the selection and schematization of sensory characteristics in order to enable receivers to conceive of something quite beyond what is actually seen. Thus, the design is a diagrammatic guide for the imaginal construction of a meaning: concept or entity. Design is mapping in the diagrammatic sense (figure 3).

Consequently, design develops diagrammatic representations of mental maps. In other words, the design process is the process of actualization of mental (internal) diagrams that takes place on two planes: on a mental plane of thought-shaping, and on the material plane of its sensory (external) counterpart. Design brings into existence mental diagrams of our conceptualizations about objects and events. These planes constitute the two modes of the diagrammatic modeling of thinking. They define the two aspects of the meaning-making process, which entails diagrammatic reasoning and its representation. We can think of a reasoning itself, which involves making conceptual relations by spatial means, as of "'mapping' in its hypothetical sense."[16] Correspondingly, the design is the mapping in its actual sense. Therefore, it is a process of representing conceptual relations by spatial means in a graphic or other medium. 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.

13 Ulric Neisser. *Cognition and Reality: Principles and Implications of Cognitive Psychology* (San Francisco: W. H. Freeman and Co., 1976), 111.
14 Floyd Merrell, "Model, World, Semiotic Reality," in *On Semiotic Modeling,* M. Anderson and F. Merrell, eds. (Berlin and New York: Mouton Gruyter, 1991), 263.
15 Fernande Saint-Martin, *Semiotics of Visual Language* (Bloomington: Indiana University Press, 1987), 111.
16 C. W. Spinks, "Diagrammatic Thinking and The Portraiture of Thought," in *On Semiotic Modeling,* M. Anderson and F. Merrell, eds. (Berlin and New York: Mouton Gruyter, 1991), 446.
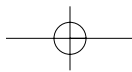
Figure 1
A Woman in the Land of Dixie, designer, Elzbieta Kazmierczak, 1999, front (a) and the back (b) of the book cover.

Designs as Shortcuts to Meaning
Designs are shortcuts through and to meaning. They rely on the mutual reinforcement of pictorial and textual components, which takes advantage of cognitive differentiation between the processing of different types of sensory information. They "show" what is meant, and thus benefit from the efficiency with which humans process visual information. Linguistic messages are processed more slowly, since they require sole intellectual processing which takes longer. Graphic diagrams represent the way humans think, and therefore they are comprehended quickly. Not surprisingly, they are well-suited to different learning styles.

Designs do not represent objects as they are in and for themselves. They are schematics. Designers strategically bring into designs only those aspects of the object that are essential to the design objective. Thus, the design process is driven by the dichotomy of chosen versus rejected characteristics of an object. Consequently, designs do not rely on lengthy descriptions or specifications, as do textual communications. Instead, they provide selections of sensory cues necessary for the immediate grasping of an adequate interpretation. Graphic diagrams provide a geographical overview of relationships among corresponding relevant concepts. They are sensory schemas for the comprehension of conceptual relations.

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 an almost intimate closeness of the modeled relationship. As such, it represents all that is needed to convey the dichotomy between the two opposite elements. The designer has developed a schematic picture of the face in order to provide a diagrammatic model of the female-to-female relationship. There also is an overtone of a possible reading that the two profiles might be male ones as well. That does not impair the design. On the contrary, it supports it because a male
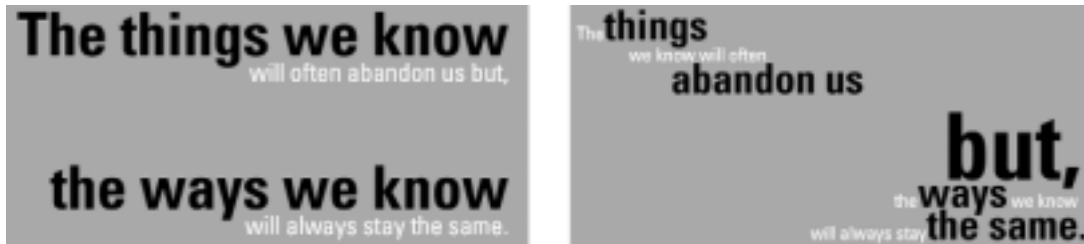
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Figure 2 (a) and (b)

Design maps of a sentence. Different spatial arrangements trigger different reconstructed meanings in a receiver. Author Peter Storkerson, 1999, designer, Elzbieta Kazmierczak, reprinted with the author's permission, © Copyright 1999.

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, the two profiles are in opposition, perhaps even in confrontational opposition, while on the back cover, 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 a specific response in the viewer. The receiver is to infer that the significant change of the relationship between heroines has occurred during the course of the book.

To make the development of the diagrammatic model function successfully as a graphic shortcut requires that the designer employ strategic thinking and planning. It frequently is overlooked that the very selectiveness of mental mapping requires intellectual discipline and reductive reasoning. Consequently, viewing the design process as an extension or result of 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 reconstruction 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 guided by its visual hierarchy. The viewer's reading of the diagram always is nonlinear, 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 the reading of diagrams.

Pictorial elements, especially those with a high degree of generalization, require linguistic support to specify referents. In this sense, diagrams are conceived as open to different readings, but those readings are limited by the logical possibilities afforded by visual syntax. The designer's strategy is to make "an intentional organization of its field of possibilities"[17] to guide the receiver. At the heart of diagrammatic models are visual relations as ways of thinking. The linguistic elements specify referents. The pictorial/graphic elements specify relations. The same applies for pictorial elements with a low degree of generalization, and a low degree of

17   Umberto Eco, *The Open Work* (Cambridge: Harvard University Press, 1989), 100.

Figure 3
Example showing Gestalt law of visual grouping. In arrangements we look for simplest shapes. Thus, we interpret this arrangement as two partially overlapping squares, and not as a square and an irregular figure.

schematization, such as realistic images or photographs. For instance, different titles specify different referents and, thus, different readings of the same picture. Mona Lisa will "read" differently, in an art history book, in a costume design book, or in a teenage girls magazine as an example of poor makeup.

Perception and Thinking
Unlike many objects in life which exist for themselves (trees or animals), 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 with a certain functional value. Design creates objects to be experienced in particular ways (tools, books, and computer screen trash can icons). Once their identity is understood by receivers, objects of design are "seen as," and they are "expected" to "behave" in certain ways. "Seeing an object 'X' is to see that it may behave in the ways we know 'Xs' do behave: if the object's behavior does not accord with what we expect of 'Xs' we may be blocked from seeing it as a straight forward 'X' any longer." [18]

In a general sense, perception always is guided and filtered by attention/motivation, which guides comprehension. Meaning is embedded in the praxis of experience.[19] It is a derivative of our connection with the environment. Comprehension is guided not only by preconceptual, perceptual schemas, but also by cultural models. By virtue of defining objects in life, humans define frames of expectations of design objects. Depending on the filter or the frame of reference, the same object may play different 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. At the extreme, when a receiver is confused by contradictory or unclear guidelines for comprehension, she/he can perceive an object as something other than intended by the designer. These are situations in which receivers use designs in the "wrong" way. It is the designer's role to provide a receiver with proper guidelines for the comprehension of a design. In other words, the designer creates, simulates, or represents an intelligible object of design by presenting qualities that will cause and fulfill certain expectations. This also applies to the design of processes and behaviors.

Design creates objects to be understood in particular ways. Competent receivers know this, especially in media-savvy cultures. Receivers are methodically reading the designs with the expectation that these designs were meant to be read, and that they were intended to have a significance or "content" that is greater than, and different from, the subject matter presented. The problem for a designer is to trigger an appropriate contextual frame in the receiver for constructing meaning. Certainly, part of this process can be

18 Norwood Hanson, *Patterns of Discovery: An Inquiry Into the Conceptual Foundations of Science* (Cambridge: Cambridge University Press, 1965), 22.
19 Charles Sanders Peirce, *Collected Papers* Charles Hartshorne and Paul Weiss, eds. (Cambridge: Harvard University Press, 1931–35), vol. 5, 402.
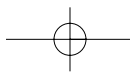
handled by social conventions such as genres, but much of the process must be handled in ways that there are perceptual and intuitive, such as visualization.

There are two aspects of graphic diagrams that are important to visualization of conceptual structures. First, the logic of visual syntax (formal relations) guides the sequence of the reading of a diagram. Second, diagrams are gestalts and, as such, fall under the laws of visual perception. In other words, besides being objects for communication, diagrams are objects for cognition. As spatial models, they create sensorial configurations which operate semiotically to communicate conceptual relations. Therefore, graphic diagrams operate through visual cognition.

Gestalt psychology describes the laws of visual grouping, explaining that the whole of the visual arrangement determines the perception and comprehension of its components. Perceptual processes operating according to perceptual schemas orient us to physical reality and function consistently across cultures. For example, in figure 3, one square appears behind the other. Once we grasp a configuration, that comprehension encompasses and specifies the structural relations inside it. Thus, we perceive gestalts top-down or general-to-specific. Graphic diagrams are holistic and synoptic, like any other sensory arrangement, in the sense that they are always perceived as wholes or gestalts. A receiver looks for a familiar pattern to decide about the relations within it. Specifically, the receiver looks for the meaning of the design elements upon comprehending the whole first. Gestalt psychology explains why diagrams enable top-down comprehension of unfamiliar content and support the remembering of complex relations. When applied as teaching or learning aids, diagrams are excellent tools for facilitating meaningful learning and remembering of the unknown material.[20] Graphic diagrams provide spatial models of conceptual structures, and thus facilitate understanding and the remembering of otherwise difficult to grasp concepts.

Graphic diagrams accomplish so much because they materialize the spatial and temporal ways in which we think. In graphic diagrams, "the spatial relations between their tokens share logical properties with relations between denoted objects."[21] That is to say, there is a direct mapping between conceptual relations and relations shown in graphic diagrams. As a result, in diagrams, "certain inferences are somehow more immediate, or even are automatic," and "conclusions appear 'for free,' as compared with textual systems where a logical inference must be made to produce the conclusion."[22] In figure 4, we see the most rudimental diagrammatic notations of basic conceptual relations: connection, overlap, mutual causation, clustering, and inclusion. Once again, they show us what they mean. They operate not by resemblance to appearances. They are visual representations of diagrammatic reasoning, operating according to the rules of visual logic guided by perceptual schemas.

20   Charles D. Holley and Donald F. Dansereau, eds., *Spatial Learning Strategies: Techniques Applications and Related Issues* (Academic Press Inc. Harcourt Brace Jovanovich Publishers, 1984), 14.

21   Corin Gurr, "Combining Semantic and Cognitive Accounts of Diagrams," in *Diagrammatic Representation and Reasoning,* Michael Anderson, Bernd Meyer, and Patrick Olivier, eds. (London: Springer-Verlag London Limited, 2002), 128.
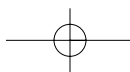
22   Ibid., 131.

Figure 4
Concept diagram of mental relations: connection, overlap, mutual causation, clustering, and inclusion.

Figure 5
Directional nature of an arrow.

Figure 6
Directional nature of a triangle.

Therefore, in spite of the theoretically unlimited possibilities of assigning meaning to abstract shapes, an arrow lends itself for use in those situations in which the logic of the syntax of an arrow is applicable. In short, an arrow always implies a specific direction, motion and, thus, possibility for transition (figure 5).

It is important for a communication designer to be acutely aware of the semantic entailments of graphic shaping. She/he must keep in mind that the changes in the sensory organization of gestalts create different patterns for recognition. Different sensory configurations are recognized as different signs (diagrams), which may involve different interpretations, or inferences. For instance, a change in the position of the same triangle always changes its indexical function. It points toward a different direction every time it is turned (figure 6).

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 movement 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. Once again, meaning is embedded in the praxis of experience.

A Family of Graphic Diagrams
The graphic page itself is diagrammatic. The spatial coordinates of height and width define it. This plane maps our position in the world, which is mapped in relation to our orientation within four directions. Geographic directions—north, south, east, or west—or corporeal directions—forward, backward, right, or left are mapped onto the plane of a graphic page as up, down, right, and left. In this context, it is easier to see the diagrammatic nature of text layouts, which are diagrams as well.

The "meridian" poster (figure 7) is a concept diagram for connecting fragments of information on a topic. It uses the code of symbolic representation by integrating text as if it were an image. The complexity of the architecture causes the viewer to consider syntactic relationships as guides to semantic associations of texts.
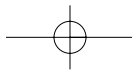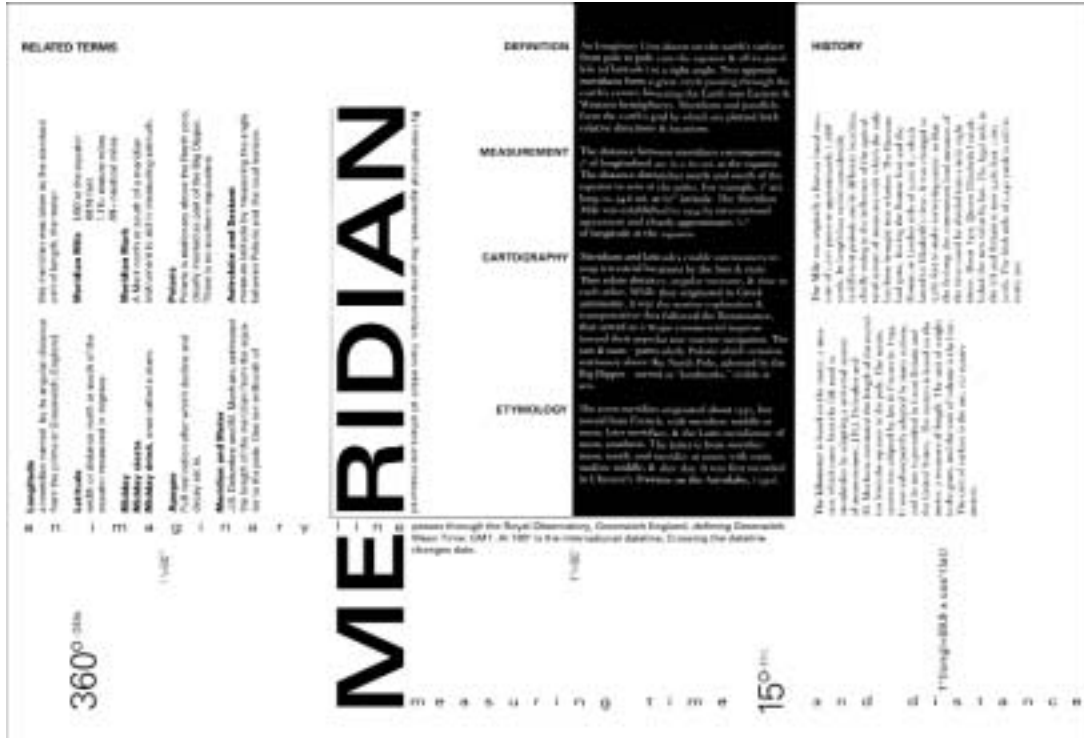
Figure 7
Concept diagram: *Meridian,* designer, Peter Storkerson, 1993, 12" x 18," is reprinted with the designer's permission, © Copyright 1993..

Figure 8
Indexical diagram: street map.

The viewer is guided to make conclusions about conceptual relations using cues from visual syntax or composition. That is because sensory proximity and perceptual dynamics determine what we link together. Whatever we link sensorially, we can link conceptually. Height and width correspond to the surface of the earth. The visual syntax leads the viewer to combine texts and, in doing so, to build a semantic field or topic. The rules for reading texts are not explicitly stated. Instead, they are indicated by a complex logical layering of information according to proximity and directionality.

Figure 8 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 9 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.

Illustrations are diagrams in disguise. They may not look like diagrams, but they work diagrammatically. Figure 10 is an illustrative diagram. It uses the convention of realistic representation of mechanical projection of photography. This is not a portrait of a
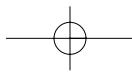
Figure 9
Indexical diagram: projection of the South
Pole in a global context.

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
us about the conceptual relation between the man's desire and the
cake.*

*A frequently used practice in diagrammatic modeling is to
bring together mutually excluding viewpoints such as, for instance,
in polar projections (figure 9), or in the editorial illustration in figure
11. Here the receiver is confronted not with a portrait of a man, but
with the diagrammatic representation of the personality shattered
by the addiction. The pulling of the contradictory forces inside the
head is visualized literally by the strings hooked to the head. There
also is a blend of mutually excluding viewpoints. The image simul-
taneously shows the views of the outside and the inside of the head
of an addict. Once again, illustrative diagrams do not portray
anything we see in reality. They use a "lifelike" way to communi-
cate diagrammatically.*

*Another illustrative diagram, (figure 12), an assemblage art,
relies on our knowledge of physical relations—shapes, movement,*

Figure 10
Illustrative diagram: *Man and Desire*, artist,
Peter Storkerson, 2002, 12" x 9". Reprinted
with the artist's permission, © Copyright
2002

Figure 11
Illustrative diagram. *Addicted,* illustrator,
Steve Mayse, 1996, cover illustration for
Physician Magazine, mixed media,
30" x 22" x 8". Photographed by Randy
Jacobson, Kansas City.

Figure 12
Illustrative diagram: *Night of Hope,* artist,
Steve Mayse, 1998, 60" x 40" x 10".
Photographed by Randy Jacobson, Kansas
City.

and support—to build symbolic relations. For example, the wooden lattice makes "hope" a ladder leading to the hand, which supports and balances "the night." In a synoptic overview, the design forms an upward arrow. The linguistic component "a night of hope" provides the referent for the ladder, thus, giving the receiver the cues for the referential meaning of the arrangement. The richness of this type of image design stems from the dual nature o fits elements, which are simultaneously physical and symbolic. This promotes in the viewer, alternative readings—symbolic and mimetic—in dialectic alternation.

To summarize the experience of designing diagrams, let us gather the designer's "tenets" of diagrammatic modeling:

1 *Designs vary on the scale of degrees of diagrammatic schematization. That schematization varies depending on the design purpose, the subject matter, and the medium used.*
2 *Designs vary with regard to the taxonomy of semiotic space in which they participate. Thus, the correspondence between mental diagrams and their graphic representations motivates different forms of diagrammatic expression such as indexical, illustrative, flow chart, and concept.*
3 *In a reductive, condensed, and synoptic way, they show only those features and aspects of objects or events which guide the receiver's involvement.*
4 *Graphic diagrams: (1) depict relations and 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.*