Diagrams as Tools for Worldmaking

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In the introduction to J.J. Gibson's The Ecological Approach to Visual Perception, the author asks the reader ". . . to suppose that the concept of space has nothing to do with perception. Geometrical space is a pure abstraction. Outer space can be visualized but cannot be seen. The cues for depth refer only to paintings, nothing more. The visual third dimension is a misapplication of Descarte's notion of three axes for a coordinate system."[1] With this statement, Gibson challenges his readers to put aside the commonplace convention of space in order to better follow his argument. Likewise, this special issue of *Visible Language* on diagrams asks the reader to step aside from their conventional ideas about diagrams and to look beneath the surface.

Perceptual fundamentals: gains and losses

If we set aside an inventory of diagrams, any attempt to classify them or an analysis of their conventions, what is left? Where should we begin? It is tempting to begin with human physiology and cite the facts of foveal excitation, angle of vision or thresholds for contrast. After all the human system for visual reception of information is a given – it provides the constraints for what can be received. But this quickly becomes a reductive approach that remains on the diagrammatic surface and becomes a checklist of the obvious all the while slighting the dynamic nature of human perception. It also sets the stage for a stimulus-response approach that we know is limited.

Another model of more recent origin, the Shannon model of communication,[2] also needs to be side-stepped (*see figure 1*). Acceptance of this model returns us to the problem of limited channel capaciity and facts such as that the eyes can processs 10^7 bits/second while the ears process 1.5×10^6 bits/second.[3] Despite the external factual appearance of such information, the actual processing of data remains a black box.

Returning to Gibson,[4] we are reminded that we do not perceive or think with binary processes. He stated that there is a significant difference between ambient light reflected off surfaces in our environment – the stuff of perception yielding visual information – and radiant light, which at most transmits information about the atoms from which it originates. Gibson returns us to concepts that may seem obvious.

Man and the environment in which he lives are complementary with the components and events of the environment falling into natural units which are

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Figure 1 Claude Shannon's 1948 model of communication.

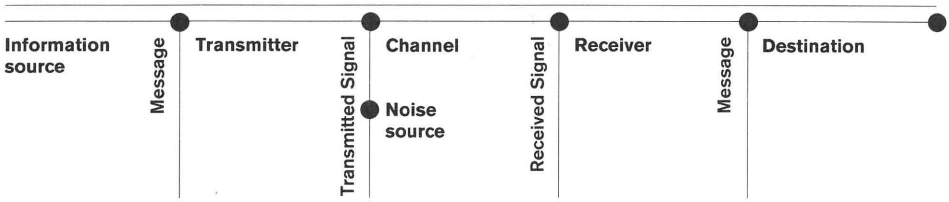
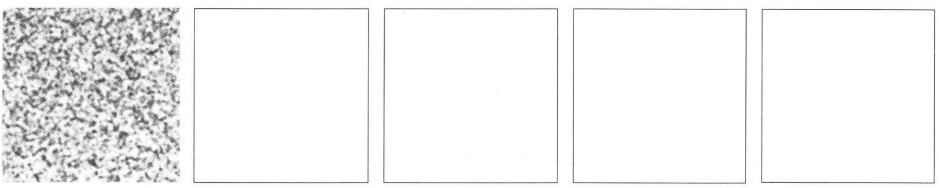


Figure 2 Expanding frames of perceptual reference.



5
Gibson, *Ecological Approach to Visual Perception*, 64.

6
Gibson, *Ecological Approach to Visual Perception*, 110.

7
Philip Morrison et al. 1982. *Powers of Ten*. New York: Scientific American Library.

nested – leaves on a tree in a forest in a geographical region, for example. The environment persists in some respects and changes in others.

- Man lives in a medium – the gaseous atmosphere – not in space. The surfaces within this medium persist or change in terms of texture, layout, property of being in light or shadow, for example.
- Man sees the unformalized, familiar geometry of surfaces – a surface is seen rather than the plane of a formal geometry. The fundamental ways surfaces are laid out have intrinsic meaning for behavior unlike the abstract, intellectual concepts of mathematical space.
- Man sees by virtue of ambient light. "The orthodox theory of the formation of an image on a screen, based on the correspondence between radiating points and focus points, is rejected as the basis for an explanation of ecological vision . . .The information that can be extracted from ambient light is not the kind of information that is transmitted over a channel. There is no sender outside the head and no receiver inside the head."[5]

With these observations, Gibson carefully provided the groundwork for what he called an ecological optics. It is interesting to note that Gibson was an advisor on the training of aircraft carrier pilots whose task was to precisely land a fast plane in a small space. This seems to have led him to his notion of perception as a flow of information rather than as a frozen "image." He defined perception as an act of attention. We attend to various events by observing changing optical information that disturbs the local structure of the array. He went on to tentatively state that the following indicate the visual changes to which we are most sensitive: deletion – accretion, shearing, transformation, magnification – minification, deformation, nullification and substitution.[6]

10^{-11}

Returning to the previously noted complimentary relationship between people and their environment, this idea merits closer examination. Figure 2, which borrows heavily from the book *Powers of Ten*,[7] shows how perceptual frames of reference have expanded from: the range of direct human interaction and experience (10^{-2} to about 10^{3}), to the world of minification (10^{-3} to 10^{-4}), to extreme minification (10^{-5} to 10^{-16}) and in the opposite direction they have expanded by human flight (10^{3} to 10^{7}), and through magnification (10^{3} to 10^{25}). Parallel to these changing scale relationships between people and the irvisible, kinesthetically experienced environment and the abstract and remote environment unavailable to the unaided eye, is the exploration of electromagnetic radiation far beyond the visible spectrum. This will not be developed further, but it serves as a reminder that the relationship between man and environment has shifted during the past five centuries from the tangible to the intangible with a concommitant expression in abstract language. This idea will be expanded upon later.

Gibson's theory of information pick-up emphasizes the dynamic qualities of an environment in a state of flux, with features that are variant or invariant, to which an active perceptual system attends through its own dynamic adjustments for orientation, exploration, optimization and extraction. We attend to change, the variant aspects of our environment and we attend to them directly rather than through the commonly supposed, highly mediated sequence of stages in figure 3. Information pick-up is the term favored by Gibson, it is the means by which direct knowledge of the world is obtained. This model side-steps such problematic terms as memory, a priori categories, sensory inputs and others.

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Figure 3 **Commonly understood stages in the act of perceiving an object,** redrawn from *The Ecological Approach to Visual Perception.*

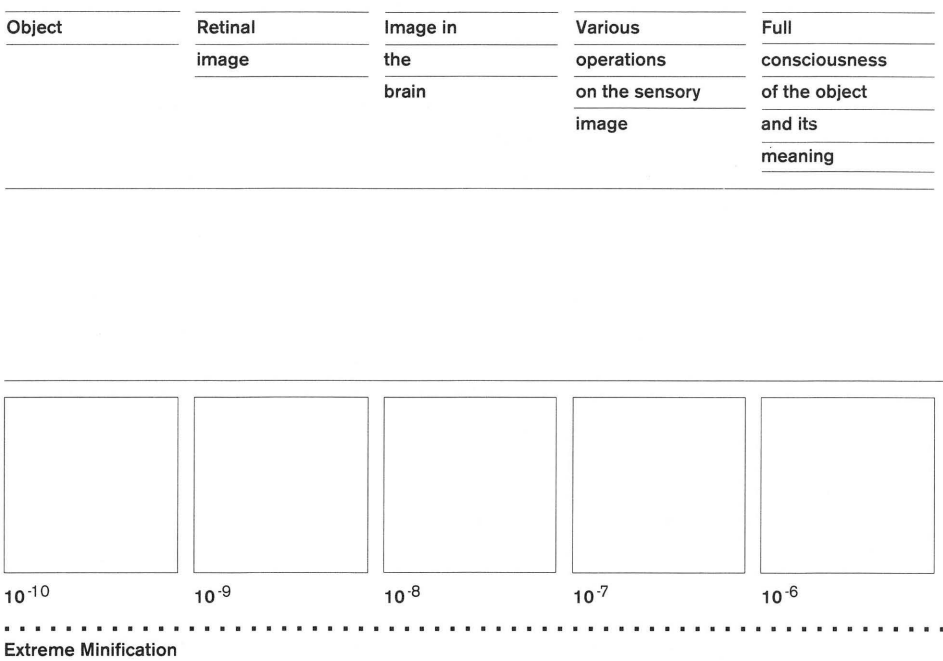


Figure 2, continued.

8
Gibson, *Ecological Approach to Visual Perception*, 253.

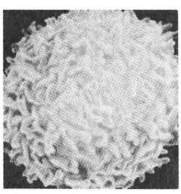
9
Gibson, *Ecological Approach to Visual Perception*, 244

10
Gibson, *Ecological Approach to Visual Perception*, 258.

11
Gibson, *Ecological Approach to Visual Perception*, 272, 273.

"Knowledge of the environment, surely, develops as perception develops, extends as the observers travel, gets finer as they learn to scrutinize, gets longer as they apprehend more events, gets fuller as they see more objects, and gets richer as they notice more affordances. Knowledge of this sort does not 'come from' anywhere; it is got by looking along with listening, feeling, smelling, and tasting."[8]

By afforances, Gibson means the usefulness, pleasure or aesthetic value that are the property of an interaction between an observer and an object – affordances are neither physical nor phenomenal. The relationship between perceiving and knowing are in a much closer and direct relationship in Gibson's theory than most philosophers would acknowledge. Gibson does make a distinction between direct perception and the facilitation of knowing mediated by some tool, such as instruments to extend our sight, the use of verbal descriptions and the use of pictures. He goes on specifically about picture-making: "Consider the human habit of picture-making, which I take to be the devising and displaying of optical information for perception by others. It is thus a means of communication, giving rise to mediated apprehension, but it is more like direct pick-up than word-making is. . . it can be pointed out here that picture-makers have been experimenting on us for centuries with artificial displays of information in a special form."[9]



10^{-5}

"Knowing is an extension of perceiving. . . Toys, pictures, and words are aids to perceiving. . . They transmit to the next generation the tricks of the human trade. . . The extracting and abstracting of the invariants that specify the environment are made vastly easier with these aids to comprehension. But they are not in themselves knowledge, as we are tempted to think. All they can do is facilitate knowing by the young."[10] And later, Gibson carefully develops a definition of a picture: ". . . a picture is a surface so treated that it makes available an optic array of arrested structures with underlying invariants of structure. . . A picture can only be seen in a context of other non-pictorial surfaces. . . A picture is a surface that always specifies something other than what it is."[11] Pictures record what its maker has noticed and considers worth noticing. This is done with invariants that have been observed in learning information pick-up.

In order to round out this relationship, a review of one of Gibson's examples puts perception and picture-making into a clear context. Of several examples, a simple one discussed a child's ability to identify the graphic presentation of a man in silhouette, as a paper doll or even as a stick figure. Gibson theorized that what the child identified were the invariants of head-body-arms-legs and that consequently images with these elements in the right relationships signaled "man." He went on to stress that pictures do not present sense data but present information. In his examination of children's scribbles and their early drawings, he saw the invariants of the visual world: straights, curves, angles, apexes, intersections, connections, parallels, coincidences, etc. These, in fact, are exactly the concerns of abstract art.

Communication theory revisited

A contemporary communication theorist, W. Barnett Pearce, reexamined communication and produced three insights:

- we live in communication
- communication is more complex than we imagined

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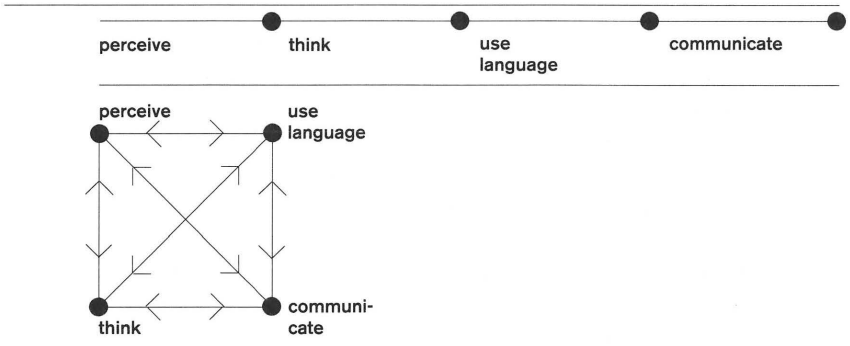
Figure 4 Comparison of linear and actively linked structures.



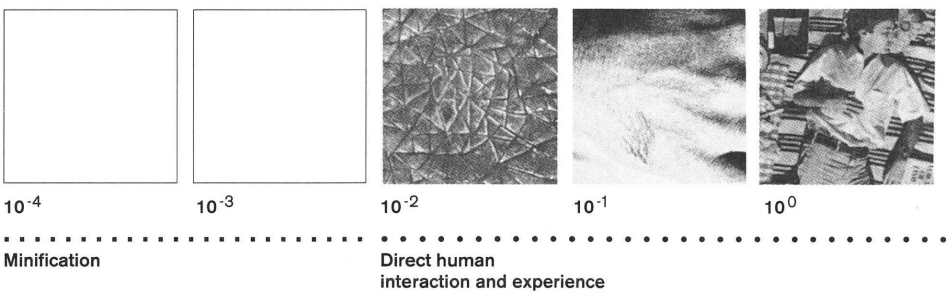


Figure 2, continued.

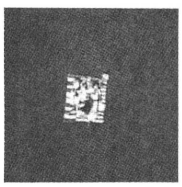
12
W. Barnett Pearce. 1989. *Communication and the Human Condition.* Carbondale, Illinois: Southern Illinois University Press.

13
George Miller. 1986. "What We Say and What we Mean." *New York Times Book Review,* January 26, 37.

14
Pearce, *Communication and the Human Condition,* 23.

- communication is more a way of thinking than an artifact to be produced or transmitted.[12]

This prompts us to question what diagrams are really about. Pulling back from the specifics of statistics, relational models or flow charts, for example, diagrams are about perception, framing thought in certain ways in relation to language and communication. These terms look deceptively simple, particularly printed on the page in linear fashion. It is easy to assume that these terms define four sequential steps: perceive, think, use appropriate language, communicate. Perhaps this sequence is an artifact of "reading" with its incessant linear structure (*see figure 4*). Communication theorists now look on earlier notions of how communication works as simplistic. Communication is usually taken as the transfer of meaning from one mind to another. Even theorists such as George Miller who early on embraced the engineering model of communication and was himself interested in channel capacity ("The Magic Number Seven Plus or Minus Two"), now believes the "post office" model to be in error. In this model communication involves ". . . wrapping an idea in words and sending it off to the other person, who unwraps the words and discovers the idea."[13] Miller observes that this model does not account for emotion, an ecologically important human attribute. Passing along the word happiness does not elicit the emotion of happiness in the recipient even though the message is clearly received. Three individuals reading a newspaper account of a political speech may become angry, amused or bored as they read the message.



10[1]

Pearce's reconstruction of communication concentrates on three terms: coordination, coherence and mystery.

- "Coordination names those practices in which persons attempt to call into being conjoint ennactment of their vision of the good. . . and to prevent conjoint ennactments of what they envision as bad. . . "
- "Coherence refers to the process by which we tell ourselves (and others) stories in order to interpret the world around us and our place in it. It specifically does not assume that these stories are an accurate description. . . "
- "Mystery stands in opposition to those who would attempt to impose an overrestrictive 'rationality' on the stories and the coordinated patterns of action in which we live. . . Mystery is at once a reminder of the fallability of the process of the social construction of reality, and of our emancipation from any particular set of stories and practices."[14]

All forms of communication practice involve the re(construction) and expression of resources. The resources are the various languages we use, verbal, visual, mathematical. It includes the pragmatics of use that we have observed as well as insight into extended or altered uses. Meta-systems with elements and relationships and rules also come into play. A major shift occurs when communication is not seen as a subset of human activity, but is conceived as a way of thinking about human action. We are, of course, limited by our own reference point. Gibson insists that we see ourselves in the environment – we see our hands and limbs, the shape made by our brow, nose and cheek – our personal frame for seeing the environment. In physics, an "exact" science, wave and particle theories of light co-exist, each anchors a subset of problems. Some contemporary physicists would propose that the physical world has a structure incomprehensible to our minds. "We are now approaching a boundary beyond which we are forever

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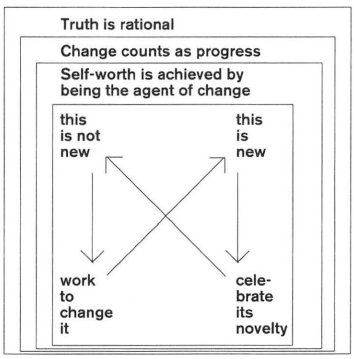
Figure 5 **Pearce's "strange loop of modernity,"** redrawn from *Communication and Human Condition.*



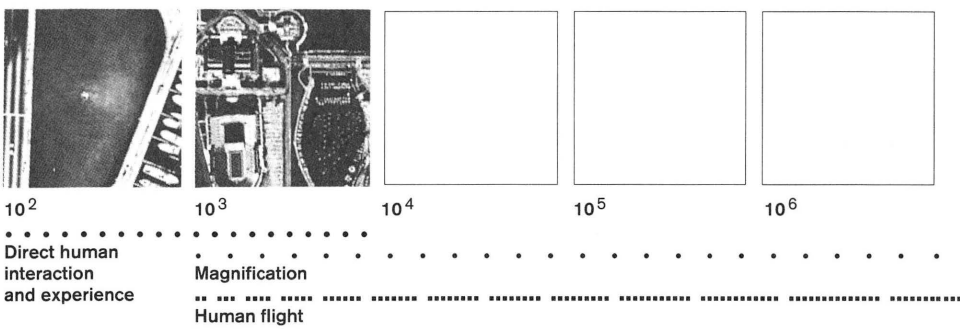


Figure 2, continued.

15
Jame B. Conant. 1962. *The Changing Scientific Scene 1900-1950.* Ed. Walker Gibson. *The Limits of Language.* New York: Hill and Wang, 15-28.

16
Pearce, *Communication and the Human Condition*, 133.

17
Pearce, *Communication and the Human Condition*, 145.

stopped from pursuing our inquiries, not by the construction of the world, but by the construction of ourselves."[15]

Because we are deeply enmeshed in specific forms of communication that are often both pervasive and invisible, models that present the cultural presumptions regarding communication are useful. Pearce presents four such models:

1. monocultural communication which concerns itself with communication within a homogeneous and closed culture (this need not concern us here);
2. ethnocentric communications, which make explicit distinctions between "us" and "them" and do concern us in the construction of diagrams;
3. modern communication practices that put resources and coordination at risk as the only constant is the expectation of change — these practices concern us for this is the prevalent context for diagram communication today; and
4. cosmopolitan communication which is a practice to which we might aspire — it stresses coordination through social eloquence.

Ethnocentric communication practices stem from unacknowledged constraints such as stereotypes and often lead to unanticipated results. A common theme in this model exalts the superiority of one's group and dismisses other groups as subhuman or barbarian. "Ethnocentric communication is robust, enabling particular patterns of resources and practices to perpetuate themselves in a complex, pluralistic world. The way of being human that it creates may include many types of artifacts and belief, some of which have great beauty and some considerable ugliness."[16]

Modern communication celebrates change. In figure 5, Pearce's "strange loop of modernity" is presented. "Coherence is stressed more than coordination. The primary moral injunction is to change resources and practices. . . this injunction is grounded in the notion of both truth and personal worth. . . the largest contextualization is foundationalism, here expressed as the belief that 'truth is rational.' Within this context, 'change' counts as 'progress' because it is assumed to make successive approximations of truth. Engaged in a collective quest for truth and control of the environment, individual worth is produced by being the agent of change . . . in which the individual is forever engaged in a process of creating 'new things'."[17]

There is a common feature in monocultural, ethnocentric and modern communication, it is that the goal of coordination is achieved by attention to coherence and mystery. Cosmopolitan communication shifts attention to coordination itself. Pearce cites three conditions that serve to propel the change from modern to cosmopolitan communication. They are: democratization, the communication revolution and disillusionment with modernity. While the first and last of these may seem self-evident, the reference to communication revolution requires expansion. The communication revolution is characterized by: the expanding technological means for producing cultural symbols, global communication and migration which puts into contact people who would previously have been oblivious of or blindly ignored each other — they are forced to acknowledge or even actively coordinate with people they perceive as foreign or exotic. Recent world events as reported by paper or television serve to underscore the increasing need for cosmopolitan communication. "The necessity for coordination has been made overwhelmingly clear by the history of this century. The result is a set of

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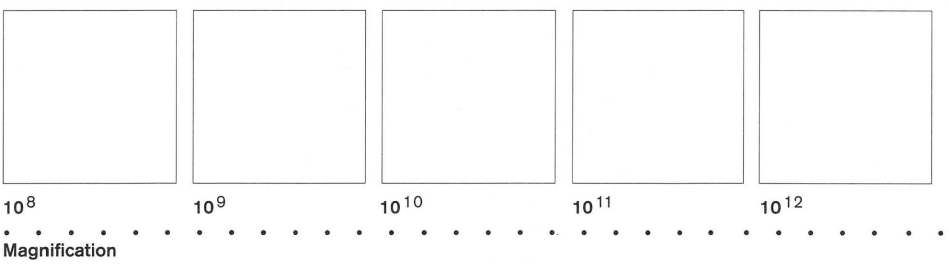

Figure 2, continued.

18
Pearce, *Communication and the Human Condition*, 171.

19
From a discussion with Dennis Livingston in Baltimore, August, 1989. Livingston frames his life and work as a social activist first, his role as a communicator creating diagrams is secondary.

20
Lupton, Ellen. 1990. Dennis Livingston: Social Graphics. New York: The Herb Lubalin Study Center of Design and Typography, 1.

social and material conditions that call for a way of communicating unlike any of those based on 'rhetorical eloquence.' They demand 'social eloquence'."[18] In practical terms what does cosmopolitan communication mean? Pearce describes a process he calls interpretive/critical research which is characterized by the following steps:

1. select an interesting set of practices characterized by conflict between groups,
2. describe the events in a neutral way,
3. learn to speak like a native to both groups,
4. describe the emerging logic of the interaction,
5. describe the interaction in the context of the resources of all participants as a system,
6. assess the opportunities for critique and intervention. This process allows for a transformation to occur in which the researcher does not take sides but achieves a suspension of belief, opening the way to entertain other communication options.

There is at least one person creating diagrams within the cosmopolitan context, Dennis Livingston, a social activist in Baltimore. He is an anathema to statisticians who carefully observe the logic and consistency of data collection and presentation. Livingston has stepped into the ambiguous arena of multiple data frames in his attempt to present the inter-relationships between larger cultural problems.[19] He found: "His ability to visualize abstract problems could be used to communicate ideas to people in an engaging manner, bringing life and urgency to stastistical figures. Visualization is a mode of understanding, of thinking as well as a mode of communicating: Livingston uses graphics to think through problems, to discover relationships within the data. The act of plotting figures on a graph or diagramming a process not only 'explains' what is already known but reveals new knowledge."[20]

Two of his charts demonstrate the power of his synthesis and the clarity he achieves regarding particular social problems. In the "Weatherization in Maryland" chart (*see figure 6*), he relates income, home-ownership, weatherization status of the dwelling unit and receipt of three forms of energy assistance: energy audit, energy loan or weatherization. The chart shows how few low-income households have benefited from any form of assistance, demonstrating the fact that too often well intentioned programs are established that never reach the intended constituency. "Social Stratification in The United States" also manages to chart many variables in a telling way: race, marital status, labor classification and income (*see figure 7, page 268*). It is clear from these two examples that Livingston advances his political interests in demonstrable ways. He seeks a larger conception of social and economic context rather than searching for satisfaction or utility in iso-lated fragments. Jeremy Campbell in *Gramatical Man*, identifies an important attribute of language that Livingston is taking full advantage of: "One important property of language is that, while its symbols may be used to bring about physical results in the real world of substance, they need not be used for that pur-pose. Symbols can be decoupled from physical reality to a greater or lesser extent. Words are not deeds, though they often lead to deeds. Symbols can be manipulated more freely than substance, and they can be

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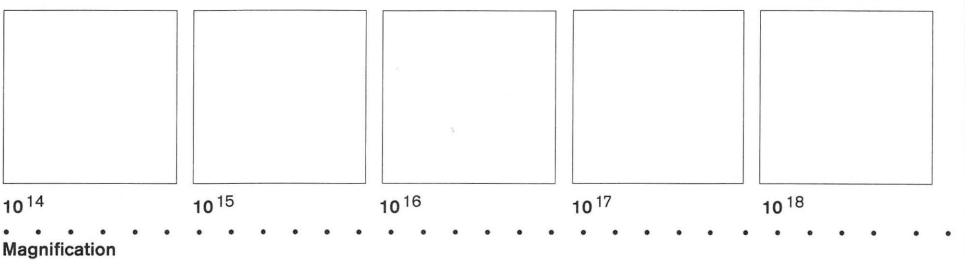

Figure 2, continued.

21
Jeremy Campbell. 1982. *Grammatical Man.* New York: Simon and Schuster, 91.

22
Nelson Goodman. 1978. *Ways of Worldmaking.* Indianapolis: Hackett Publishing Company.

23
Goodman, *Ways of Worldmaking,* 7.

24
Goodman, *Ways of Worldmaking,* 17.

manipulated to form new statements and expression which are only tentative, playful, figurative. Symbols are at liberty to be a little irresponsible and experimental."[21]

From a theoretical perspective, Campbell proposes that we explore with language – that we be wary of conventions that are not challenged. Livingston, from a social activist perspective, knows that the isolated context within which social and economic problems are addressed is senseless. He steps pragmatically into diagrammatic situations in order to challenge the conventions and the scholarly constraints that fail to provide insight into these problems. Both Campbell and Livingston know that we create worlds with diagrams and language. And sometimes we trap ourselves.

Worldmaking itself

Nelson Goodman in *Ways of Worldmaking* [22] describes two complimentary methods for constructing a world: composition, which involves assembling wholes and parts and subclasses, conjoining features into complexes and making connections, and decomposition, which involves separating wholes into parts, analyzing complexes into component features and making ever finer distinctions. Identification and repetition depend on specific organization. How information is classified as relevant or irrelevant depends on emphasis or weighting. The information is not neutral as it is presented. Order is yet another aspect under our control, including both proximity and periodicity and even value. Measurement is based on order – we are able to deal with vast quantities perceptually or cognitively only if they are carefully and clearly ordered. The time of years, months, days, hours, minutes, seconds is not built into the world but is a form of order superimposed on the world. It is a constructed frame of reference.

Instead of sharing a stable body of knowledge, we find ourselves in a dynamic situation. We can reframe, supplement, reduce and reroute information. Goodman observes: "Much but by no means all worldmaking consists of taking apart and putting together, often conjointly: on the one hand of dividing the whole into parts and partitioning kinds into sub-species, analyzing complexes into component features, drawing distinctions; on the other hand, of composing whole and kinds out of parts and members and subclasses, combining features into complexes and making connections. Such composition or decomposition is normally effected or assisted or consolidated by the application of labels: names, predicates, gestures, pictures, etc." [23]

The conventional version of worldmaking with diagrams may no longer be appropriate. It may be necessary to reconfigure the process by developing a better fit between the way information is structured and the way information is searched for and used. This is shifting ground. How do we know if a schema is useful? Truth has been a traditional measure applied to information. Goodman states: ". . . [a] version is taken to be true when it offers no unyielding beliefs and none of its own precepts. Among beliefs unyielding at a given time may be long-lived reflections of laws of logic, short-lived reflections of recent observations . . . Among precepts, for example, may be choices among alternative frames of reference, weightings and derivational bases."[24] Somewhat further on he offers measures other than truth for consideration including: compactness, comprehensiveness, informativeness and organizing power.

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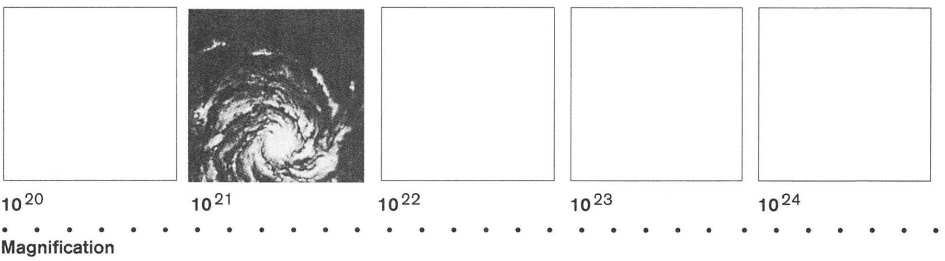

Figure 2, continued.

Gibson, Pearce and Goodman, a perceptual psychologist, a communication theorist and a philosopher, all underscore the mutability of our conventions and suggest that we construct alternative worlds through the synergy of attention, classification and language. They set the stage for this issue.

Examining the Past

There is more to presenting a diagram than technically translating data, or an idea or a set of relationships into the appropriate language whether in a list, a table, a chart or a diagram. It is more than an issue of aesthetic mediation or the tendering of a symbolic invitation to the reader to pay attention. The problem is one of communication – how will the user best understand the information – which approach is the clearest. Lenk and Kahn in their article "To Show and Explain. . ." take us back three and four centuries to the work of Simon Stevin and Amos Comenius. Stevins anchored abstract mathematics by visual reference to the commonsense experience of the student. Comenius developed language primers to both show and tell in a direct and memorable way by grouping related ideas into a clear context. Both Stevin and Comenius are masters of didactic function with diagrams.

McArthur's "Sign Function and the Potential of the Printed Word" shows with historical and contemporary examples a kind of diagrammatic impulse with language that transcends its usual linear sequence. He suggests that editors and designers might actively use this concept as we seek to encapsulate large ideas while maintaining inter-relationships and as we seek to abbreviate and streamline statements for quick delivery.

Early in this century, Otto Neurath took a very specific approach to the audience for isotype diagrams. He developed a logical set of icons representing fixed quantities to present a clear, rational message to his sometimes semi-literate audience. This iconic, statistical approach has spread round the world into very different languages and cultures. (It is not our purpose here to question its utility – the ease with which the reading of these diagrams is taught.) Chizlett in his article "Damned Lies. And Statistics" examines the philosophical and historic context in which Neurath operated. He opens for us the concept of truth – what the statistician knows about the manipulation of numbers – what responsibility the designer of a chart has to truth and his audience. Diagrams are no more value-free or objective than any other form of communication. They have an inherent point of view by virtue of what they include or exclude, how they count, what method is used to display the information and even how the proportional attributes of space are used. Returning to Goodman's observation that there can be other measures than truth (compactness, comprehensiveness, informativeness and organizing power) does not eliminate the author's fundamental concern with the ethical responsibility of the diagram designer.

Questioning the Present

Diagrams reveal thought processes – they are a way of thinking. Sims-Knight in her article "To Picture or Not to Picture. . ." draws our attention to common difficulties in thinking clearly and using statistics. Psychological studies that demonstrate common errors in thinking in divergent contexts are carefully presented in support of her argument. She proposes a more rigorous performance

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Figure 6 **Dennis Livingston's "Weatherization in Maryland."** *(Reproduced by permission of the author.)*

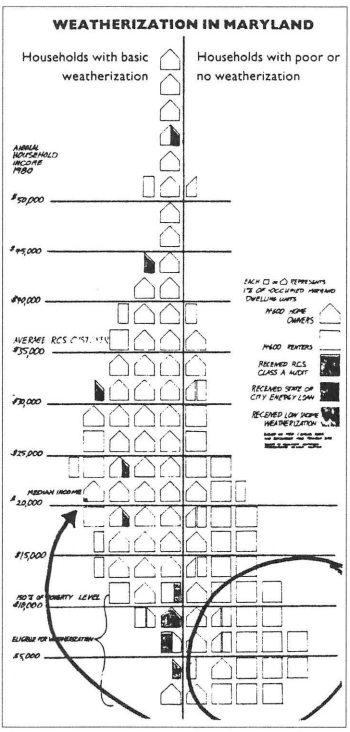
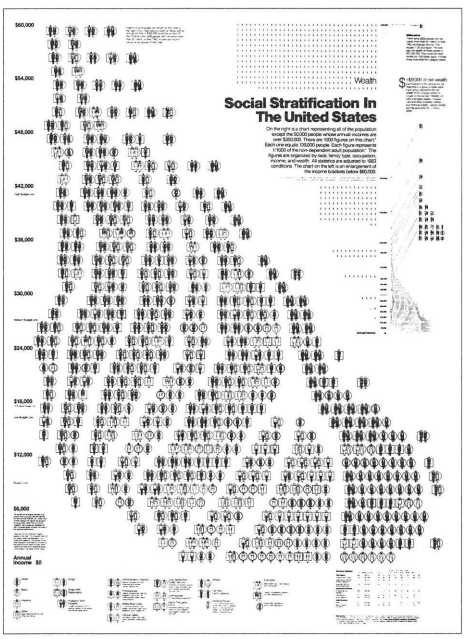


Figure 7 **Dennis Livingston's "Social Stratification in the United States."** *(Reproduced by permission of the author.)*



criteria for assessing the design of communications. She cautions against paying too much attention to aesthetics and warns against decoration. Conversely, she encourages the designer to develop revealing structure, to attend to the content and its inter-relationships and overall meaning. The antidote to over-used intuition is scientific experimentation or user-based, interative design. While designers may not applaud her careful argument, pointing out the practical issue of the cost of scientific study to its incremental benefit in predictable communication, they may, however, be more receptive to user-based design.

Also in this section, we encounter Storkerson, who like Pearce asks broad questions concerning communication strategies. He asks us to reconsider the usual typologies of diagram presentation – to question accepted taxonomies – to alter the frame of inquiry in "Explicit and Implicit Graphs. . ." He examines diagrammatic structures. His method reveals some hardened categories and his discussion suggests that we can make new discoveries if we carefully question how information is framed.

Working toward the Future

Both articles in this section explore the syntax of diagram presentation. Cohen in "Blush and Zebrackets. . ." takes the problem of writing computer code and describes two ways to structure program detail in order to enhance clarity. Both are methods that catch our eye and insist on discrimination. They may appear to be small incremental steps in clarifying code, but in a larger sense, like McArthur, Cohen is looking to break the linear convention and insist on the nesting characteristics of language.

The syntax of diagrams on the computer is the focus of Sivasankaran and Owen's article "Data Exploration. . ." Here syntactic possibilities extend into time and space as they define transposition operations that facilitate the dynamic exploration of information. Information is entered or played against time. The analyst enters the diagrammatic space, and what was formerly a snapshot, now becomes in almost Gibsonian terms, a flow of information. The data puzzle becomes a more compelling resource which can be reconfigured without loosing essential relationships, in which insight is gained through active observation.

Running here and there throughout the issue is an article titled "The Kamikaze Photon". . . by Greg Stone, a science writer. He invites us with his compelling demonstration of light and space to stretch our understanding of reality. The writing is poetic but also clear in its patient description of events.

This special issue on diagrams is edited and designed with a view to opening discussion. The typographic design is diagrammatic in its use of the double page spread as the screen for the information. The text runs on the right hand page with illustrations and notes on the left page. The Kamikaze Photon weaves through the open left pages and some diagram demonstrations, such as figure 2 in this article, Expanding frames of perceptual reference, are developed as a sequence over several pages. As our ability to collect and store information expands, we need to develop tools for analysis and synthesis that address a changing more inter-related sense of worldmaking. The expanding syntax for diagrams is clear, but effective change in framing and meaning is less obvious. What is revealing and what is true or what is comprehensive, compact and informative is open to question.

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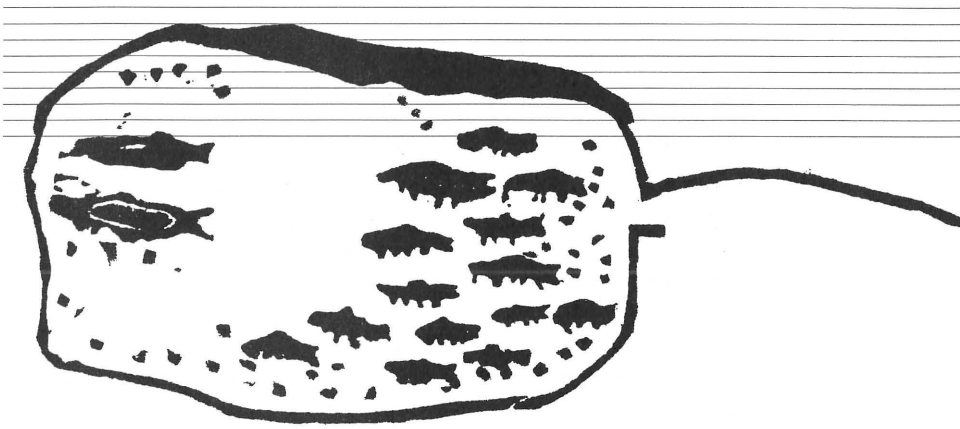
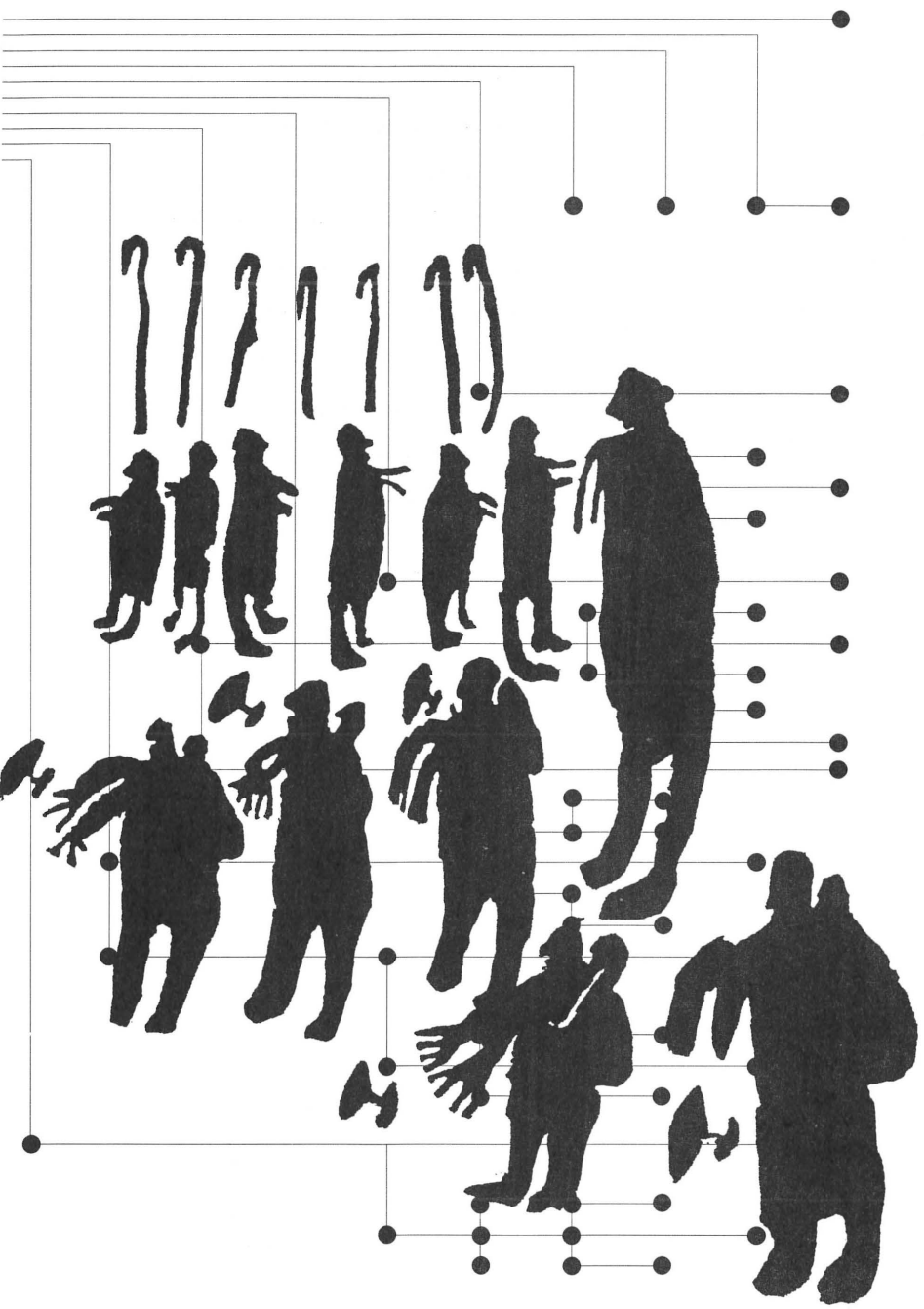


Examining the Past
or
looking at conventions



Krzysztof Lenk,
a native of Warsaw, studied at the Academy of Fine Arts in Warsaw and Cracow. Since 1982 he has been professor of graphic design at Rhode Island School of Design in Providence, where he teaches typography, information graphics and design for the computer screen. Lenk and Kahn have long had a common interest in the history of graphic information and its transfer to the computer. Recently they formed a partnership in Dynamic Diagrams, Inc., where they work as consultants in visual logic, as designers of computer user interface, and as inventors of diagrams for print and electronic media.

Paul Kahn,
a native of New York City, took a degree in English Literature at Kenyon College, Ohio. Since 1985 he has been with the Institute for Research in Information and Scholarship at Brown University where he now serves as director. He works with a variety of hypermedia systems in education.

The development of diagrammatic presentation during the sixteenth and seventeenth centuries is briefly examined with particular emphasis on the work of Simon Stevin and Johann Amos Comenius. Stevin juxtaposed abstract mathematical notation with concrete examples from life. Comenius joined languages including Latin, a vernacular language, numbering systems and diagrammatic representation into experiential chunks for effective teaching. The authors believe study of these early visual pedagogical constructs offer renewed insight into diagrammatic possibilities for contemporary education.

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12 Bassett Street,
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Visible Language 26:3/4,
Krzysztof Lenk and Paul Kahn,
pp. 272-281,

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Lenk, Krzysztof and Paul Kahn.
How They Used Circles.
High Quality
19/1991:18-25.