The Diagram Is the Message

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The diagram is a special case of picture-making. It involves the same representational condition: the mapping of a content in shapes which themselves possess—and transmit—a characteristic content. It is necessary to distinguish between the paradigmatic intent and the emblematic form of a diagram. In the Postscript the error potential implicit in the interplay of these properties is demonstrated by examples which include the book arts.

From the grottoes of Combarelles and Altamira to the galleries of the Louvre the walls bear eloquent testimony to man's basic need for pictorial representation. First, say the historians of art, there was sculpture; "the object represented through all its profiles," writes Faure, "having a kind of second real existence." Sculpture was followed by the bas-relief, "which sinks and effaces itself until it becomes engraving,"[1] and finally there was pictorial convention, the representation of the object painted on a cavern wall. The modern archaeologist, armed with the tools of science such as carbon-14 dating, might disagree with this sequence, but the argument is irrelevant to our purpose. What is important is that man needed pictorial representation both for communication with his fellows and for self-expression. Pictorial representation, then, can not only be traced back to the Reindeer Epoch and the dawn of civilization; it shares with language, writing, kinesics, and all the variant forms of non-verbal communication a major role in that total process by means of which cultures came into

1. Elie Faure, *History of Art: Ancient Art* (Garden City, N. Y.: Garden City Publishing Co., 1921), p. 13; also, J. Pijoan, *History of Art* (London: Batsford, 1933), chap. 2: "Art in the Reindeer Epoch"; and R. Huyghe, *Ideas and Images in World Art* (New York: H. N. Abrams, 1959), pp. 104–24.

being and evolved.[2] From the bison of Font-de-Gaume to the image from an overhead projector is quite a leap technologically, but the intervening millenia have not altered the human compulsion to outwit time, as it were, by recreating to hold unchanged forever the fleeting image of a moment.

In the present essay, the authors are concerned with but one specialized form of the picture—the diagram. Diagrammatic representation is a skeletal form of graphic representation; in it extraneous detail is omitted, it is highly stereotyped and stylized. But it does not dispense with the pictorial *as if*.[3] It merely employs reduction. This reduction may eventuate in outline drawings of botanical specimens in a fieldbook for flower identification, the denotative devices of a picture language (e.g., Otto Neurath's Isotype), the abstract figures used to exemplify molecular structures in organic compounds, the schematic wiring diagram for an electrical circuit, or Charles Morris' graphic representation of the human action system.[4] The element of reduction that characterizes, and in a sense defines, the diagram may either facilitate or impede recognition, or even make recognition impossible. Its success or failure depends upon the extent to which it employs a form of signification that is meaningful to the viewer. For diagrammatic representation employs what may be regarded as a very special and often sophisticated form of *semasiography*, and the solution to the problem of signification that it presents is quite different from that which attempts to invoke reality in more elaborate pictorial terms. But if that which is pictured can-

2. I. J. Gelb, *A Study of Writing* (2nd ed., Chicago: University of Chicago Press, 1963); C. Cherry, *On Human Communication* (2nd ed., Cambridge, Mass., M.I.T. Press, 1966) esp. chap. 7: "On Cognition and Recognition"; E. T. Hall, *The Silent Language* (Garden City, N. Y.: Doubleday, 1959); J. Ruesch and W. Kees, *Nonverbal Communication* (Berkeley: University of California Press, 1957).

3. Cf. E. H. Gombrich, *Art and Illusion* (New York: Pantheon, 1961), chap. ii; and the same author's delightful *Meditations on a Hobby Horse* (London: Phaidon, 1963). See also Gelb, pp. 35 ff.; L. Hogben, *From Cave Painting to Comic Strip* (New York: Chantecleer Press, 1949), pp. 179–83.

4. *Toward a Unified Theory of Human Behavior,* ed. R. R. Grinker (New York: Basic Books, 1956), p. 350 f.

not be recognized by the viewer, it matters little how it is pictured. As Abraham Kaplan has observed, "Appearance is what is to be known, reality what it is known as."[5] The object of the diagram is to reveal this reality. There is no other justification for its existence.

The diagram is a special case of picture-making: it bodies forth its subject in a pictorial way, in shapes which themselves possess a characteristic content, but are used to represent another. Any histogram in *Fortune* magazine illustrates this characteristic of the diagram.

The problem of symbolic significance presented by diagrammatic representation—one might say the semiotic of the diagram—have long occupied the most competent minds of Western scientific and philosophic thought. We do not propose to attempt to scale these precipitous paths, even were we competent to do so. Our objective is much more humble. Science is probably responsible for the extensive use of diagrams because the attributes of the diagram as representation fit so appropriately many of the concepts, phenomena, and processes of science. From the literature of science the diagram, which probably began in that shadowy realm of cosmology, or had, at least, philosophic origins, spread to other neo-scientific fields, the social sciences, management, history, linguistics, and eventually even librarianship. So recent has been its introduction into library literature that one will find few examples of diagrams prior to the 1930's, for it was during those years that librarians turned the corner and saw before them the vision of a new heaven and a new earth bathed in the light of the scientific method.

It may, therefore, not be altogether inappropriate for librarians to pause for a moment in their mad rush into scientific methodology to inquire into the nature of diagrammatic representation, to remind themselves of its proper use, and to ponder Alfred North Whitehead's remark that "the object of symbolism is the enhancement of the importance of that which is symbolized."[6]

5. A. Kaplan, *The Conduct of Inquiry* (San Francisco: Chandler Publications, 1964), p. 85.

6. Quoted after C. Morris, *Signification and Significance* (Cambridge, Mass.: M.I.T. Press, 1946).

A simple diagrammatic situation obtains in the family tree reproduced in Figure 1. Correspondence with fact is obvious in this filiation scheme. It becomes much more subject to interpretation when used, e.g., as a stemma in descriptive bibliography[7]—although specialists, who are painfully aware of the complexities behind the lines connecting texts A and B, may remind us that certain skeletons in family closets could also affect the stemmatic simplicity of family trees.

Similar relatively straightforward situations obtain in various kinds of block-diagrams as long as they map synchronous or diachronic situations as in Figures 2 and 3. Both diagrams involve, as it were, implicit locus problems. In the case of Figure 3 this is duly accounted for by Professor Ash, when he refers to information theory as "an attempt to construct a mathematical model for each of the blocks" in the figure, and adds that "we shall not arrive at design formulas for a communication system. . . ."[8]

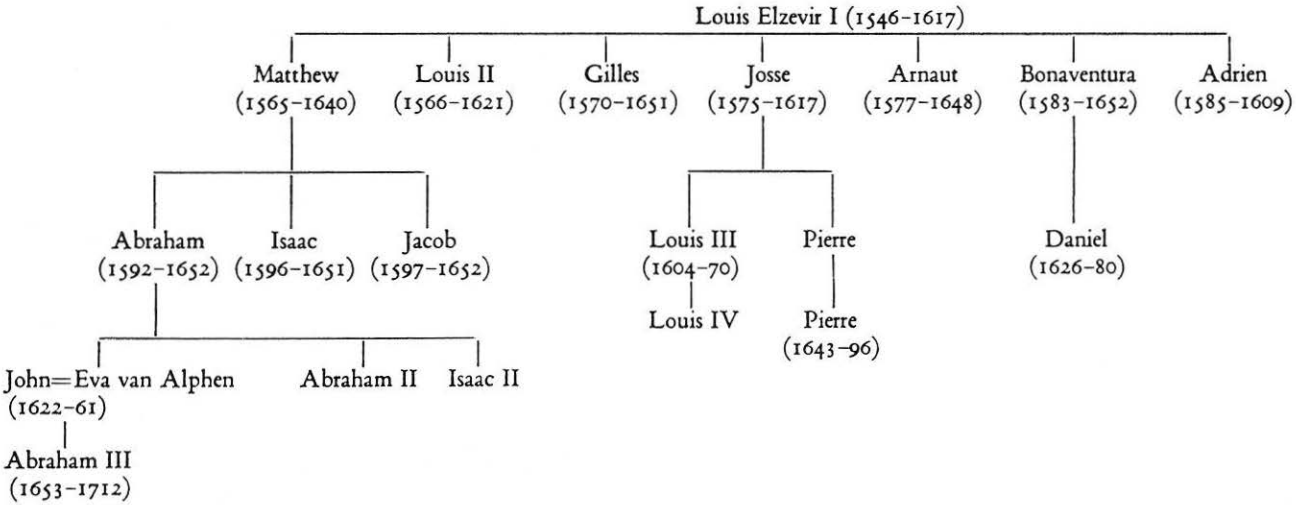
The diagrammatic situation recalls Clyde Coomb's insistence that the term *data* be restricted to observations which are already interpreted in some way and "are in part a product of the mind of the observer. . . . We buy information with assumptions—'facts' are inferences, and so also are data and measurements and scales."[9] Pictorial information likewise is bought with assumptions. If one would not understand that in Figure 4 the legends enclosed in blocks and the swirl of connecting lines between them signify steps, decisions, conditions, and circumstances which are considered to be situationally related significant determinants in accordance with present-day theoretical convictions, he would not benefit from P. J. Runkel's careful commentary.[10] As soon as we are not attuned to the inferential situation and, if you will, the

7. *Cf.*, e.g., P. Maas, *Textual Criticism* (Oxford: Clarendon Press, 1958), pp. 42–49.

8. R. B. Ash, *Information Theory* (New York: Interscience, 1965), p. 1.

9. C. H. Coombs, *A Theory of Data* (New York: John Wiley, 1964), pp. 4, 5.

10. *Handbook of Research on Teaching*, ed. N. L. Gage (Chicago: Rand McNally, 1963), p. 126 f.



The Elzevir Family

Figure 1. N. E. Binns, *An Introduction to Historical Bibliography* (2nd ed.; London: Association of Assistant Librarians, 1962), p. 96.

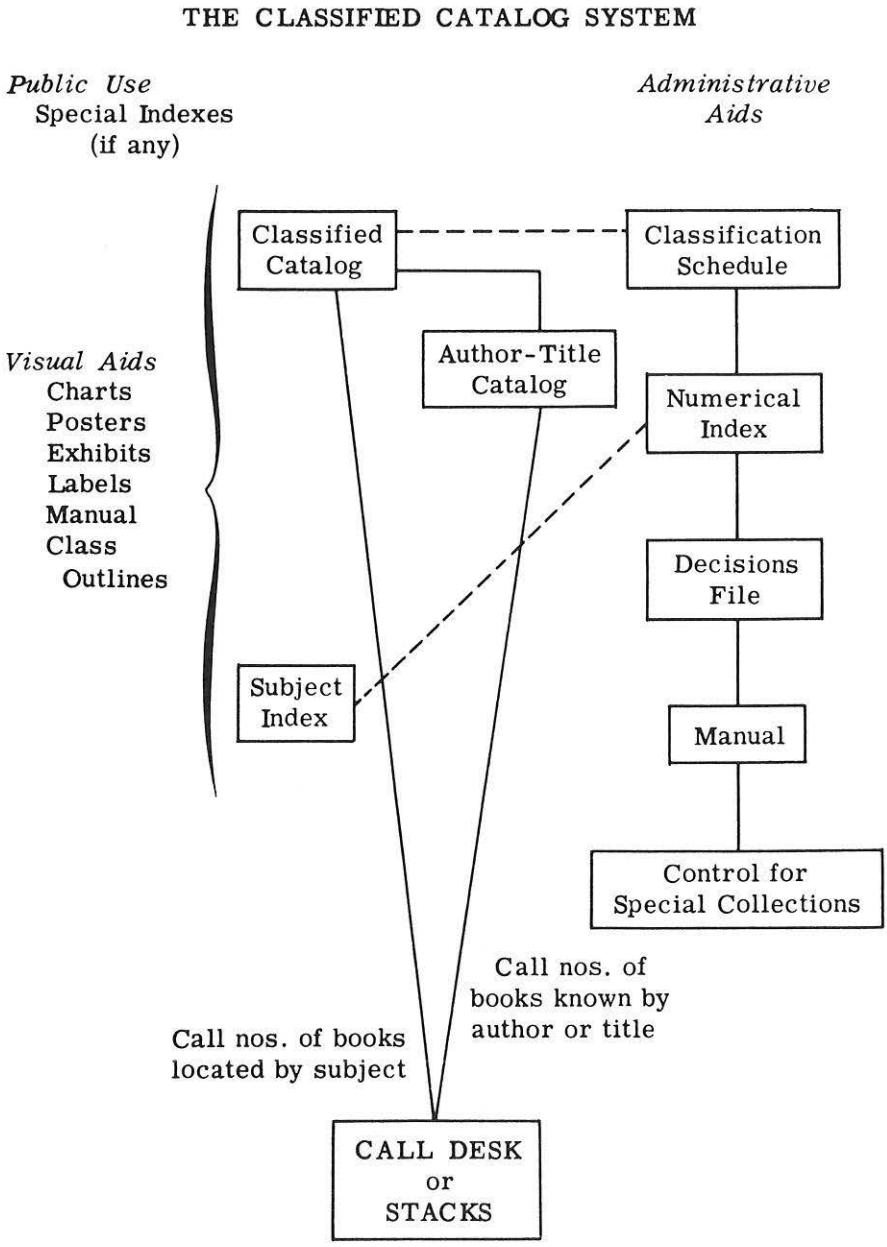


Figure 2. J. H. Shera and M. E. Egan, *The Classified Catalog* (Chicago: American Library Association, 1956), p. 67.

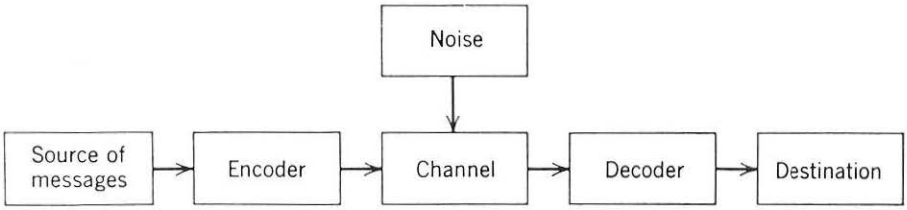
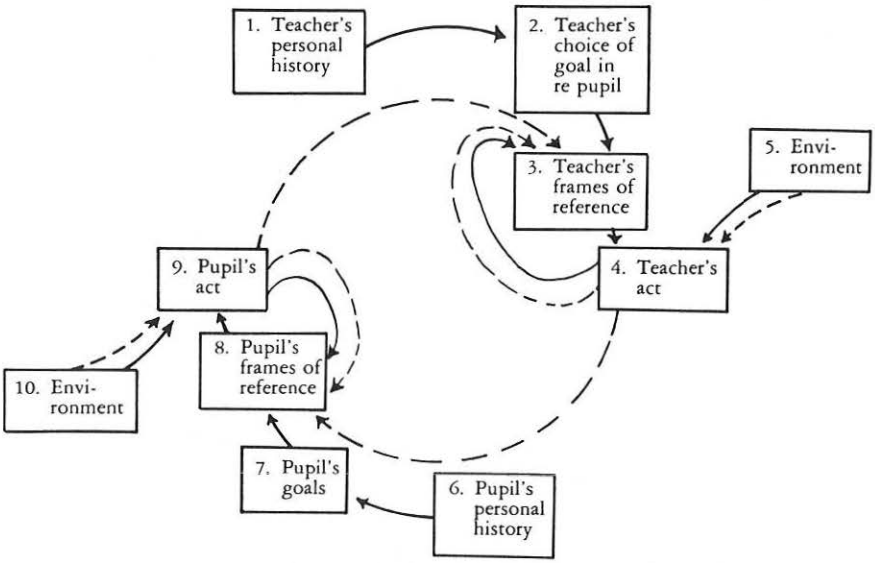


Fig. 1.1.1. Communication system.

Figure 3. R. B. Ash, *Information Theory* (New York: Interscience Publishers, 1965), p. 1.



Solid lines represent intrapersonal communication via the nervous system, etc. Dashed lines represent interpersonal communication via vision, speech, etc.

Fig. 22. A Brief Model for Pupil-Teacher Interaction (P. J. Runkel, personal communication, 1958).

Figure 4. N. L. Gage, *Handbook of Research on Teaching* (Chicago: Rand McNally, 1963), p. 126.

style of thought which generate the diagram, we find it difficult to read the picture. Figure 5 is a representation of the mechanism of government, the wheels of state in the Holy Roman Realm. Iconographic expertise may bring us somewhat closer to the meaning of the diagram and contemporary modes of representation. But the hierarchical pattern, significant as it is, will surrender its message only if and when we understand the theory of state and government and, in this case, certain specific popular and regional ideas, traditions, and idiosyncrasies held by the fifteenth-century designer.[11] Modern organization charts are said to harbor similar intricacies. Conversely—Figures 4 and 5 do make explicit situations of complexity and articulate pictorially, at least, certain aspects of these situations which as such do not seem to lend themselves readily to articulation.

S. R. Ranganathan uses diagrammatic representation for his modes[12] "by which the field of knowledge may throw forth new specific subjects:"[13] dissection; denudation; lamination; and loose assemblage.[14] These diagrams are well known to librarians. They have a long and interesting history as representations of class relations and syllogistic moods in formal logic. Schopenhauer, who used the familiar circle diagrams to indicate conceptual relationships in his *Die Welt als Wille und Vorstellung* (1818),[15] credited the "exceedingly happy idea" of graphic representation of these relationships to L. Euler (1768), J. H. Lambert (*c.* 1765), and G. Ploucquet (1763), "who used squares and probably thought of it first." Actually, the use of the figures can be traced further back to J. C. Sturm (1661), J. H. Alstedius (1614), and

11. *Cf.*, e.g., T. Steinbuechel, *Christliches Mittelalter* (Leipzig: J. Hegner, 1935), pp. 208–72.

12. R. S. Parkhi, *Decimal Classification and Colon Classification in Perspective* (New York: Asia Publishing House, 1964), pp. 415–18.

13. S. R. Ranganathan in *Bibliographic Organization,* ed. J. H. Shera and M. E. Egan (Chicago: University of Chicago Press, 1951), p. 96.

14. J. H. Shera and M. E. Egan, *The Classified Catalog* (Chicago: American Library Association, 1956), p. 30.

15. i, 1, 9.

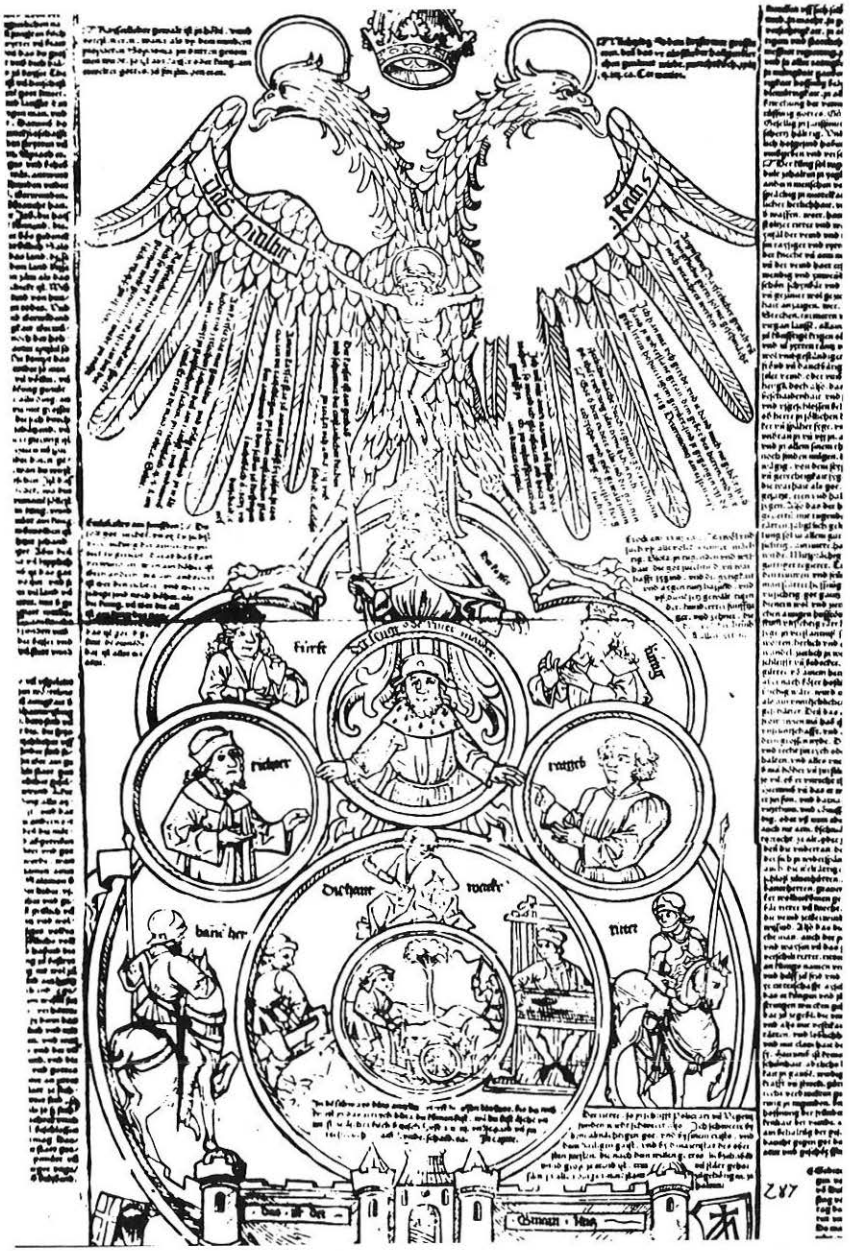


Figure 5. W. L. Schreiber, *Holzschnitte, Metallschnitte, Teigdrucke aus dem Herzoglichen Museum zu Gotha. . . .* (Strasbourg: Heitz, 1928), plate 15.

L. Vives (1555).[16] Leibniz used both circles and straight-line figures to diagram the old mnemonic designations coined by Peter of Spain.[17] Syllogistic diagrams were familiar to the ancient commentators of Aristotle and the Megarian Stoic school. Their use during the Middle Ages is yet to be explored, although medieval predilection for diagrammatic representation and, specifically, the *pons asinorum* (a diagrammatic statement of the Aristotelian doctrine of the *inventio medii*), is well established.

Schopenhauer diagrams within the context of his presentation and with obvious reliance on the traditional Euler figures. He diagrams what we know and neglects the visual factors exhibited by his figures. This is amusingly demonstrated in his representation of "dissection" of a conceptual sphere including two or more concepts which "exclude each other," yet fill the sphere (Figure 6).

Euler's graphics of propositions and syllogisms in his *Lettres à une princesse d'Allemagne*[18] are much more elaborate. He is fussily concerned with the proper interpretation of his figures: One might make bold to state that Euler would not have let pass Schopenhauer's figure, above. "These circles, or rather these spaces, for it is of no importance of what figure they are, are extremely commodious for facilitating our reflections on this subject, and for unfolding all the boasted mysteries of logic, which that art finds it so difficult to explain; whereas by means of these signs the whole is rendered sensible to the eye. We may employ, then, spaces formed at pleasure to represent every general notion, and mark the subject of a proposition by a space containing A, and the attribute by another which contains B. The nature of the proposition itself always imports, either that the space of A is wholly contained in the space B, or that it is partly contained in

16. I. M. Bochenski, *A History of Formal Logic* (Notre Dame, Ind.: University of Notre Dame Press, 1961), p. 260 f.

17. *Opuscules et fragments inédits de Leibniz,* ed. L. Couturat (Paris: F. Alkan, 1903). Bochénski, p. 258, ascribes to Leibniz the introduction of the Euler diagrams.

18. *Letters of Euler on Different Subjects in Natural Philosophy Addressed to a German Princess,* ed. D. Brewster and J. Griscom (New York: J. & J. Harper, 1833), I, 337–54.

(3.) A sphere includes two or more spheres which exclude each other and fill it.

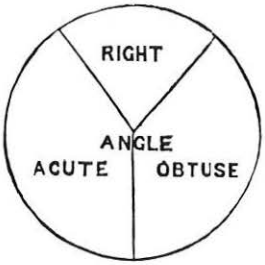


Figure 6. A. Schopenhauer, *The World as Will and Idea* (New York: Charles Scribner's Sons, 1883), I, 56.

that space; or that a part, at least, is out of space B; or, finally, that the space A is wholly out of B" (Letter 103, February 17, 1761). Euler uses these "emblems" to develop a veritable pictorial notation which, he hopes, would be "a great assistance towards comprehending more distinctly wherein the accuracy of a chain of reasoning consists" (Letter 102, February 14, 1761).

Euler, Schopenhauer, and Ranganathan use diagrammatic figures of great similarity. Ignoring the purposes for which each employs the figures, we may observe that a variety of situations is mapped with essentially identical graphic shapes. Euler's emblems "are" more explicit than Ranganathan's because of Euler's insistence on detailed contextual exploration, illustrated by the diagrams in Figure 7. The "lamination" emblem, for instance, appears as a paradigm for both, affirmative and negative situations, and we are reminded to look, as it were, in more than one direction, beyond the shape of the emblem. In the case of syllogistic diagrams the figures for relations between more than two or three classes developed by J. Venn[19] and W. E. Hocking,[20] are

19. J. Venn, "On the Diagrammatic and Mechanical Representations of Propositions . . .," *London, Edinburgh and Dublin Philosophical Magazine,* 5th Ser., X (1880), 1–18.

* Our author subjoins here the following diagram, with this short introduction:—"I shall once more give you a visible representation of these figures or emblems of the four species of propositions."

Emblems of the four Species of Propositions.

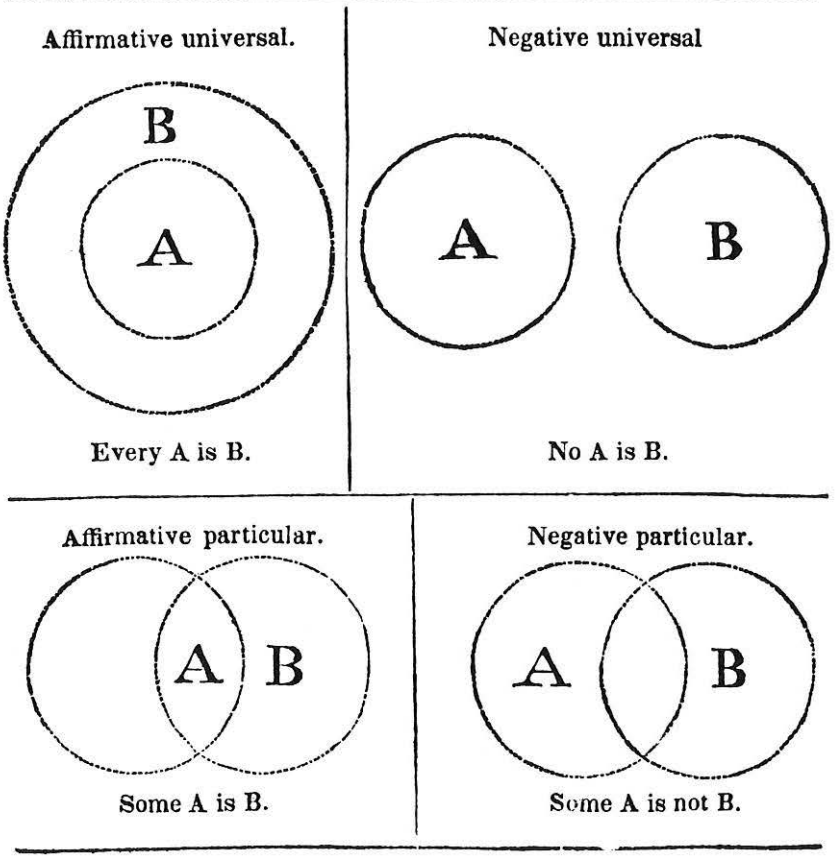


Figure 7. *Letters of Euler on Different Subjects in Natural Philosophy Addressed to a German Princess,* ed. D. Brewster and J. Griscom (New York: J. & J. Harper, 1833), I, 341.

the graphic results of precisely such "thinking beyond the diagram." On the other hand, the concrete pictorialism of the emblem as such may invite further interpretations resulting in clarification or extended application. Thus Peter Caws uses a series of "lamination" emblems to represent the relations between the world of ordinary experience and scientific theory, and maps imaginatively the scope of argument in each part of his *Philosophy of Science*.[21]

Part III

In our attempt to follow on a humble level Wittgenstein's advice to "treat of the network, not of what the network describes" we have traversed familiar territory. We all have long been aware of the fact that pictures depict as we look at them, that they are what we see and signify what we know. It does not take much intellectual effort to understand the implications of the diagrammatic situation which offers concrete, definite emblems and the attendant advantages of explicit relationships graphically represented, but has to be clearly understood in its conceptual context in order to be properly construed as a paradigm.

Most of us, at one time or another, have been aware of the illusion created by certain forms of advertising, which shrewdly ring the changes on these properties of the diagrammatic situation as they present us with stunning graphic tableaux of "irrefutable objective scientific data gathered by an independent research organization." This is abuse, or more or less serious deceit, aimed at "them"—the unthinking public. But it is important to remind ourselves that essentially the same conditions obtain when we use diagrams in our attempts to ascertain the truth through reflective inquiry. If used properly, diagrams can explain and simplify, can reveal an underlying order, permit systematization, and point to gaps in our knowledge or our design. They enable

20. W. E. Hocking, "Two Extensions of the Use of Graphs in Elementary Logic," *University of California Publications in Philosophy,* II (1909), 31–44.

21. P. Caws, *Philosophy of Science* (Princeton, N. J.: Van Nostrand, 1965), p. vi.

function determining a "simple" straight line would be quite complicated."[2]

(2) Conversely, we might consider this interplay and its effects as such. In the field of the book arts this has been done primarily in terms of artistic creation and its impact. When William Morris championed Emery Walker's "principles" of book design—at about the time Charles Sanders Peirce developed his pragmatic theory of signs—he may have had in mind systemic interpretations and their potential, although the products of the Kelmscott Press do not graciously corroborate such an assumption. Today we have a whole literature on the design of books and the component parts of books. Yet when it comes to inquiry into the effects (and the intrinsic properties attendant upon these effects) wrought by the emblematic characteristics of books and related materials, we do not seem to have gone very far beyond the position held by early commentators, such as Polydore Vergil, who noted in 1499 the "new kind of writing, invented in our times," which makes it possible that one fellow prints in one day all that could be written by several scribes within a whole year.[3]

We coin terms such as *mis-en-page, Schriftbild,* etc., which designate but do not explain. We draw more or less appropriate analogies concerning typographic characteristics, letterform, and over-all arrangement, and express expected and experienced effects in a metaphoric phraseology fully as naive, but seldom as charmingly compelling as Hogarth's "peculiarity in the lines . . . that *leads the eye a wanton kind of chace.*"[4] We map page spaces and opening. But we do rarely probe for causes or implications and ignore the pertinence of history. After a century, Theodor Birt's *Buchbegriff* remains simply outside the "professional" liter-

2. Carl G. Hempel, *Philosophy of Natural Science* (Englewood Cliffs, N. J.: Prentice Hall, 1966), 40 ff. For an interesting illustration of, as it were, the emblematic properties of terminology, see *The State of the Social Sciences,* ed. L. D. White (Chicago: University of Chicago Press, 1956), p. 44.

3. Polydore Vergil, *De rerum inventoribus* ii, 7.

4. William Hogarth, *The Analysis of Beauty* (1753), ed. J. Burke (Oxford: Clarendon Press, 1955), p. 42. Italics are quoted.

ature and its concerns.[5] Even sophisticated approaches, such as tachistoscopic experiments, seldom question the status-quo of traditional notions: syntactic and diacritic marks, letter width, word separation, etc., are treated as "data", i.e., as quasi absolutes of "the" printed page.[6] In the forties and fifties we discussed the ideas of William Ivins.[7] Now we have exchanged them for the more buxom pronouncements of Marshall McLuhan. But, somehow, we do not get down to the specifics and reflective inquiry into the specifics of the problem of the book as an object which offers its contents in terms of its properties as an object—designed within a specific contextual field of purposes, conventions, assumptions, etc.

How did a fifteenth-century reader approach a page of tiny black letter crowded into compact double columns? What does the closely-spaced roman, unrelieved by paragraphs, or the simultaneity of text and surrounding scholarly commentary on a Renaissance folio tell us about the designer's intent; and what effects do these visual arrangements entail? Have you ever contemplated the unmitigated uniformity of a mid-sixteenth century duodecimo in italics and asked questions concerning the matrix of subordination supportive of interrelated contents, which most of us take for granted? We smile at the "allusive" printing of the 1800's, but may ignore, at the same time, allusive effects operative in the "standard" product of our time.

All these questions involve emblematic properties which are the *terms* on which the contents is offered. How intricately these terms may affect the "information" becomes crystal clear in situations involving contexts that are foreign to us or with which we have lost direct or imagined affinity, e.g., Chinese xylography, or

5. Theodor Birt, *Das antike Buchwesen* (Berlin: W. Hertz, 1882); and "Abriss des antiken Buchwesens," in I. von Mueller, *Handbuch der klassischen Altertumswissenschaft,* i, 3.

6. Cf., e.g., L. Carmichael & W. F. Dearborn, *Reading and Visual Fatigue* (London: G. G. Harrap, 1948); and H. F. Brandt, *The Psychology of Seeing* (New York: Philosophical Library, 1945).

7. W. M. Ivins, *Art and Geometry: A Study in Space Intuitions,* 1946; *Prints and Visual Communication,* 1953; both published at Cambridge, Mass.: Harvard University Press.

ancient "books".[8] It seems that a generation concerned with electronic media, CRT terminals, KWIC and KWOC indexes, and computer printouts can no longer afford to ignore them.

(3) The following two items are offered by way of summary. We have found them easy to keep in mind.

"Well! I've often seen a cat without a grin," thought Alice, "but a grin without a cat! It's the most curious thing I ever saw in all my life." Lewis Carroll, *Alice in Wonderland.*

J.H.S.
C.H.R.

8. Note, in particular, the remarkable chapter v, "Laterculis coctilibus," in A. Leo Oppenheim's *Ancient Mesopotamia* (Chicago: University of Chicago Press, 1964).