Explicit and Implicit Graphs: Changing the Frame

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Graphing and Taxonomy

This article explores aspects of graphs and maps as forms of inquiry and discourse.[1] Recent concern with the quality and clarity of map and chart making, seen particularly in the work of Edward Tufte, focuses on presenting data and on understanding that information must tell a story. Such work uncovers some problems that lie beneath presentation, in the process of conceptualization upon which graph making is habitually based, both in terms of what constitutes knowledge, and in terms of expressive visual form. Graphs, as we use them, rely on strict rules of organization and of logic, which depend on a particular world view. That world view is dominated by a belief that the explicit propositional discourse of science is the valid model of language and thought.

Graphs[2] are abstract documents. In them certain characteristics of a complex object are carefully selected or emphasized in relation to a particular argument. Their ritual forms declare them as discourse – they provide distinct ways of reading and interpreting. Graphs, charts and maps abstract characteristics to provide models of their objects for analytical purposes: The United States becomes a line shape with a series of boxes and dots; an experiment investigating the conductivity of a metal as affected by temperature becomes a curve on paper; the buying and selling of goods becomes a series of bars placed next to each other. There are many forms of discourse: the novel, poetry, newspaper and journal articles. Some, for instance, are fictional, while others are informational. Graphs are formal, informational, propositional and explicit. They are used to present glosses of often large amounts of data in ways that give the data a unity of expression that can be quickly grasped. The graph can also precede or create what it describes.

Place and procedure

The chess board is a graph charting a configuration of pieces – each piece a bundle of moves with an implied structure, positions defined by the rules of the game (*see figure 1*). The game consists of all possible positions and moves. Any particular position consists of all possible subsequent moves and outcomes. Moving chess pieces mechanically

Figure 1   A diagrammatic presentation of chess.
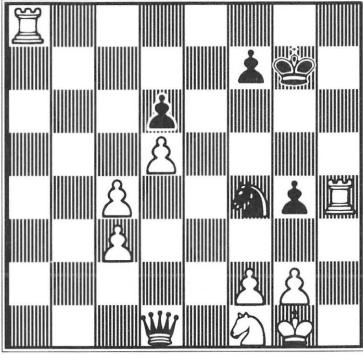
explicates what is already implicit in the position. The apparent physical reality of the board and pieces and the procedures of the game merge. Graphs present concepts. Geographical maps present methods of getting from A to B. The resemblance is to an idea. But it takes for granted the typical geographical map that accepts the physical form as given, preceding the technology or rules of construction. (Does the United States really look like any map?) The rules have been so successful that they recede into the background. Like chess boards, maps and charts are conceptual or procedural documents, physical manifestations of logical constructs. A new method of travel radically alters the relationships between points as transportation maps often show. Where a train route is placed on top of a map of topography, topography remains the organizational principle. Increasingly, transportation maps disregard topography to simplify their statement.

Graphing and reportage

Reportage is graphing: a giving of form, a transportation and translation of experience into a matrix or plane of conceptually informed variables where it becomes data in an analysis. That plane forms and informs the structure of the inquiry, the resulting report and the reported reality. The experiences that form data are reconstituted as functioning elements in the conceptual structure of the inquiry or story. That structure functions not only as a conclusion, but more importantly as an organizing principle, a beginning – it is a way to select, locate and configure data into a coherent picture. It is a way of constructing a problem. The data serve as bricks in the hands of the architect-builder. But it is the structure of the building that is visible, a structure which the materials must be able to support, but which they do not imply.

Inquiry is a way of explaining things as if the things themselves were the focus of attention, but that is not the only point of view. In *Art as Experience*, John Dewey points out that we often mistake works of art for their tangible results, whereas the works lie in the ways they change how we see the world.

Point of view is well established in twentieth century thought from the phenomenologies of Husserl and Merleau-Ponty, and the philosophy of language that Wittgenstein founded to gestalt psychology and the semiotics of Umberto Eco and Roland Barthes. It argues that the world is experienced through the mediation of perception. Experience is possible through shaping it in specific forms. Point of view is fully constituted by perceptual rules. Questions about the outside world are also about the perceiving subjects (us), and the communication technologies for sensing as well as media that provide for culturally approved ways of looking.

But this point of view is foreign to the philosophical topology of factual inquiry at least as it is usually practiced. That practice seems to rely more on positivist principles. Inquiry emerges from the context of problems, not first as a way of knowing, but as a way of exploring. (It often emerges as a way of knowing from the standpoint of the specialist

Figure 2   A hypothetical chart.
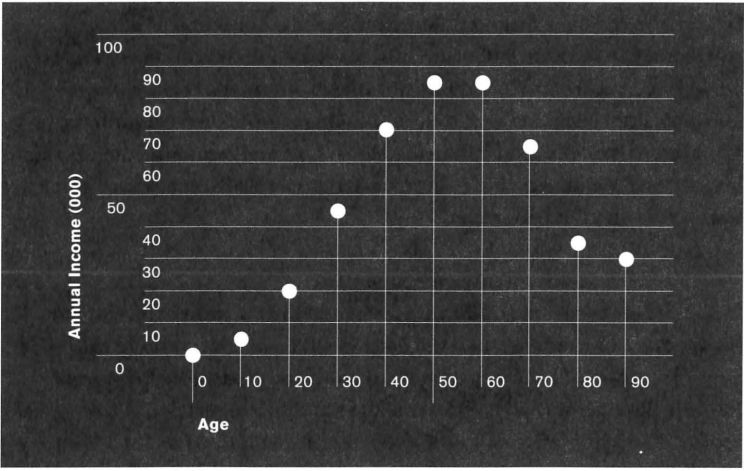
College Educated Income

whose professional life is given over to the maintenance and practice of a field of inquiry, who, thus, has a personal stake in that particular perspective.) The pragmatic bias of inquiry is toward a single or a clear set of interpretations which can be put into practice.

Ways of thinking are as much matters of form as of content. The chess board plays its part as context for the game played upon it and the rules for constructing graphs define the rules by which the knowledge they impart is constructed. Likewise, a printed page, with its rows of horizontal lines of text, frames its content. The printed page now in view, for instance, creates the possibility of the novel and its linearity bears very little relation to the structure of conversation.

Explicit discourse of viewing.

To summarize, the graph is a form of inquiry and of discourse: a way of asking and a way of speaking. The enquirer has selected this way of framing the question, while the map maker has chosen it as a way of communicating. Graphing has its most explicit expression in its physical or graphic form. But graphing is not just some sort of naive picture – it is an implicit set of directions from author to reader on how to read or interpret the page. It is also explicit, consider, for example, a legend which directs the reading. As a form of language, a graph is a ritual by which only certain aspects of presentation are considered relevant and certain ways for reading them are defined. The graph discloses its contents literally, not metaphorically. Within the graph, terms or variables define and enclose data with unequivocal, clear definitions. The graph defines the ways in which data are related to each other by their physical relationships.

Thus, the graph is explicit in two ways. There is a strict and known set of rules by which it is to be read, and it is read as a series of explicit statements. There are no metaphoric ambiguities or figurative entanglements within it. This explicit, positivist world is a major part of its *Weltanschauung*. Some rules are communicated by legends, but most are learned in school, like learning mathematics, or like learning to read street signs.

In the fictitious example at the left (*see figure 2*), we would say that there is a single clear reading. We expect to consider the physical relationships between income (the vertical axis with hash marks) and numbers as a depiction, reckoned against (the horizontal axis with hash marks) figures and age. The curve mediates them and relates them as orthogonals. Vertical and horizontal axes are obvious because it is identified as a graph. How is relevance defined? Income and age both have specific meanings: age is chronology not maturity and income (both earned and unearned) is dollars received. Any other meanings that might apply in other sentences are excluded. The constituents or variables of the graph have clear and unequivocal meanings. These meanings are sometimes defined, but more often they are customary understandings. They may be given specific definitions peculiar to the graph, or they may be equivocal outside it, but within the graph, they constitute rules for

the association of data. The rule of implicit justification forces the graph to project a compatible world.

What can be said about the terms brought together in the graph can also be said about its use of space. It is a ritual use of space implying a single interpretation of spatial organization. Type style, color, the texture of the paper and a range of levels of meaning used by the artist or designer are irrelevant here. This graph would mean the same whether hand drawn on paper or scratched into the dirt. It is a very specific reading – a ritual of intention and attention.

Contents and Form

Anything outside the box or visual area the graph occupies is outside its conceptual space. Even the characterization of what the graph is: i.e., career income history, is outside the graph, appearing as a title, it sets a context for how the graph is to be read. The title is the next level, the graph in a larger context, it is, perhaps, a conversation about the joys and advantages of education. Titles make a graph explicit by helping to indicate that it is a graph, not some sort of art, and by giving it a linguistic standing like monetary expectations of the college educated. In this way, graph findings are a phrase and they can be used in other sentences.

All elements within the graph are equal, and each can be independently varied. No information is hidden and nothing is modified or viewed as logically subsequent to anything else, at least not within the logic or taxonomy of the graph. In the case above, age and income can be varied independently. You can move back and forth on the line in any way you wish. The decisions may be irreversible in life, but they can be reversed here, as "what ifs." Moreover, the graph includes implicit relationships between its members. If I create a map in which Boston is 200 miles from New York, New York is 200 miles from Washington, and Washington is 200 miles from Boston, the three must form an equilateral triangle.

As far as visual simultaneity is concerned, we are not entirely free to rove over the page. There are certain discrete packets of information that get considered with respect to each other, some are logically prior to each other. On the other hand, the unity of gesture aids examination from many different angles to probe, question and extend. Like any good proposition or formula, a graph can teach us things we didn't know we knew. As we will see, this is a small subset of the possibilities, and it contrasts sharply with visual art in which each gesture is seen in the light of others.

Layout: a visual form of taxonomy

We may not usually look at pages as taxonomies, but, like other objects, pages are organizations of parts and parts of organizations. Advertising pages are carefully designed as taxonomies and arranged in a fashion which offers the reader a particular reading. Order in the visual

Figure 3   An advertisement as diagram.

3
For an illustration of
the complex meaning
of text juxtaposition,
see Spivak, G.C.
in Derrida, Jacques,
Of Grammatology,
Baltimore:
Johns Hopkins Univer-
sity Press, 1967, trans-
lator's preface, p. xii.

field attests to the existence of such taxonomies. Part of the mystery is that the meanings of many visual taxonomies remain obscure. The accounts of practitioners such as designers and typographers reveal some of their procedures, but the internal structures remain surprisingly implicit.

Pointing out the universality of taxonomy does not dilute or trivialize it. Any sentence, paragraph or block of text that can be glossed in a word, can function as a part of speech in a new syntactic structure made up of the other text units or blocks. The taxonomy or syntax of a page demonstrates clear relationships, whose description may be elusive. These relationships may mirror the relationships among words. They may also be as open to multiple interpretations as are words themselves.[3]

Graphs within graphs

In the concentric graphing (see figure 3), the three x-y graphs of curves, taken together with their titles and legend, are resolution comparisons, the headline "High Resolution" communicates this clearly. The two pages below top-rated speed are not of importance in themselves (even at full size, their texts are not readable) but together, as their head indicates, they are exhibits. The bottom chart is just a series of words which the headline indicates are fonts. Each of the three has a subscript specifying what is meant, e.g., 135 fonts are standard on all LaserMaster plain-paper typesetters. Together, the three form implicit histograms: one of printer resolution, one of speed, and one of font availability.

Taken as a group, they form a large chart that communicates that LaserMaster offers more value. Here the knowledge of comparison is so taken for granted that the real alternative, e.g., laser writer, is not even mentioned. Like any statement, it can be heard as the answer to an implicit question.

Additionally, the advertisement functions graphically. The eye does not follow each word and read it as if it were text, line-by-line down the left hand column. Discrete packets of information, each of which is self-sufficient as a meaningful statement, is visually apparent by hierarchy and organization through a variety of devices including color, size, border and shape. The text on the right, which is meant to be read linearly stands in sharp contrast, in size, type appearance, grammar and style. This example page stands as a testimony to the inadequacy of linear reading and the lack of a syntax for reading pictures.

The page as a whole functions as an implicit graph. Its rules and claims are unstated, and the relationships between elements are up to the interpretation of the reader though here the reader is primed to make certain choices. In implicit graphs, the relationships between elements, especially text blocks are often indeterminate or open to multiple interpretations.

4
*International Code
of Botanical
Nomenclature.* Utrecht:
International Bureau
for Plant
Taxonomy and
Nomenclature
of the International
Association for
Plant Taxonomy,
1956.

5
*International Code
of Botanical
Nomenclature,* 8-9.

6
We find this kind
of alignment in poetic
and dramatic forms
as well. At one point in
Oliver Stone's film
J.F.K., a witness recalls
where she was
when Kennedy died.
As she speaks, the
picture fades to the bar
where she was and
we hear her voice-over
saying, "I heard
Kennedy was shot."
We see her in the
bar, as the television
bulletin appears,
the announcer says,
"Kennedy has
been shot." She repeats
it, others in the bar
repeat it and the
bulletin flashes to
a person on the street
who talks about it.
It reverberates and
synchronizes
everyone's experience.

Taxonomy: Organization and idea.

Graphs are visual taxonomies, used to communicate taxonomies of content. Taxonomies are organizations, ranks and files, categories and sub-categories. They are schemes for bringing items together to form new objects, both abstract and concrete. Social institutions, organizations of behavior, parents and children, chess boards and chairs are taxonomies. As such they are themselves organizations of qualities and constituents of larger organizations. These organizations express ideas by insisting on a certain relationship or set of relationships.

The problems of taxonomy reflect the problem of how to understand experience. Perhaps no one has faced the task of confronting unstructured diversity more than the botanists and zoologists developing theories of life out of empirical randomness. Their studies came out of increasing knowledge and exploration of similarity and difference in larger varieties of environments. Are two animals related? Which are the defining characteristics of groups or species?

Often different contexts and the informal nomenclatures of native populations offered different accounts of relationships or of significant characteristics. The challenge was to come up with a single system that worked across contexts yielding consistent results. *The International Code of Botanical Nomenclature*[4] was adopted in 1954 at the Eighth International Botanical Congress to provide a common way of naming across five major languages. It amounts to more than that. Its codes for naming read like a constitution with preamble, principles, rules, recommendations and accounts of exceptions.

The taxonomic rules include prescriptions that a taxon may have only one name and rules for the naming procedures including the uses and associations of prefixes. Typification, for example, presents a particularly interesting example. The type is often defined by exemplification, by a holotype. (What's a Rhesus monkey? Here it is.) Wherever it is living, it will, however, die, thus:

A lectotype is a specimen or other element selected from the original material to serve as a nomenclatural type when the holotype was not designated at the time of publication or for so long as it is missing. When two or more specimens have been designated as types by the author of a name (e.g., male and female, flowering and fruiting, etc.), one of them must be chosen as lectotype.

A neotype is a specimen selected to serve as nomenclatural type for so long as all of the material on which the name of the taxon was based is missing.[5] The nomenclatural system embodies within its grammatical rules the logical structure and problems of the objects (specimens and their taxa) themselves. In this way, the botanical taxa, the taxonomy, the taxonomies, rules for forming taxonomies and, it turns out, the rules for the administration of the body responsible for regulating the taxonomies are aligned as concentric ranks in a consistent taxonomic system.[6]

It is often not useful for a taxonomist to begin with local classifications and develop a general taxonomy from the bottom up. It is wiser to simply learn the international system and then apply it from the top down. Like the bricks of a building, the local flora and fauna do not project any single taxonomic structure. The field of cladistics, for example, claims to develop classifications of flora and fauna out of defining characteristics of species or genera. It is an objective system which seeks to trace ancestry of the defining characteristics that mark a genera or species like the opposed thumb. But cladists with the same data can build different cladograms. Some argue that the disagreement must be a matter of error. As usual, where the rules are internally consistent and logical, the bias is to resolve the cognitive dissonance of ambiguity, first by human error, and second, if necessary, by redesign of the taxonomy. Multiple interpretations remain taboo.

Taxonomy and Logic

Taxonomy is a form of logic as it is used in inquiry. The relationship is not merely one of similarity, in the way that the rules for distinguishing and using, and the items distinguished and used, merge. The emblematic textual expression of taxonomy is the outline, and its emblematic visual expression is the chart, map or diagram; its historical expression is the clockwork, and the concomitant sets of relations are cause and effect and whole-constituent parts. It can accommodate the relations of a truth table – it can provide for glosses, and glosses of glosses, etc., as each organizational object or rank provides a gloss of its constituents for use in the next one.

Clive Stace in *Plant Taxonomy and Biosystematics* has described the problem of taxonomy as follows: The need for some system of classification is absolute, for it is only by first naming organisms and then grouping them in recognizable categories that one can begin to sort out and understand the vast array which exists. This requirement is not confined to taxonomists or even to biologists, for living organisms are a part of the everyday life of all humans. Thus it is not surprising that classification is a process which mankind naturally and instinctively carries out ... for the accurate recognition (identification) of food, predators, mates, fuel, building materials, etc., is essential for his survival.

Taxonomists agree that their field is both the goal of the pursuit and its prerequisite, because one cannot build a taxonomy without the units. It is only at the end of the process that one knows what the units are.

Taxonomy and perception

In a sense, taxonomy is prior to perception in that to perceive is to perceive as, as a member of a class. It is not just the organization of parts into wholes, but the recognitions of parts of wholes. But we are rarely aware of that process. New items, are often seen in terms of old models that no longer fit. We start with the given, i.e., that the characteris-

Figure 4   Cladogram of the orders
of angio-sperms
taken from the 1966 version
of Takhtajan's scheme of
classification.
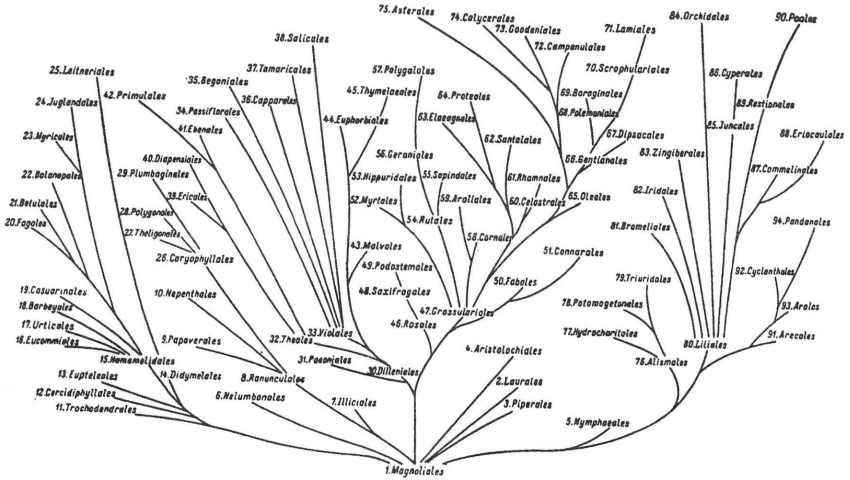
7
See
Langer, Suzanne. 1951.
*Philosophy in
a New Key.* Cambridge:
Harvard University
Press.

8
See
Mitchell, William J.
*The Logic
of Architecture.*
Camridge:
The MIT Press, 1990,
85-108.

tics of objects are within the objects and are not a part of our way of looking. But we soon discover that the question: Is Fred a man? is as much about man-ness, as distinct from boy-ness, or woman-ness (what is connoted), as it is about Fred (who is denoted). For the taxonomist, the questions are about the taxonomy. For example, how does one draw the line between race and species? Ornithologists, for example, are often concerned with these distinctions. Are different races of a bird to be considered different species if they could mate, but almost never do because they are almost never in contact? Is the answer about them or about how the taxonomy is constructed? A taxonomy is a truly conceptual and insubstantial thing. It is a web of connotations, and whether in zoology, psychology or everyday usage, it is just where taxonomy ends that empirical reality comes into existence. Fred may be approached as man, gender or race, but Fred himself, as a whole, is always beyond grasp.[7] For some philosophers, names function as symbols reflecting not objects but ideas of objects and their significance lies in connotation rather than denotation.

Visible taxonomy

Figure 4 is a tree of life, actually, it is a cladogram of angiosperms (for our purposes it could be almost anything with limbs and branches). They take substantial form on the pages of a book, but they are immaterial: nothing other than concepts. Not one of them is visible or can even pretend to be a description – they are criteria and their relevance is to each other as nodes in a taxonomy. In effect, while they are describing something else they are more powerfully being themselves. On the chart they are hypostatized by their physical, printed form.

The world of plants begins when they are recognized as belonging to categories, each tree or shrub as a member of a species – one of many within which it may be compared – as a member of a category. Here the taxonomy begins. Moreover, the taxonomy does not reveal them in their totalities, only in relation to the structure of the taxonomy. (Within the context of this article, neither author nor reader are particularized. Each is an intention, a writing and a reading in a context of critical curiosity that structures the article. Neither needs to actually feel it, but both need to understand its language well enough to fulfill their respective roles.)

Taxonomy, text and organizational object

Taxonomies are limited by practical terms, but as a matter of inquiry, each taxonomic constituent is potentially infinitely divisible. The process is open ended: a function not of the objects but of the stock of knowledge. In short, there are no objects that are not divisible into qualities, so all objects are organizations – they are themselves taxonomies. Wherever two schemata include a given constituent, it links them, claiming similarity and demonstrating their mutual consonances and contradictions. The entwining and entangling of taxonomies is inevitable. But the sources of the various sorts of knowledge collected under the

9
Porter, C.L.
*Taxonomy of
Flowering Plants.*
San Francisco:
W.H. Freeman and Co.,
1959.

entangled taxonomies are disparate, and it is entirely possible, in fact inevitable, that there will be incompatibilities or incomparabilities among them. Thus, seemingly minor problems may force reconsiderations of the whole. This is the designer's or engineer's problem as much as it is the problem of the taxonomist.

Another statement of this issue comes from the notion of contrasting sets.[8] Any object, a temple, for example, is a collection of qualities. It is brown, unpainted, marble, a religious place, a seat of power, etc. Each of these descriptors is a quality, and all qualities collectively comprise the object. The contrasting set for brown includes all colors, for paint includes painted, unpainted, stained and so on. Each contrasting set is a sort of axis of mutually exclusive alternatives upon which one can be located. What can apply to the temple can apply equally to any of its constituents, e.g., columns. Moreover, the qualities, e.g., painted, are also made up of contrasting sets, e.g., lead, latex, etc.

The term "temple" refers to a specific building, this links it to other buildings which share some, but not all, of its characteristics. The term simultaneously invokes all of its constituents, present, past and those to be created in the future. As such "temple" is a collection of collections, each of which is one of its constituent parts or qualities. It is an organizational object.

The pragmatics of human behavior are consistent – Parmenides said that perception is possible only when there is a category. What if, for instance, there were only one cup in the universe. How would it be possible to know of what its cup-ness consists. Is it its color, size, weight, material, glaze or something else? Comparison makes categorization possible and categorization allows membership to be recognized. (One might call this the rule of non-uniqueness.) To posit is to claim as existing and to position, to categorize: the two functions are inseparable.
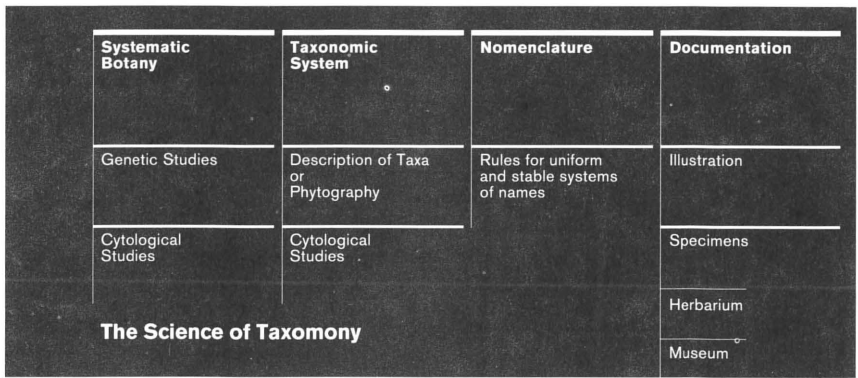
The sources of the various sorts of knowledge collected under the rubric of any word or phrase are disparate. Maintenance of contextual boundaries often become a major preoccupation. As a result, one important practical problem of constructing taxonomies is the regulation of their endogenous and exogenous boundaries: what elements are excluded as environment and what characteristics of constituents are excluded as irrelevant (or dangerous because they bring contradiction with them.) The structure provides for a relationship between inside and outside. If the taxonomy as a whole is an institution e.g., a corporate organization chart or a machine of some sort, its internal structure is its operationalization. It provides for asking and answering questions like: How can that set of parts do what that machine is purported to do?
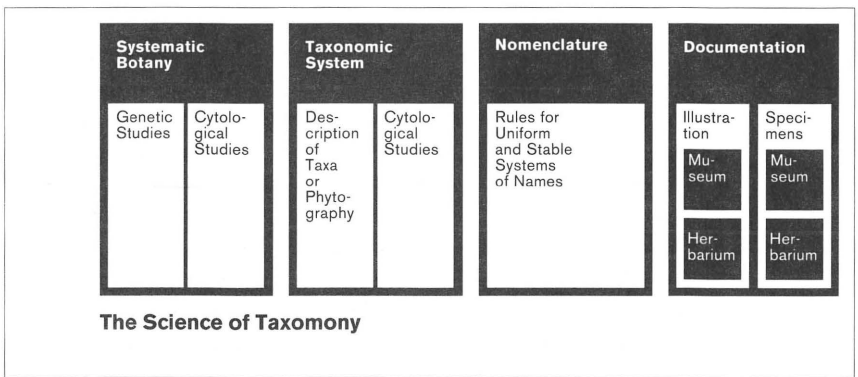
Functioning of taxonomy

Here is a view of taxonomy taken from C. L. Porter's *Taxonomy of Flowering Plants*.[9] As is often the case, the structure of the account is so correlated with that of the field that it is not entirely clear which is which. The two often seem to end up the same.

Figure 5   Three graphic structures containing
the same information.

5.1

Systematic Botany	Taxonomic System	Nomenclature	Documentation
Genetic Studies	Description of Taxa or Phytography	Rules for uniform and stable systems of names	Illustration
Cytological Studies	Cytological Studies		Specimens
			Herbarium
The Science of Taxomony			Museum

5.2

The Science of Taxomony

5.3

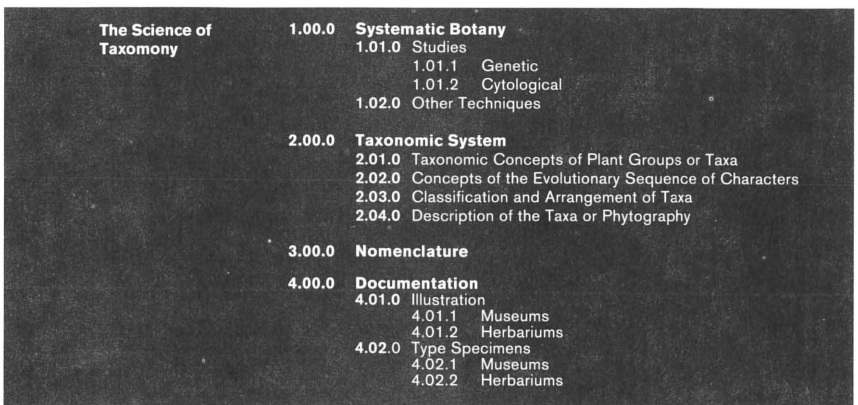| The Science of Taxomony	1.00.0	**Systematic Botany**
	1.01.0	Studies
		1.01.1 Genetic
		1.01.2 Cytological
	1.02.0	Other Techniques
	2.00.0	**Taxonomic System**
	2.01.0	Taxonomic Concepts of Plant Groups or Taxa
	2.02.0	Concepts of the Evolutionary Sequence of Characters
	2.03.0	Classification and Arrangement of Taxa
	2.04.0	Description of the Taxa or Phytography
	3.00.0	**Nomenclature**
	4.00.0	**Documentation**
	4.01.0	Illustration
		4.01.1 Museums
		4.01.2 Herbariums
	4.02.0	Type Specimens
		4.02.1 Museums
		4.02.2 Herbariums

The science of taxonomy may be thought of as a synthesis of four interrelated fields:

1   *Systematic botany:* the fact-finding field, which includes genetic and cytological studies as well as any other techniques applicable to the problem.

2   *The taxonomic system:* based on the facts that were found and including

        a   *Taxonomic concepts of plant groups, or taxa.*

        b   *Concepts of the evolutionary sequence of characters.*

        c   *Classification and arrangement of taxa.*

        d   *Description of taxa, or phytography.*

3   *Nomenclature:* a method of naming plants based on international rules that botanists have agreed upon in order to promote a uniform and reasonably stable system. This permits only a single valid scientifc name for each plant, discarded names being known as synonyms.

4   *Documentation:* which includes the preservation of living or fossil floras in a museum or herbarium, including type specimens, (those on which names and concepts of species and lesser taxa were originally based) and illustrations (which may sometimes be used in lieu of type materials).

It is remarkable how much alike most graphs are. Here are three representations, all graphs (*see figure 5*). The second could be seen as an overhead view of the first. The third translates the other two into a method of procedure or explanation. The first two present a simultaneous form, an immediate perceivable whole. The third transforms it into a procedure extended in time as a verbal or written form. The second graph contains an interesting contradiction. Any division which has further subdivisions has an empty space with its name or title in it. Logically, systematic botany should be fully comprised by studies and other techniques, and a complete description of both of these subdivisions should exhaust all that could be said about systematic botany. The same holds for genetic and cytological studies. Titles that name a category do not belong to that category or within it, but to the next level up and in comparison with its sisters, e.g., systematic botany's sisters are taxonomic system, nomenclature and documentation. Those titles indicate how data about their constituents are to be read.

Text, Image and Narrative

An outline translates between two forms of intelligibility–image and reading text. The visual form has a mimetic relationship not primarily to what it is expressing, but to how it is being ordered. The procedure of reading reveals the sense of the order. In so doing, it collaterally presents a commentary on mimesis; that mimesis is a recognized resemblance to a logical structure or linearity. That linearity may be visual, logical in the vernacular sense, or narrative such as to a normative procedure through which a story unfolds. Similarly, the classifications
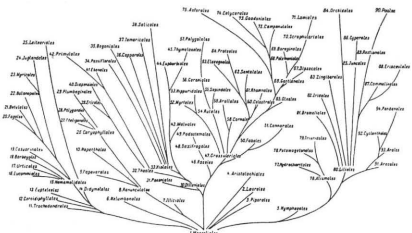
Figure 6.1   Cladogram of angio-sperms.

Figure 6.4   Cladogram as a "transection of an imaginary phylogenetic tree."

Figure 6.2   Elevation dendrogram.
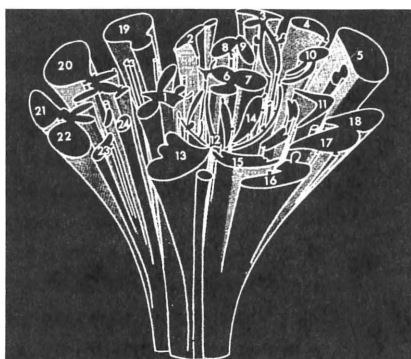
Figure 6.5   Circular graphing of a phylogenetic classification.
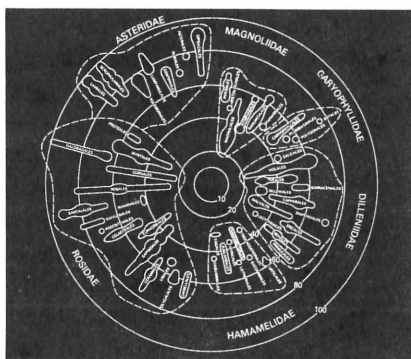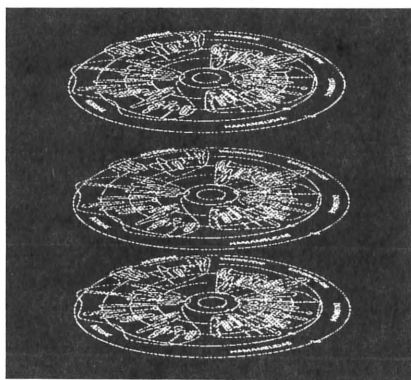

Figure 6.3   Elevation dendrogram from above.

Figure 6.6   Multiple circular graphs projected like the leaves of a book.

of animals which were first based on physical resemblance and differ-
ence, are now based on genetic resemblance. As mimesis is displaced, the
idea of genetics becomes a way of seeing literally.

The graphs present a bureaucratic view of the process of discov-
ering and understanding plant species. It is not a narrative of discovery,
but a sort of post-fact "if I knew then what I know now...." The pragmatic
functioning of the system including the questions it answers and way
it evolved are often given in accompanying text. The reading of the text
requires readers to immerse themselves in the writer's culture. Very often
the teacher translates, but generally not with the goal of bringing the
writer's culture to the student but enabling the student to inhabit the
culture of the writer.

Six logically equivalent graphs

One might presume the dendrogram, number 1, to be the
logical or historical origin or precedent (*see figures 6.1-6.6*). The tree of life
motif provides a mimetic image for what is a logical statement.
Graph number 2 removes some mimetic aspects to disclose a logical
structure. Number 1 reads first as a tree, then as a graph, while number 2
reads first as a graph, then if inverted, as a tree. Or, it could be seen as a
mimesis of outline: a 90 degree rotation would yield an outline.
Graph number 3 presents a Boolean form, a set of nesting categories.
Graph number 4 returns to the form of number 1, but as a transection of
branching seen from an oblique angle. Graph number 5 provides a wafer
thin horizontal slice, and Graph number 6 projects a series of possible
slices at different heights. It becomes obvious that apparently illus-
trative or mimetic representational gestures may have taxonomic
consequences or origins, they can present ways of thinking clothed
in decoration. They function digitally with something approaching gram-
matical and syntactic structure. In short, the tree of life appears to be a
metaphor, but it is more importantly an organizing principle of branching
that underlies both the tree and the taxonomy. Organization is disguised
as illustration.

Empirical researchers, whether in the life sciences or social
sciences, have long been aware of the problems of conceptually mandated
or a priori taxonomies. They would prefer the data to create their own
taxonomic frame. That would satisfy the positivist model. With the
modern computer it is possible to provide for more detailed communica-
tion between contents and taxonomic frame – to provide for a better
affinity. In systematic zoology the method is called numerical taxonomy,
and in social science, it is called factor analysis. Such methods tease
out the strength of correlations. Relationships can be considered through
separation or associatation. These methods may aid the creative
leap that invents a taxonomic frame or a story that can account for the
phenomena presented, but they cannot effect it. No procedure seems
adequate to do that.

Likewise, the gulf between the structure of item or phenomenon,
and the rules for making the account of it, is well known in the social

Figure 7   A hypothetical chart.

Units Sold
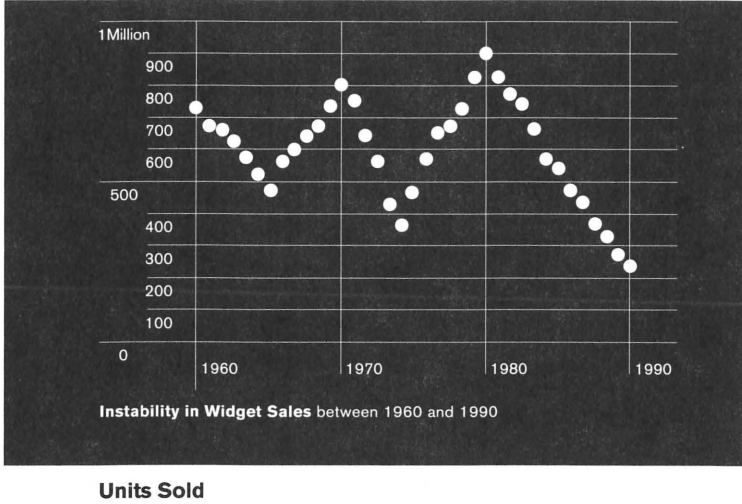
Figure 8   A hypothetical chart.
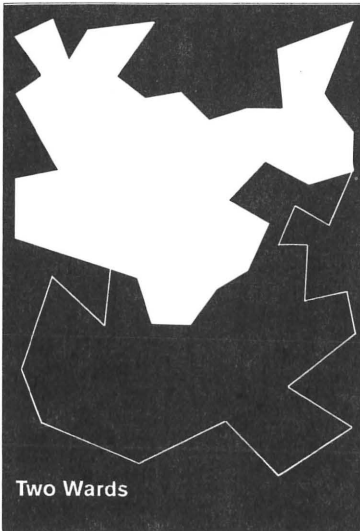
10
Paintings, though
they are still,
often express motion
through the impli-
cations of position.
More generally
what they are about
is the sort of story
a viewer constructs
by inference
from what is and is
not depicted.

11
This summarizing
has conceptual verbal
and visual aspects:
a single idea, a word
or phrase, short
enough to be heard as
a sound, small enough
to be seen clearly
without moving the
eyes. The visual term
is foveal, what
is perceived within
the retinal fovea where
vision is most acute.
Larger objects must be
assembled by scan-
ning. Sound patterns
beyond a certain
duration and verbal
patterns beyond a cer-
tain complexity
must also be assem-
bled or read.

sciences. Accounts provide for the intelligibility of stories, intelligibilities that belong to the taxonomies in which they are placed: the lives of peoples are placed within a particular context–sociologists or economists' accounts reflect the structure of their fields and their formal inquiry. The results could be ones the people studied would find utterly alien. This is a particular issue where the researcher visits a foreign or primitive culture and comes back with a report. Does the report resemble the lives or do the lives come to resemble the report? It seems that like charts stories impose their structures on their contents.

Frame for taxonomy

The charts on the left demonstrate the graphical and categorical relationship of the subject of charts and the charts themselves (*see figures 7 and 8*). Units Sold appears as a title. "Wards 1 and 2" may seem to be an exception, but on closer inspection, the visible intelligible subject is the ensemble of wards 1 and 2. Each is marked individually as 1, and 2, but the whole exists outside the chart and the chart is finally about gerrymandering. It also does not exist in the chart, but is inferred by the viewer the way motion or narrative can be inferred in some images.[10]

Returning again to the second graph of *The Science of Taxonomy*, it models information location. Each of the titles is a gloss for the total of the information which comprise it such as a model for a book or page layout in which text blocks were allocated space simultaneously on each page. The spatial allocation could be extended to succeeding pages by the same rule, making each block of information a three dimensional prism and each page a slice through all of them. It would be like having a series of books open simultaneously, the front page of a newspaper or the display windows of adjacent shops.

The hierarchies of graphic display could be defined by size of text, typestyle and location. Viewed at a distance, only the headlines would be seen. Headlines compose a next higher level; the units that the texts below are meant to comprise and the components of the overall story into which the individual articles may be woven by the reader form the next level. This disjuncture between title and contents is in the nature of the gloss. It summarizes its contents in a single word or phrase making it a unit to be used in different syntactic contexts.[11]

Titles putatively report the contents, but actually they determine how the reader experiences the material. The reader reads the articles as articles "about" with the headline delivering the clue. The headline provokes the selection of contrasting sets and the contours of the taxonomic boundaries of the articles that follow beneath them. If the redistricting graph were entitled not gerrymandering, but language, or topography or Abstract Number One, the maps would be seen in entirely different ways. This aspect will be discussed further in terms of the logical disjunction between the whole and its constituents.

In the newspaper, items provide discrete packets of information, not to be read linearly, but to be construed like components of an image, each in light of the others. Articles are written in such a way that the

Figure 9   A hypothetical chart.

Inflation

reader could stop reading any article at the end of a paragraph and have it still make sense. In this context, the images function equally as implicit charts which the headlines narrate. There are few fixed rules that overdetermine a single reading. The "what it means" presents itself as a speculation or conclusion made by the reader.

Taxonomy as inevitable myth

The disparity between content and taxonomy reveals the taxonomy as a social construct. The power of a taxonomy is not just in the propositional demonstration that something is true, i.e., that there is a denoted object which is a member of the defined class, but in the creation of the class itself – the connotation – independent of any of its constituents. Constructs are the tools by which experience is made intelligible. One could pick any of many different ones, but one cannot avoid picking one any more than we can speak without using a language. Money is a construct – money has value as long as it is believed to have value.

Overdetermination

The tendency is to see the constituents of taxonomies in terms of atoms and to resist the view that the atoms, themselves, are tightly defined by their taxonomies. While watching a television program about animal behavior patterns, pecking order or submission-dominance be-havior among wolves is shown, you flip the channel and see Humphrey Bogart (Sam Spade) approaching Sidney Greenstreet (Gutman) with his henchman (Wilmer). (Gutman has sent Wilmer to kill Spade.) Spade is polite, usurping Wilmers position and displaying a willingness to cooperate with Gutman, his real adversary. In the context of the movie, this is a turn in the sleuthing, but after watching animal behavior you see it as pack behavior, human style. Seen this way, the scene cuts have a new rhythm and it elicits a very different set of feelings. The juxta-position of diverse sets of information develops a rich context. This is why observing contextual boundaries is important and why sciences prolifer-ate. If the constituents were the same across context, one science could collect all knowledge.

Inflation in the future

The customary language of graphing focuses on truth-falsehood in terms of the agreement between the scheme and its constituents. In the example at right, the symbol is halved to indicate fifty-percent infla-tion, but in so doing, its area is quartered and its perceived size is altered by a different factor. The visual ambiguity arises from the question of which rule is intended for use (*see figure 9*).

Another question of truth or falsehood which presents itself is in the matter of context, or meaning: the taxonomy within which the chart, graph or statement functions as an item. Newspaper reporters and advertisements are often cited for taking things out of context, which really means contextually transforming them. Any narrative alters mean-

ing by altering context. Both printing and writing allow statements to be transported. Statements can be taken across boundaries of context. The form of the statement often displays its context and its intended meaning. The competence of any viewer is limited by their knowledge of contexts seen in terms of cultures, periods, pursuits or professions. Transportability and its reciprocal contextual competence make the statement that we encounter not so much: Is it true? but what does it mean?

Framing in reverse

A truth is normalized to a frame. What is empirical and what is conceptual is simply a matter of point of view. The theoretical question of whether a particular being belongs within a given species or genus appears to be an analytical question to the person digging up his bones, but it is an empirical question to the taxonomist, i.e., does my taxonomy (as an empirical object) work? That which is backward in terms of explicit presentation, e.g., here it is – what does it mean? is the way most experiences in life are presented. It is explicit discourse which is backward. Likewise, any declarative statement can be seen as a response to a question, stated or unstated, which forms its frame. In the larger context, the logical space occupied by the explicit discourse of the graph is vanishingly small. The universe of applicable meaning has been collapsed to a single or discrete set of points of absolute precision in which all terms have precise and unequivocal meanings, and alternative contrasting sets have been eliminated. It is a construct – a certain way of seeing.

Graphs without rules

Most of life is spent in the larger universe of meaning, with things or events that do not insist on a particular interpretation. Without narration, items project themselves as potential information, as texts to be decoded and as segments from larger contexts. Newspapers present that sort of challenge. The introductions and framing that were part of early television and radio sound dated, as increasingly, items are juxtaposed and montaged together. Whether there is an implicit juxtaposition of image and text, text and text or of any other statement, the receiver is concerned with finding a universe of discourse, the placement of that statement in a frame in which it makes sense. In short, we have graphs without rules that reinforce any one reading. Writing and publishing have transported these words from a then and a there to the here and now. It is they that are real while the author is ephemeral. The ritual structure of the journal article is a taxonomic frame that regulates the reading. It is one of many particular forms.

Digital versus Analog

Nelson Goodman has developed a taxonomy of symbolic systems according to criteria that contrast richness against precision

which he terms analog versus digital. An archetypal analog system is an image, photograph or painting, while a typical digital system is the word. Analog systems are rich, diffuse and dense. A brush stroke can have infinite variations in weight, angle, curvature, any and all of its characteristics. Each centimeter is perceptible and any of its perceivable aspects contain potential information. It may, on the other hand, be difficult to determine precisely what is being expressed in a drawing. Every aspect of every gesture is there in its fullness and the associations are potentially infinite. To be more precise, number is in some sense irrelevant to analog systems because they are not made up of discrete units.

Conversely, the digital world is discrete and precise in its symbols. A digital symbol has a precisely definable, and repeatable meaning. The number 100 means exactly that. Twenty-four, 24, and 24 all mean the same thing. Words refer to discrete meanings (or sets of meanings) as well as locations or uses in syntactic systems. Like the notes of a piano, there are always spaces in between them. The multiplicity of specific meanings or uses of any word and the variety of contexts or sentences into which any word can be placed provide webs of meaning. The closest digital similarity to analog density is in the multiple ways in which statements can be interpreted. It is just that aspect that is exploited in poetry. There remains, nevertheless, a gulf between multiple, inderminate meaning and continuous shift. Graphs and charts live in the digital world by glossing, by abstracting only specific, discrete meanings and by applying strict rules for reading. Graphs trade richness for precision, they capitalize on the agility that precision yields.

What is easy to do in the analog world approaches impossibility in the digital world: a freehand curve, the variability of hand printing and subtleties that are difficult to define. What is easy in the digital world is impossible in the analog world: absolute precision, repeatability, clarity and certainty.

The analog world is one of gradual growth and continuous change. Its essence is continuity. The digital world is one of contrast, change by increment or by comparison.

The Implicit Graph

Graphing can be explicit or implicit. The previous discussion concentrated on explicit graphs, those which ideally approach a notational precision and a carefully directed reading. Newspapers, for example, can be looked at as implicit graphs, often with carefully worked out taxonomies for headline size and placement of various kinds of stories. The visual resources of size and placement provide procedures for assembling readings. The front page delivers a snapshot of the day, with its hierarchy of headlines. This kind of graphing lacks the title to claim a univocal interpretation – it is a graph without a title – it is an implicit graph. We associate words according to generally understood conventions of page reading: line-by-line, column-by-column, page-by-page, but that

Figure 10   Karlheinz Stockhausen.
Klavierstücke XI, excerpt.
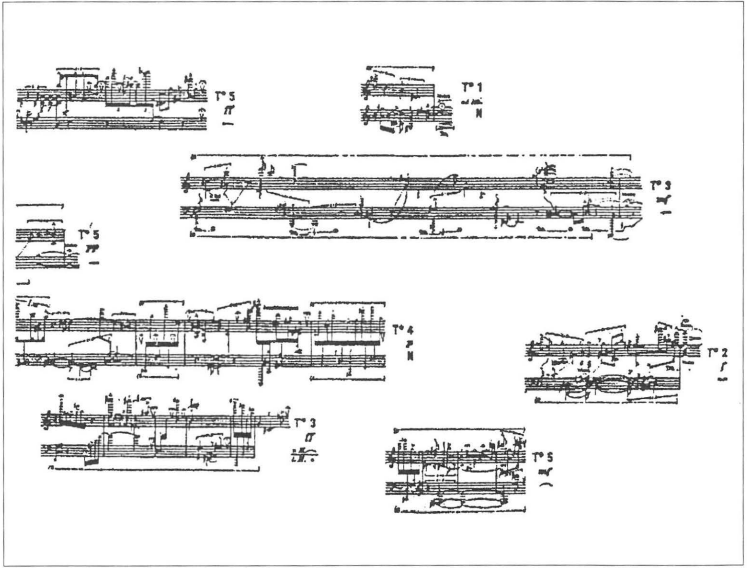
12
Eco, Umberto.
The Open Work.
Cambridge:
Harvard University
Press, 1989, 1.

13
Eco, *The Open Work*,
3-4.

is rarely how we read. Newspapers, advertisements, any walk down an urban street present us with multiple, simultaneous texts which we often read like an implicit graph. The taxonomy also functions associatively, its building blocks remain digital but the interpretive freedoms provide structured choices. If the question asked of a chart is: is it true? The question asked of the implicit graph is: What does it mean? How many things?

In *Klavierstücke XI*, Karlheinz Stockhausen makes freedom of choice part of the procedure of performance (*see figure 10*). He presents to the performer a sheet of music paper with a series of note groupings. The performer must choose among the groupings, first for the one to start the piece, and next, for the successive units in the order in which he selects to present the piece. In this type of performance, the instrumentalists' freedom is a function of the narrative structure of the piece, the performer determines the sequence of musical units by the order he chooses.[12]

According to french composer Henri Pousseur, " ...the poetics of this 'open' work tends to encourage acts of conscious freedom on the part of the performer and place him at the focal point of a network of limitless [but we can see not random] interrelations, among which he chooses to set up his own form without being influenced by an external necessity which definitely prescribes the organization of the work in hand."[13] The performer is free to interact with an already structured text and make it into an intelligibility that follows his own sense of structure, in the full expectation that it will not be one which was specifically predicted or projected by the composition as he received it. This is often the characteristic of aleatoric works. Aleatoric methods are somewhat like what happens whenever there is a large display or exhibition through which one may wander, or a collection of writings among which a reader may sample. For example, in John Cage compositions, pop art painting, automatic writing or quasi-mechanically produced work, the relationship between writer and reader is occluded or specifically made an issue. The otherness of the work is one of its themes. When Cage creates music out of apparent chance, he concerns himself with the role of intention in art, asking if there was a creator in any meaningful sense at all. Is the receiver receiving noise? If he perceives an order, is it an order of his own creation or some version of the natural order? Such works often actually exhibit a high degree of intention in their authorship, but the intention may be hidden as when a very carefully chosen group of words are shuffled. The works may be also about something other than what their form would lead one to presume at the outset. Clearly, in either case, the receiver's expectations are an integral part of the works, either to be presumed and furthered or to be challenged. These are more fully open texts. Rather than telling us how to read them, they ask us to discover how to read them.

14
Eco, *The Open Work*,
53.

15
Eco, *The Open Work*,
58.

Information v. æsthetics

In The Open Text, Umberto Eco considers the problem of information according to Norbert Wiener's theories–a noninformative datum may specify a likely situation, while a highly informative datum specifies an existentially unlikely situation. For example, this apartment rents for $1,001.50 per month versus this apartment does not rent for $1,001.50 per month. The latter is highly likely, but the former is unlikely and can be counted as informative.

If no assumptions or projections about the receiver is made, the information content belongs to the data, but if there is any presumption about the receiver, the information content must be assigned to a receiver-message nexus. In order to contribute to the general information of a community, a piece of information must say something substantially different from the community's previous common stock of information.[14] Additionally, the degree of informative content is related to its degree of organization. This could be seen as the relation of a number of unlikely events taken together and made interdependent. This contrasts with random, independent atoms, which like grains of sand form a uniform pile or plane – a visual form of entropy. Indeed the most powerful arguments are those that encompass large amounts of complex (already highly articulated) information in a clear structure.

What is the likelihood that the message will be received over noise. Redundancy, for example, counteracts noise. About fifty percent of the English language consists of redundancy and the other fifty percent is determined by the statistical nature of the language and functions as a supplementary means of clarification. In written and visual texts, it is possible to re-read, to read nonlinearly, to build that aspect of performance into the medium rather than the message. (Terms like redundancy and repetition are biased toward meaninglessness.) When contexts are never identical, no exact repetition is possible. Moreover it is only by repetition that a pattern becomes perceivable. An unrepeated refrain is not a refrain. Redundancy may be essential and repetition may be better called reference.

From the point of view of communication, I have information when

1   I have been able to establish an order (that is a code)
     as a system of probability within an original disorder; and
2   within this new system, I introduce through the elaboration of
a message that violates the rules of the code elements of disorder in dialectical tension with the order that supports them (the message challenges the code.)… Such communication is disorder only in relation to a previous order.[15]

Art as enriched information

The situation above is classic Hegelian dialectic, the opposition of a pair in contradiction with each other, resolved by a more adequate frame of meaning. In the closed or univocal work, the dialectical aspects have been banished. Without contradiction, new information

Figure 11 Poetic/typographic
development of a text.

It may
rain tomorrow,

As pregnant droplets fall
from the eves
of the temple roof
onto the mats below,

Or it may not rain
At all

cannot modify or comment upon existing information except by either extension or refutation of the given. Comment upon what is given has the power to transform it by showing and altering its limiting frame, its presumptions and its meanings. Such comment is often banished as speculative. Information and meaning are indeed canonically conjugate. They are denotation and connotation, two halves of the same whole. Open text, the text of expression or art, is not the opposite of science but its enlarged version institutionalized. John Cage causes us to face the same questions as other taxonomists by creating the situation in which we must give form to experience.

Consider the following: It may rain tomorrow, as pregnant droplets fall from the eaves of the temple roof onto mats below, or it may not rain at all. By definition, no information has been transmitted. But something has happened. Something has been named, and it has become a focus of intention which cannot be undone (*see figure 11*). The work of much fiction, poetry, the limits of physics or neurology and other works of art is to propose just this sort of reality for the receiver to consider, perhaps as "what ifs" or as ways of seeing the world. Such proposals may appear to be worked out systems or to be an indeterminate or clearly open work.

The open work is a system of multiple intelligibilities, consisting of possible meanings, their interrelationships, what can be inferred from them and so forth. None of the meanings are diffuse or analog, but there are degrees of freedom in interpretation and rationality that allow multiple interpretive procedures. The intelligibility is, in part, for the receiver to construct. One sees in art the same process that one sees in the speculative sciences. In Western culture, art is expected to say something new. It is something new because the "work" is something that cannot be specified in known frames. Its purpose is to open new avenues. It is information outside the accepted bounds of information. Such works often include the systematic breaking of rules.

Going back to Wiener's statement regarding probability or expectancy, it appears that a breaking of rules may be necessary for the transmission and acquisition of new information or knowledge. Indeed such knowledge may be constituted by breaking the known rules– breaking the rules reveals them. To exclude this breaking is to limit the possibility of learning.

The open work exists within the digital domain, it expands through choice and decision. It returns us, in a sense, to the chess board. Texts can be juxtaposed in the same ways as words or objects. They can be above, below, in front, behind or form progressions or mazes. The juxtapositions may be used to indicate foreground, background, relative importance or centrality-peripherality. It is tempting to speculate that there may be an obvious visual unity when there is also a taxonomic unity. Certainly, where a visual orderliness is perceived, relationships are sought out.

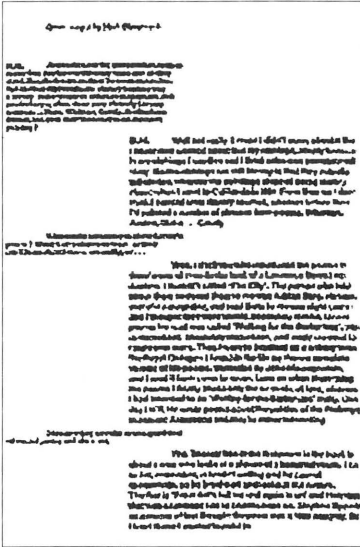Figure 12 Two spatial variations
in presenting text.

Figure 13 A newspaper front page as a chart.

16
Steinsalz, Adin.
*The Talmud, the
Steinsaltz Edition*,
volume 1. New York:
Random House, 43.

Implicit graph, open text

Here are two layouts using contrasting texts (*see figure 12*). The first uses contrast of placement to indicate interviewer and interviewee. In the other, one text is an inset. They serve as independent voices, but they also invite comparison to each other. The visual distinctions point to relationships between the texts, but these differences are not made explicit, the texts will have to be read to determine what the relationships are.

The front page of the newspaper provides an intricate layout (*see figure 13*). The style books which specify typefaces and placements, rules and other conventions for front and editorial pages are often over two-hundred pages in length. The front page, itself, has typically between thirty and fifty modulations of typeface, size and style alone. But the style books written to enable typesetters to execute design rules are not useful for understanding the relationship between visual display and meaning. The front page of a newspaper remains, itself, a text to be interpreted.

Open text graphically realized

The Talmud uses a visual form based on discussion. It displays sections of civil and canonical law along with the commentary of the rabbis. That commentary consists not only of exegesis, but of debate and discussion between rabbis and the text and between each other. Each text relates forward and backward as the continuity of the laws or the continuity that presents the character of a rabbi (*see figure 14*). That rabbi's commentary may be considered next to the law or against the language of any other rabbi. The commentaries often present themes or threads that can lead outside of the Talmud, but there is no authoritative outside text or narrator to interpret the page for the reader. The result is an open indeterminacy of ensemble – each part of which interacts with the others as each modifies and is modified by the others.

"Viewed superficially, the Talmud seems to lack inner order. The order of the Talmud is not that commonly found in standard textbooks. The arrangement of the Talmud is not systematic, nor does it follow familiar didactic principles. It does not proceed from the simple to the complex, or from the general to the particular. Nevertheless, the Talmud does have an inner order, different from the kind with which we are familiar. Textbooks deal with specific material, and it is therefore easy to present that material in a clearly defined order. The Talmud, by contrast, deals with an overwhelmingly broad subject, the nature of all things according to the Torah. Its contours are a reflection of life itself. It has no formal external order, but is bound by a strong inner connection between its many diverse subjects."[16]

The talmud realizes conversations in print. Unlike the Platonic dialogues, which are often tracts written as if conversational, the voices of the Talmud are independent, raising independent meanings and questions, each providing a separate context through which to look at the whole. For any given speaker's statement, you may look in terms of any one or all of the other speakers on that page, the law they are discussing, the speaker's statement in comparison to his statements on

Figure 14 The Talmud

TERMINOLOGY

הַאי מַאי **What is this?** A term used to express astonishment at the previous statement, often with the significance "How can you make such a comparison?!"

בִּשְׁלָמָא **In peace** [i.e., granted that...] This term introduces a question in which the element that is understood and acceptable is placed first and the difficulty is placed second. Its structure here indicates that a Halakhah is understandable according to the viewpoint of one scholar, but is difficult to understand according to the viewpoint of another scholar. "אִי אָמְרַת בִּשְׁלָמָא רַבָּנָ... אֶלָּא אִי אָמְרַת סוּמְכוֹס..." — "If you accept the viewpoint of the Sages it is all right, but if you accept the viewpoint of Summakhos the following difficulty arises..."

TRANSLATION AND COMMENTARY

אֵלָּא מַאי [1]**The Gemara now attacks the basis of** this question, and objects. **Then what would you rather say instead — that the Mishnah follows the view of the Sages who disagree with Summakhos?!** [2]**Surely not, for in a case where** ownership of property cannot be decided they say: "**The burden of proof rests on whoever seeks to take money or property away from someone else.**" **Yet in our Mishnah, even though each claimant seeks to take the garment away from the other one, and neither brings proof that he is telling the truth** (by bringing witnesses, for example), **nevertheless the** Mishnah rules that the claimants take oaths and divide the article. Our Mishnah would seem, therefore, to be in accordance neither with Summakhos nor with the Sages! (In this comparison of cases, three rulings have been quoted: [1] Our Mishnah, where the claimants have each taken an oath; [2] the ruling of Summakhos, that in a case of doubt the object is divided between the claimants without recourse to an oath; [3] the ruling of the Sages in that case that the burden of proof rests on the person seeking to take exact payment. Since these three rulings seem to be mutually exclusive, we are seemingly forced to the conclusion that our Mishnah is in accordance neither with Summakhos nor with the Sages!)

הַאי מַאי [3]**The Gemara now rejects this objection: What sort of comparison is this that you have just made?** [4]**There is no problem if you say that our Mishnah follows the view of the Sages.** It is possible to distinguish between the two cases and to justify the different rulings. [5]**There, in the case brought in** tractate *Bava Kamma* where the responsibility for the death of the calf is in doubt, **the two litigants are not both holding on to** (in physical possession of) a disputed item. The money demanded in compensation for the damage done to the calf is in the possession of the owner of the ox. Therefore **the Sages say: Whoever seeks to take property away from someone else** (in this case the owner of the calf from the owner of the ox), **must bring proof** that the property is his, because, in principle, possession of money or an article does confer a presumptive advantage on its possessor. Therefore the owner of the calf must bring proof that the ox was responsible for the death of the calf. [6]**But here,** in our Mishnah, **where both claimants are holding on to the garment,** and neither is in exclusive possession of it, the claimants are not considered to be "extracting" property from each other, and hence **they divide the garment between them after taking an oath.**

LITERAL TRANSLATION

[1]**But what** [do you say, that our Mishnah follows] the Sages?! [2]**Surely they say: "Whoever seeks to take** [property] **away from his fellow, upon him is the** [burden of] **proof"!**

[3]**What** [comparison] **is this?!** [4]**It is well if you say** [that our Mishnah is in accordance with] the Sages. [5]**There, where both** of them are not holding on, the Sages say: "**Whoever seeks to take** [property] **away from his fellow, upon him is the** [burden of] **proof.**" [6][**But**] **here, where both are holding on** [to the garment], **they divide it with an oath.**

וְאֶלָּא מַאי, רַבָּנָן? [2]הָא אָמְרִי: "הַמּוֹצִיא מֵחֲבֵירוֹ עָלָיו הָרְאָיָה"! [3]הַאי מַאי?! [4]אִי אָמְרַתְּ בִּשְׁלָמָא רַבָּנָן: [5]הָתָם דְּלֹא תְּפָסֵי תַּרְוַיְיהוּ, אָמְרוּ רַבָּנָן: "הַמּוֹצִיא מֵחֲבֵירוֹ עָלָיו הָרְאָיָה". [6]הָכָא, דְּתַרְוַיְיהוּ תָּפְסֵי, פָּלְגִי לַהּ בִּשְׁבוּעָה.

RASHI

עָלָיו הָרְאָיָה — נְכָסִים, וַאֲפִילוּ לֹא נָגַע מֵידֵי, וְהֵיכָא חוֹלְקִין [בִּשְׁבוּעָה]. הָכִי גַרְסִינַן: אִי אָמְרַתְּ בִּשְׁלָמָא רַבָּנָן, הָתָם דְּלֹא תָּפְסֵי תַּרְוַיְיהוּ אָמוּר רַבָּנָן כוּ׳, הָכָא דְּתָפְסֵי תַּרְוַיְיהוּ פְּלוּנֵי בִּשְׁבוּעָה, אֵלָּא אִי אָמְרַתְּ סוּמְכוֹס, וּמַה הָתָם דְּלֹא תָּפְסֵי תַּרְוַיְיהוּ אָמוּר סוּמְכוֹס פָּלְגִי בְּלֹא שְׁבוּעָה — הָכָא דְּתָפְסֵי תַּרְוַיְיהוּ לֹא כֹל שֶׁכֵּן. תַּרְוַיְיהוּ תָּפְסֵי — וְאֵין כֹּל אֶחָד חוֹלֵק מַמְּבֵירוֹ. בִּשְׁבוּעָה פְּלֵגִי לַהּ — כֵּיוָן דְּתָפְסֵי גוּבַיְנָא כַּמָּה שְׁמְּבֵירוֹ תָּפֵס, דְּהֵא תָּפֵיס בְּכוּלֵּיהּ וְהָא תָּפֵיס [בְּכוּלֵּיהּ], לֹא קַם לְהוּ לְרַבָּנָן לְהוֹצִיא מָמוֹן מֵחֻזָּקָתוֹ נְכְדֵי, כְּדְאָמְרִינַן הָתָם: לְרַבָּנָן דָּבָר רָאֵיהּ הַגּוֹרְטוֹס שְׁטַעָה.

NOTES

dead before the goring (in which case the owner of the ox could not be held responsible for the loss of the calf) or after the goring (in which case the miscarriage of the calf could be attributed to the goring). The Mishnah requires the owner of the ox to pay half the damages that he would have had to pay for the calf if it had been certain that the ox had caused its death. In discussing this Mishnah the Talmud asserts that the viewpoint expressed in it is that of Summakhos, who maintains that, where the ownership of property or money is in doubt, the property or money is divided equally between the claimants. The majority viewpoint of the Sages is, however, that the burden of proof rests on the person seeking to extract

money from another person. In the case discussed in that Mishnah, therefore, the Sages would exempt the owner of the ox from making any payment for the loss of the calf, because the ox cannot be proved to have been responsible for its death.

דְּלֹא תָּפְסֵי תַּרְוַיְיהוּ **Where both are holding on to the disputed object.** Absolute ownership of an object depends on judicial proof that the object belongs to its possessor (through inheritance, purchase, or gift). But there are also presumptions (חֲזָקָה) regarding ownership, which although not absolute proof nevertheless create a situation of apparent proof. One of these presumptions, as in the case of the owner of the bull, is חֶזְקַת מָרָא קַמָּא — prior ownership.

other pages, to the continuity of the whole book. Each look from a
new angle will alter all of the others, like a painting or game of chess, but
with more elements and more moves. It will be both orderly and varied:
a potentially endless exploration which, through its external refer-
ences, can snare the rest of the universe in its own peculiar way. Add to
that the temporal/cultural remoteness of its readers, and its willingness to
conspire with them to form new meanings and a living tradition
emerges.

A second feature of Talmudic organization is that subjects
are arranged to stimulate interest. Tracts usually open with a somewhat
puzzling introduction, taken from the very depths of the subject, and
only afterwards does the discussion return to them. Sometimes too, the
Talmud passes from one subject to another in an associative way.
After the statement of a certain scholar is cited, a whole series of his state-
ments may be presented. Hence the Talmud may drift away from the
first, central topic. Sometimes in discussions of this kind the focus
of attention may shift from subject to subject until we find ourselves far
from the original starting point. However, not only does the Talmud
ultimately return to the original subject, but it is also guided by an inner
connection, sometimes very subtle but often very strong, between all
the subjects discussed. This connection is never superficial, and the
seemingly wayward digressions in fact add substance and interest to the
central theme.

The Talmud provides for almost free association, for a dialectic
of meaning and context for various interests. It at first appears discur-
sive, but its discursions add a richness that a specific, discipline often fails
to bring. There is no forced hierarchy of ideas. Most items outside the
Mishna or Gemara condition each other. These are the ways we per-
ceive images – as many elements as possible are simultaneously available
– it also describes hypertext in the ability of the receiver to interact and
actively construct a particular document.

The Talmud does not have to be read in order, in fact there
might be some question of what "in order" means. The various texts can
always be seen next to each other for potential juxtaposition. All of
these tendencies run toward fragmentation, separation, specialization of
vocabulary and montage – the unmediated confrontation of texts.
Talmudic confrontation is more a matter of debate in which the voices are
placed together in direct communication with each other. The document
may seem prolix or unfocused at times, but that is perhaps because it
is carrying a number of types of truth at once and leaving them all open
for examination, regardless of whether they might or might not be
convenient. Like the newspaper, the text arrangement encourages the
reader to become aware of the many aspects that form a comprehensive
understanding.

This ancient model shows one methodological approach to the
modern problem of information fragmentation. It does not build a

17
This would be an ana-
log to the speech act;
it might pretend some
external basis, but
it would have created
that basis. We report
the news. The news is
what we report. We
already conditionally
accord that authority
to the printed word, as
constituted by the
writing style, page lay-
out, binding and pre-
sentation rituals of
scholarly publication.

grand scheme, but presents an open montage in which each utterance provides a packet of information which is sensible in itself and which can be juxtaposed with others. Multiple and comparative contexts are built into the structure of the work itself. Rather than an encyclopædia with separate bits of information, it is like an unending conundrum of expanding meaning. Like Stockhausen's composition, the participant assembles the work as he chooses.

Finally, what about the analog. Both images and printed language are visual forms. They differ merely in the rules for reading them. I understand Goodman's position to be that images become analog in that there are no a priori rules by which characteristics are excluded. Thus each image is unique because every characteristic, even the ones we are not yet aware of, is potentially important. That does not mean that every characteristic is actually important. In drawing, where two lines meet is critical. If one ends, while the other continues, it indicates distance. Thus in some Giacometti drawings, the figure recedes into the ground provoking taxonomic questions. We know that drawings are full of lines that we do not actually see. Those lines encode information in ways that we have learned so thoroughly that if we want to draw, we study them so we can draw them as well as read them. It may be that drawings are digital like language but made up of many more decisions.

An image may be more like a book than a proposition. The idea is that a picture is also digital, just more, much more complicated, and with more freedom to include various aspects and define them differently. Modern publication of information in textual and multimedia formats will increasingly beg this question. Information is meaningful when its form is a matter of conscious choice – when it is evidence of an expressed intention. Traditional publication placed practical limits on the dimensions of expression. Now, the individual can have control over many aspects of visual and auditory performance. It will be less and less possible to mark off any of these aspects as irrelevant or to separate the word from the way it appears on the page or the screen.

Conclusion

Widespread verbal literacy began when Gutenberg made it possible for printed publications to be mass produced and disseminated. Modern society is built upon the text: book, newspaper, broadside and sign. Printed text dominates and redefines previous forms of communication, it takes a supremely authoritative position. Modern technologies, such as computer printing, television and video animation are changing the form of mass culture fundamentally and rapidly. In the short run for the masses, the future of literacy seems uncertain, if not for intellectuals. Television is not yet fully authoritative because it has not yet crystallized ritual forms by which it can declaim[17] or create its objectivity. The comments of interviewed pundits are somewhere between conversation and thesis, while documentaries are somewhere

between drama and fact, but television continues to evolve and gain authority.

Moreover, daily life confronts us with montage, disparate messages coexisting in space and time, which we weave together by a process of understanding how they relate to each other. Who sent them, to whom, why, what do they mean to me? These are ways to create relationship among the messages. The history of the computer as a scientific device gives computer generated or processed information a leg up in the objectivity game, and as we know, computers, television, still photography and sound are all in the process of merging to form a new unified environment of intersubjective creation sufficient to displace written communication from its privileged position.

Current ways of thinking about communication media reflect the past – the printed text environment of apparently linear reading for discrete fact, and art and other images for associative looking. Both views operate as normative broadsides as much as descriptions. Not only are these forms essentially different; they have been kept apart – forcibly if necessary. Their differences are understood as sequence versus simultaneous, or eye versus ear, or directly given versus encoded. It is possible to collapse some of those distinctions and to call both image and written text spatio-temporal – even to displace the distinction to digital versus analog. Even so, echoes of the essential distinction remain.

What we take to be paradigmatic of text or word interpretation is formal discourse (simply one of its forms) and that in doing so, we limit our understanding of the word. It is as if we believed normal conversation to be an imperfect form of oration. The difference between images and text seem less matters of essential differences, than matters of the rules by which we read them or our belief in these rules. Both texts and images come in small intelligible packets such as objects and sentences which can be combined in various ways.

Once the sacred linearity of text, and the rules of strict univocal interpretation are overcome, it is apparent that written text and image present similar problems of interpretation and that those problems are far less concerned with whether it is true than what the "it" is. Further, it is less a matter of explanation rather than explication.

The problems of taxonomy demonstrate that the "what is it?" question is in the relationship of classification which appears as category, item or constituent. This question often appears directly in an image, but context must be identified. The question appears in explicit, univocal text, as the probing of intertext – the multiple meanings of words.

The proposition defines its constituents but its definitions hold only as long as it remains hermetically sealed in an unproblematical context. The graph title defines its contents. Once we step outside that contextual box, when we apply that graph to a new problem, or reapply it to an old one, or see it near another graph, that certainty has been destroyed and we again find ourselves back at the beginning asking what the image, graph, text refers to: what does it mean.

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18
For an interesting
discussion on this
aspect, see
Dennett, Daniel.
*Consciousness Ex-
plained.* Boston:
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152.

Meaning transports us from what we take to be its qualities, to the recognition that they are qualities to us, that the item is a nexus of a something out there and the form of what we see. This process takes place so automatically that we are hardly aware of it. When I write, or say something, you know that it has been written or said and you normalize it to the ritual (journal article–author). In this approach, reasoning carries with it some enormously complex machinery by which all aspects of experience are recorded and bundled with it, as a sort of postmark.[18] This aspect seems to have confounded artificially intelligent computer programs. To grossly oversimplify, or perhaps to put it backward, the computer doesn't know where it is, so it does not know how to frame its input.

Because our habitual language strives for context-free knowledge we are sometimes confounded when efforts to create crossdisciplinary knowledge result not in integration but in further division as new disciplines arise at the margins of previously existing ones. Put simply, information must tell a surprising story. The story is the taxonomic structure which allows the information to exist. The facts may tell the story, but they are not the story. The story is created by us as a pattern of intelligibility that mediates between us and the phenomena we observe. Each discipline or disciplinary shift, context of use, social class or cultural origin, presents new taxonomic frames in which existing knowledge is incompatible, or at the least, in terms of which it must be interpreted or postmarked.

In an era of exploding information and cultural diversity, we need fresh ways of taking in information. We need to use or develop the information more quickly and fully. The new media technology performs the same functions already performed by print. The new graphic capability to combine image and text freely and to treat text as image, opens new practical possibilities in terms of liberating text from linear reading. The language of visual juxtaposition includes logical proposition but is also far richer. It includes things above, below, in front of or behind; things that are bigger, smaller, opaque or transparent. We have some awareness that these visual structures mean something. We can create the kind of montage that better enables information use in various contexts. This is the beginning of thinking about what visual interpretation of text can mean. Graphs, which look like pictures but read more like words, give us the opportunity to test traditional views.

M

$207 \frac{84600}{100000}$

B

Q

O

30

B

N

C

28
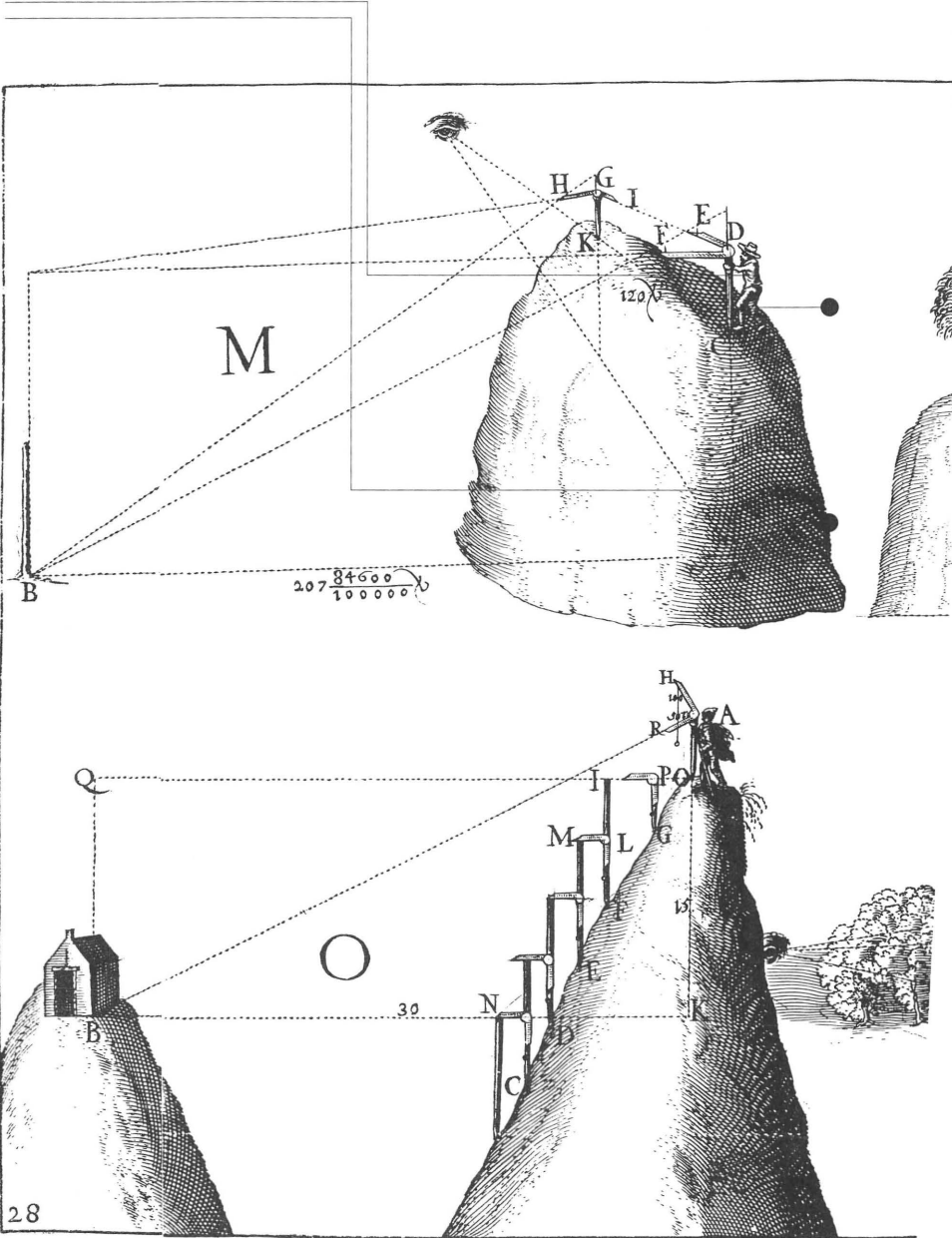
Working toward the Future
or
extending conventions
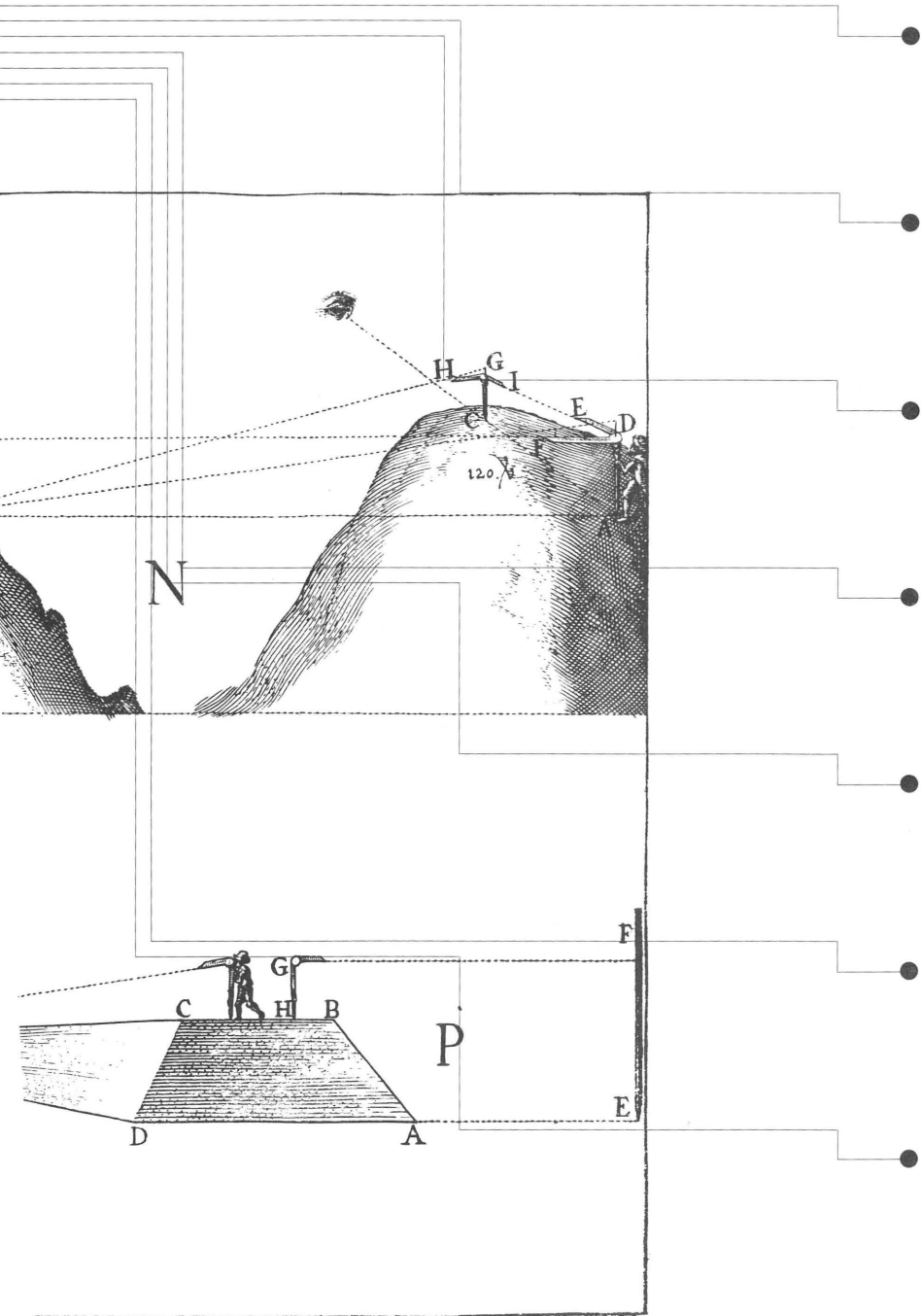
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stereotelephonics,
digital typography,
hypermedia and virtual
reality.

Two systems are introduced that increase

the information density of textual presentation

by reconsidering text as pictures, expanding the range

of written expression. Both schemes indicate nested

associativity, and both employ stripes, but in different

styles: Blush uses large-scale vertical gutters,

superimposed as reverse-fielding on indented outlines

or computer programs; Zebrackets uses small-

scale horizontal striations, superimposed on parenthet-

ical delimiters. These systems are implemented

as computer programs, active filters that represent

textual information graphically.

1
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AT&T Bell Laboratories.

2
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Japan.

4
As extreme examples,
the programming
languages Occam and
Miranda use white-
space directly to
represent scoping
information, without
any explicit begin-end
pairs.