ABSTRACT

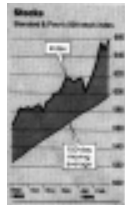
The diagram is a formal, graphical system of representation that combines, or has the potential to combine data and narrative within a single entity. If an analytical description is to recognize this alliance, it is to disaggregate these aspects and locate them within the diagram as its affordances, and as rules for reading and interpretation. This chapter will combine theories of narratology and characteristics of graphic language to explicate the narrative aspects of diagrams in the context of communication.

INTRODUCTION: GENERAL FRAME

**The distinction between data and information**

In The Visual Display of Quantitative Information, Edward Tufte opens by proposing the generally accepted view that the foundation of graphical presentation is the data. "Graphics reveal data."[1] Such data are the referents of graphical presentation, but they are distinct from what the graph is doing or saying.

Here are two diagrams : one, perhaps, of stock averages, and the other, perhaps, of the speed of an airplane. The graphs are interpretable regardless of the referents or of the accuracy of the correspondence between the graphs and their referents as data. In practical terms, Tufte is at pains to be aware of the distinction between data and information. Data is stuff, but pieces of information are the constituents of a story.



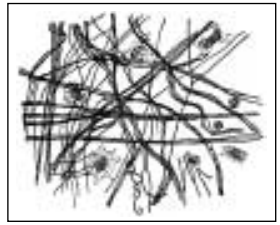

*Left: New York Times, Feb. 26, 1996*
*Right: fabrication*

**Graphic narrative**

That intelligible activity is the gesture or narrative of the graph. Within a graphic, the data points themselves are passive – data points – while their patterns or relationships are intelligibly active– lines, bars, scatters. Those patterns, defined by the (agreed upon) structure of the graph carry the narrative or story. That narrative may be complex or trivial; the stocks above are "going up and forward in time! ", or "look at the number ! " of convictions against Polisi.

*Tufte: Envisioning Information. p. 31*

If graphs remain graphs when we do not know what they are about, they remain graphs when they lie, when they require specialized knowledge, when they use a language which is so personal that they communicate only to their creators.



*"Loose "ligament tissue of the Rat. Kandinsky. Point, Line, and Plane. p. 106*

[1] Tufte, Edward. The Visual Display of Quantitative Data. Cheshire Connecticut; The Graphics Press. 1983. p.14

The relationship between graphic structure, narrative, and referent parallels the relationship between word meaning and syntax in sentences. In 'IBM is building a new computer.', 'IBM' is the subject or referent, and 'is building a new computer' is the predicate or narrative substance. With respect to referent, we ask whether 'IBM' is so constituted as to be able to build a new computer, interested in building a new computer, etc. Such questions concern issues of validity and verification, often covered under such considerations as credibility and legitimacy.

**Narrative and science**

The concern with data accuracy or denotation is one that Tufte shares with Tukey,[1] Karsten,[2] Bertin,[3] and other statisticians. As a question, it is accessible in Tufte's work because while he argues that graphs must be clear and honest, he shows examples which reflect the larger questions of graphic communication.

Jean-François Lyotard relates science as fact and narrative as story in the following way:

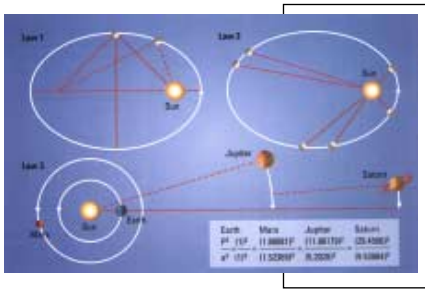
> *In the first place, Scientific knowledge does not represent the totality of knowledge; it has always existed in addition to, and in competition and conflict with, another kind of knowledge, which I will call narrative…*

Lyotard's 'narrative' has its origins in myths and stories passed down from speakers to listeners. For Lyotard, both narrative and science are legitimate, though their legitimacies are different. In myth, the listener is a future speaker and the speaker is elevating the listener to his level, while in science, the speaker is delivering information to a listener who is his intellectual peer. In both case, the legitimacy of the exchange is a matter of agreement between speakers and listeners, and in both cases the exchange is subject to later refutation.

More importantly, even within scientific discourse, narrative is the source of hypotheses tested. Narratives exist alongside scientific facts as
- the sources of hypotheses and
- the stories that relate data to the meaningful world.

**Hidden narratives within science**

One implication is that scientific discourse encloses narratives within the rubric of fact, and projects the view that, in effect, the narratives exist within the facts. "Science requires that one language game, denotation, be retained and all others excluded.[3] Therefore, it is not surprising that within the general discourse on graphs, their denotations or factual referents are emphasized at the expense of their narrative or meaning.



*Scientific representational model*

*Narrative reference*

[1] Tukey, John W. The Collected Works of John W. Tukey: Volume V Graphics: 1965-1985. Pacific Grove California; Wadsworth and Brooks / Cole Advanced Books & Software. 1988

[2] Karsten, Karl G. Charts and Graphs. New York; Prentice Hall. 1923

[3] Bertin, Jacques, Semiology Graphique, Wisconsin; University of Wisconsin Press

[3] Lyotard, Jean-François. The Postmodern Condition. Minneapolis, Minnesota; University of Minnesota Press. 1984, p. 25

Diagram can be located along the following axes:

- text: image: object
- nominal, noumenal, and phenomenal
- idea / experience
- abstract / empirical

**Doblin taxonomy**

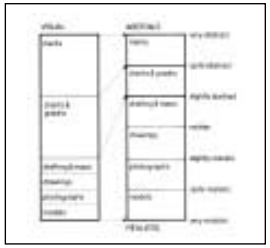
Jay Doblin has provided two types of classification represented as applicable to graphing: a twelve cell matrix, and an orthogonal axis spanning 'realistic' to 'abstract.' Doblin classifies charts and graphs as visual and noumenal, i.e. that what distinguishes graphics is their use of visual resources, and that their interpretation requires a level of logical processing not required by language: in his words, 'conceived by reason, but not knowable through the senses.'[1]

*J. Doblin's taxonomy of expressive types.*

The designation of graphics as noumenal points importantly to the role of the viewer in constructing the graphic meaning or message. Unlike language in which we can be told, with diagrams, we must question and observe. On the second count, that of diagrams as visual, rather than nominal or numerical, there are difficulties. Diagrams often operate in those two realms simultaneously. From this standpoint, it would perhaps be more appropriate to define a juncture of visual, numerical, and verbal, as an area in which graphs are most likely.

Doblin designates noumenal numerical material as 'mathematic [the] numbers and symbols used for complex calculations.' But here, too, the graphic elements are important. We depend upon graphical manipulation to grasp and execute mathematical calculations. Such manipulation operates by strict rules which map physical movement to quantitative result.

A third area of difficulty is the designation of graphs as 'quite abstract.' Diagrams can vary from extremely abstract to relatively 'realistic,' in Doblin's parlance. In addition, other forms like photographs can vary drastically from the empirical snapshot to fully formal studies of line and color.



*J. Doblin's taxonomy of abstraction.*

Within the graphic realm, diagrams can be compared to other forms including graphic design, illustration, artistic painting and photography. Both diagrams and graphic design attempt to reduce the complexity of the visual field to narrow the range of interpretation, and both tend to concern themselves with concepts or ideas rather than experiences. Illustrations are often made to show or 'illustrate' ideas but they do so using empirical detail, and paintings may vary from abstract to highly realistic, but at least until the very recent past, they have been most concerned with conveying or evoking experiences.

[1] *Doblin, J. A Structure for nontextual communication. in Kolers, Paul. A., Meril Wrolstad, and Herman Bouma. Processing of Visible Language 2. New York; Plenum Press. 1980. p, 88*

Peter Storkerson



There is a tradition in Western thought that argues for the separation of verbal and visual communication into two distinct forms: eye versus ear, simultaneous versus linear in time, explicitly clear (denotative) versus vague and evocative (connotative). This view is contentious in that it tends to take formal language as its model of text and art as its model of the visual, but it is nevertheless useful.

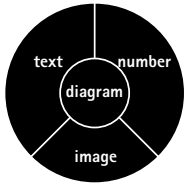



Diagram at the juncture of text, number, and image

**Simultaneity & interpretive frames:**

Nelson Goodman, for example, demonstrates that the message of a text is not on the paper but in the words. Stealing a book is not stealing the message, only an artifact, while stealing a painting is stealing the unique object. There are two issues here:

1 What is the clarity of the message
2 What is the breadth of the interpretive frame.

We can locate diagrams at the juncture of the nominal and noumenal levels, with formal rules limiting the fields of interpretation and languages specifying the relationships that are being expressed.

**Visual 'noumenality'**

Within formal language, there are strict agreed upon rules for reading that limit the interpretive frame to clarify a single message. These rules include what parts and aspects of the page are interpretable and the rules of interpretation. e.g., the words are interpreted, not the paper, and the words are there because they were written. In painting and photography by comparison, every observable aspect can be part of the interpretation. Unlike the verbal message with a single initial interpretation, the graphic interpretation depends upon the questions an observer asks on the basis of the interpretive resources made available in conjunction with his or her own questions.

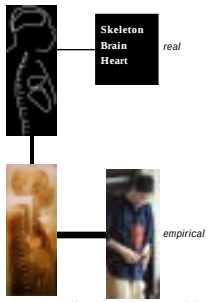
| Verbal | Visual |
|---|---|
| linear / independent | simultaneous / interdependent |
| received | observed |
| explicitly given | implicit / deconstructible |

Comparison of presentational forms

Another aspect is the issue of simultaneous interpretation, i.e. that all aspects within a visual field can be related to each other and their physical configuration can alter their meaning as a whole.

Thus, nouminality is a characteristic of visual fields in general. It is reflected in the informational mode of seeing in which we visually inspect all available materials in an order we choose and make our own observations:

- Verbal information is imparted through time, and received; 'What did it say?'
- Visual information is simultaneous, and inferred by the viewer; 'What did I see.'




Diagrams mediate between empirical object and intelligible structure

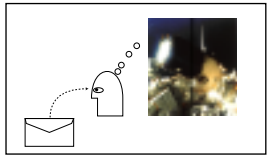
**Diagram and representational system**

Finally, diagrammatic presentation refers both to a denoted object and to a representational model. It interprets the denoted object in terms of that model. . Increasing abstraction demonstrates that it often not the denoted object but the representational model that is the communicative goal of the diagram. The outside referent is merely the empirical, while the model is the real (or intelligible).

Narrative is the method by which diagrams convey their meaning. Narratives reference diagrams to semantics or frames of meaning, and provide models of action within those frames. By combining textual and visual characteristics, diagrams can combine scientific and narrative discourses. The informational mode of visual process can communicate narrative.

Not all diagrams need to express or have their narratives. The fact that diagrams have no explicated narrative does not mean that narrative is unimportant, it may merely be that the narrative content is already known to the intended audience. The viewer may bring the narrative.

Narratives can be almost entirely held by the viewer as the knowledge he or she brings to the viewing, or they may be to varying degrees be explicated by the graphic presentation. The mere naming of the referent itself may serve to evoke the meaning. Thus, for example, the Gotti conviction graph above did not need to carry any symbolic references to those who were abreast of the trial.



*Index:*
*A sign or symbol that does not resemble the signified but is connected to the signified by knowledge or awareness of…*

**Universality of communication in graphics**

The distinction between graphics for constructive and for communicative purposes may be largely false: both are communicative, but the constructive graph communicates an audience that possesses a narrative, while the communicative graph must be designed for an audience that may not know the narrative or the data.

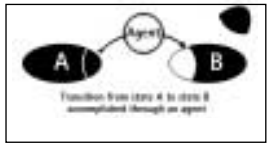
**Narratology**

Having distinguished between visual and textual aspects of diagrams and assigned narrative to the visual aspects, it is possible to consider visual narrative in general, its characteristics, and how they can or might be applied to diagrammatic practice.

Narratology has its origins in the analysis of folk tales and stories. It concerns not specific stories, but what all stories have in common: characteristics stories must have.

In narratology, narratives are defined as an event: a state of affairs, and a second state of affairs which differs from the first, accomplished through some agency. Narratives can be quite trivial, e.g.:

> *The Woman Closed the Window, The monkey opened the bag, or The Bottle fell on the floor constitute narratives. On the other hand, a poem like Candy is Dandy but Liquor is Quicker, a syllogistic statement like All men are mortal, Socrates is a man; therefore Socrates is mortal, or a statement like Tigers are large carnivorous mammals of the cat family to not constitute narratives: they do not*




*Narrative kernel:*
*an altered state of affairs accomplished through an independent agent*

[1] Prince, Gerald. On formalist Narratology. Languages of Design 1. Holland; Elsevier. 1993 p. 304



There is no limit to the number of events that can be contained within any narrative, and the usual language distinctions obtain especially with respect to temporal order, e.g. 'Joan shut the door and John sat down at the table,' 'John sat down at the table and Joan shut the door,' and 'John sat down at the table after joan shut the door,' Narrative and Diagram

**Narrative and Diagram**

all mean different things. The data are the same, but the language makes different statements about them thus transforming them into information *within different narratives.* Ordering syntax within graphs is a narrative function.

After Propp, and Levi-Strauss a story is defined as follows: 'At least one represented event does not logically presuppose the situation it modifies or does not logically entail the situation it brings about and the situation that is modified and the resulting situation are paradigmatically related.'[1] If, for instance all events were entailed, we would have the equivalent of 'Socrates is a man….'

Greimas offered the following typology of narrative:[2]

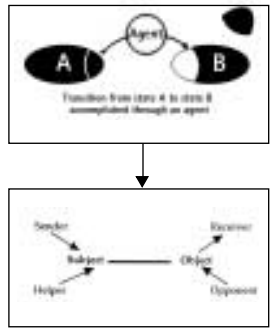
- Subject looking for object
- Object
- Sender of the subject
- Receiver of the subject
- Helper of the subject
- Opponent of the subject

Breimond abstracted further to:

- Virtuality – a situation opening possibility
- Actualization – or non actualization of the possibility, and
- Achievement or non achievement.[3]

Prince goes on to provide the notion of 'kernel stories' in which there is only one event that is not a logical result, and the ending situation is like the beginning except for a modification. At its root, the narrative is a declarative sentence with a subject, a transitive verb, and an object.

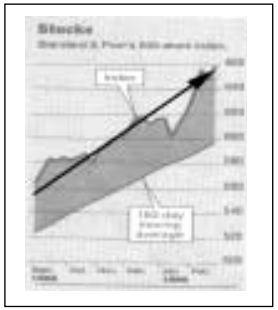
The scientific and narrative space graphics – diagram and image – show the linkage between simple narratives 'planets revolve in space' and most of the narrative elements of Greimas' typology: Astronauts, sent by their government, out in space, in search of its conquest with the help of their ship, and each other, opposed by the frozen emptiness. Will they achieve their quest or not? If we reconsider the stock average, we see a state of affairs, described by the x and y axes of the graph, and a change in the curve caused by the independent actor, a surge in stock values.




*Greimas' typology*

| | |
|---|---|
| Subject: | astronaut |
| Object: | conquest of space |
| Sender: | government |
| Receiver: | space ship |
| Helper: | tools, NASA staff |
| Opponent: | space itself |

*Space narratology*



*Stock graph narratology*

[1] Prince, p. 308

[2] Greimas, A.J. Structural Semantics. Lincoln Nebraska; University of Nebraska Press. 1983

[3] Prince, p. p310

*Henri Cartier-Bresson*
*Alicante, Spain, 1933*

**Narrative and Image**

In the graphics above, the diagram operates with gesture, while the space graphic operates by the conjunction of diagrammatic and pictorial or symbolic means. Images achieve narrative content through both gestural and symbolic means, often working in conjunction with each other and often using devices shared by diagrams. Cartier-Bresson captures three persons together, in interaction with each other and with the camera. Max Kozloff describes it as follows:

> *Cartier-Bresson has a strange picture, Alicante, Spain, 1932, in which the probabilities are so askew that it seems we are all , when looking at it, very much on our own. It pictures three people, an epicene creature in an undershirt, center, flanked on the left by a fat lady in a Phryginan cap, brandishing a table knife, and a frizzy-haired black woman on the right. The whole frame is aflutter with their arms and kindled by their glaring eyes.… The action gives t…a human exchange that is vaguely indecent, perverse, a ritual these individuals practice which we were not intended to know.*[1]

*Formal devices used to structure interpretation: grouping, similarity, and contrast through inflection and repetition of form*

[1] Kozloff, Max. The Priviledged Eye. Albuquerque, New Mexico; University of New Mexico Press. 1987, p. 5

This is not an explicitly univocal narrative. Rather it presents us with multiple narratives we see as questions. Those questions are produced by the compositional structure of the photograph, the repetitions of arms; the way they link on the two dimensional surface, and the way the body poses repeat each other. Cartier-Bresson was famous for using angle and timing to produce these narratives, which often, by the way, had little if anything to do with what was actually going on.

If we ask what is going on in *Alicante*, we have many things: Someone is brandishing a knife, someone is being pushed or being protected from the camera. Similarly, in *Madrid*, 1933, at right, we have several clusters of behavior: kids at games, and within those groups they have different activities. One of them is looking at us. A blank wall contrasts with the activity. Finally, we have a singleton, the fat old man walking across the frame.

*Henri Cartier-Bresson*
*Madrid, 1933*

By contrast, in the image at right we feel confident that nothing is going on. There is a forest, and a pawn, but no narrative. The artists say that the image has a slogan or message as its referent– that we destroy forests to create material goods– but the image itself has no discernible narrative. We leave it to the viewer to decide if the message is conveyed.

*Suzanne Hill/Ed Bloom*
*(from) The Constructed Forest*

*Mizrach, Richard*
*Playboy #172*
*[Donna Rice]*
*(from) Violent Legacies*

**Multiple Levels of Interpretation**

Here is a somewhat more complex and problematical picture from a series entitled 'The Playboys' within a collection 'Violent Legacies', by Richard Misrach. Misrach photographs in the western desert, particularly on military reservations. This is an old magazine once used for target practice out in the desert. There are at least four levels of narrative questions or possibilities here:

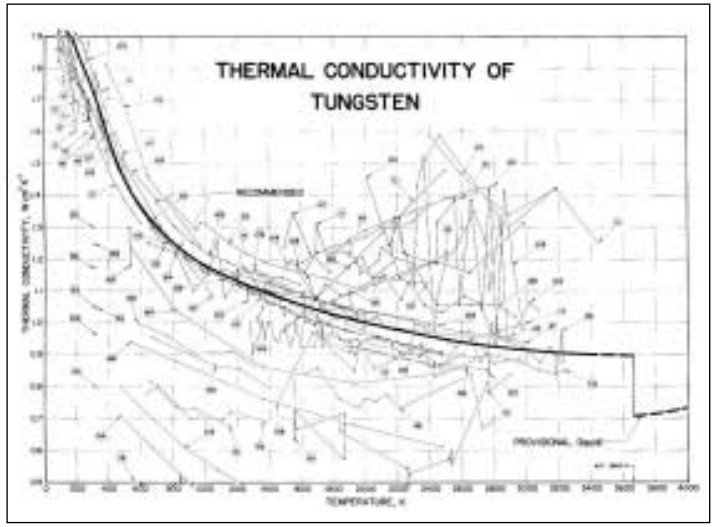
- The subject: Donna Rice is staring back at us with heart shaped pupils.
- Playboy misogyny: What are they doing with her?
- Target practice: Who shot the picture up and why?
- What is Richard Mizrach saying?

*Mizrach, Robert*

*upper right::*
*Playboy #94 [Ray Charles]*

*Right:*
*Playboys as found in the desert*

*from Violent Legacies*

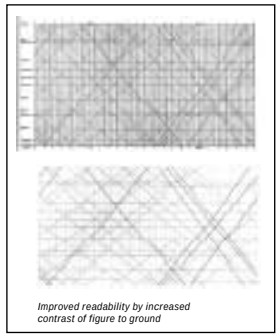



*Ho, C. Y., R. W. Powell, and P. E. Liley, Thermal Conductivity of the Elements: A Comprehensive Review, supplement #1, Journal of Physical and Chemical Reference Data, 3 (1974), I-692*
*in Tufte, The Visual Display of Quantitative Information, P. 151*

The open ended, multiple, or indeterminate narrative is characteristic of photographic or artistic discourse. In artistic discourse the figure and ground of the interpretation are constantly shifting or flipping. The insistence of scientific discourse upon the referents works to limit the interpretive frame by maintaining focus on the data as figure operating against an assumed ground in the space of the graph.

But in the Tungsten diagram, in the informational mode, the visual affordances allow open ended narratives to be seen Multiple, chronologically ordered measurements of the thermal conductivity of tungsten offer narratives about how equipment improved, how higher temperatures became feasible, how sloppy or miraculously lucky some early measurements were, about systematic and random effects. It encapsulates a history of science.

When we read the diagram for narrative, we read it for what can be inferred according to the total available affordances or resources. It is by convention that we usually consider the data to be figure against the presumed ground.



*Improved readability by increased contrast of figure to ground*

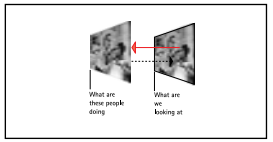
*Marey.*
*Train Schedule*
*in*
*Tufte, Edward.*
*The Visual Display of Quantitative Information*

## Interpretive levels

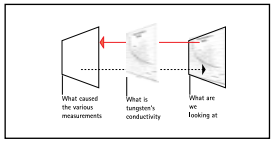
Viewer interpretive problems ore of three types: legibility, readability, and intelligibility. Legibility is equivalent to legibility in text: Can I read the words. Similarly, readability is a matter of being able to construe a recognizable whole for interpretation. Intelligibility, is the sense that the whole makes. Narratives can operate on both the level of readability with analogies which map internal structure, and on the level of intelligibility or meaning.

Narratives as subjects and predicates support levels of interpretive probing when these levels are responsible for or have an effect upon our interpretation of the final images we see. They can be used to call the figure ground relationship upon which scientific diagrams are based, or they draw links between those images or diagrams and meaningful states of affairs, real, speculative, or potential.

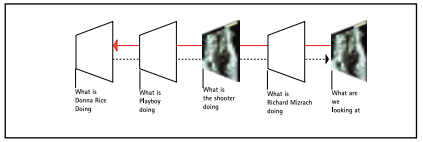
Narratives provide context for perceiving or transform the context within which we perceive images, fulfilling Lyotard's initial claim that they exist alongside scientific fact and are needed by it.




*Levels of Interpretation:*
*Alicante, Spain, 1933*

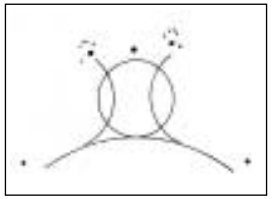



*Levels of interpretation:*
*Thermal conductivity of Tungsten*




*Levels of interpretation:*
*Playboy #172*
*[Donna Rice]*

**Narrative devices:**
Narrative devices are generally of two forms: gestural or internal to the diagrammatic gestures, and symbolic references, typically involving iconography or other recognizable references that are not part of the internal logic of the diagram. Symbolic devices may often resemble decorative additions, but can be distinguished from decorations by their relevance to the diagrammatic content; they may be subservient to diagrammatic content or may dominate.



*Wassily Kandinsky:*
*A Leap of the dancer*
*Palucca*
*Point, Line, and Plane, p. 43*

*Diagram of the leap*
*Ibid. p. 42*

*Cool Tension Toward*
*the Center*
*Ibid. Appendix*

## Gestural narrative devices

The Bauhaus, Kandinsky, and Klee are a source of narrative gesture internal to the language of the diagram. Kandinsky abstracted diagrammatic aspects from empirical forms, and captured their movement in diagrams. In 'ways of nature study,' Klee utilizes texture, contrast of shape and size, arrows, and other inflections toward empirical forms like eyes to clarify the diagram, create hierarchies and build narrative. 'Du' (you) and Ich (I) are linked as you penetrate my 'auge' (eye) directly and through the earth, as we both exist within the containment of the world. The combination of cues as to the nature and direction of links, the inflection toward the empirical such as the eye within 'ich' make the diagrammatic devices double acting: both referential and narrative.

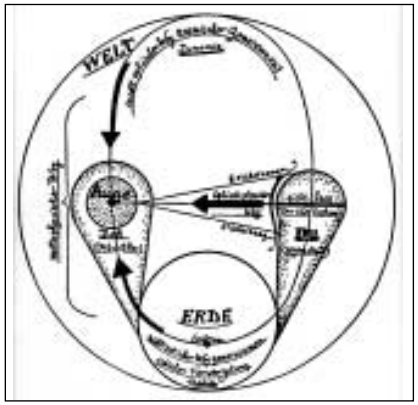
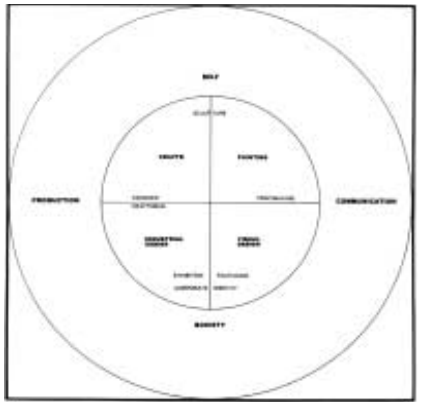



**Diagram without narrative**
In the diagram at right, there are no inflections, no references to transitory states, and no sense of predication, only subjects. Given Klee's use of German and the personal nature of his language in the diagram above, anglophones may be unclear as to how it works; in the 'circle of the visual arts' diagram at right, there is no sense of happening at all. Unlike Klee's *Ways of Nature Study*, the *Circle of Visual Arts* lacks symbolic reference and its configuration appears to be responding to formal considerations, rather than the interactions of the elements. Without narrative, the diagram lacks intelligibility. It is left to the reader to decode the terms used in the diagram and construct from them a narrative by which to make the diagram intelligible. Here, it is the diagram that is passive. The lack of narrative makes inhibits both intelligibility and readability.



*upper:*
*Klee, Paul:*
*Ways of Nature Study*

*lower:*
*Circle of the visual arts*

*both in*
*Wingler, Hans*
*The Bauhaus: Weimar,*
*Dessau, Berlin, Chicago*

In environments where diagrams need to communicate to a variety of persons who do not possess expert knowledge or semantic awareness, Narrative plays an important role in diagrammatic presentation.

Common practices include the cartoon-like narratives of Nigel Holmes who places diagrams within scenarios.

**Museum practices**
Common museum practices include dioramas, in which the diagrammatic aspects relate to the selection of materials and artifacts, and their arrangement or pose.

Larger exhibits may function as walk-in diagrams in which the viewer passes through an arranged environment.

In narrative exhibits, the narrative is found in the layout of the exhibit and the progress of the viewer through it. The Holocaust museum is a famous example of this practice, but many thematic wings or exhibits follow similar strategies.

**Taxonomy/cutaway**
Exhibits often display artifacts in geographically organized arrangements conceptually like link-node or cluster diagrams. It is also popular to make cutaways which show internal workings thus making objects which are diagrams of themselves.

A cutaway of, for instance, a locomotive, may be adequate to carry a narrative for most viewers; it is also very common to include images or other displays which relate workings or photographs to external narratives, thus the medicine man accompanies his artifacts.

*Nigel Holmes:*
*Political graphic:*
*Time Magazine, Mar. 96*


*Body slice,*
*Skeleton,*
*Gears:*
*Chicago, Museum of Science and History*

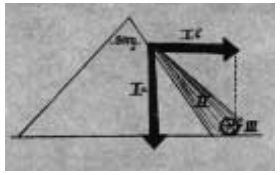
*Miel: The Rainbow:*
*Stafford, Barbara*
*Artful Science*

*Chicken cutaway:*
*Chicago, The Field Museum*

*Locomotive Cutaway:*
*Chicago, Museum of Science and History*

*Indian House:*
*Chicago:L The Field Museum*

*Klee, Paul:*
*Diagram:*
*Wingler, Hans*
*The Bauhaus*



*Shaman exhibit:*
*Chicago, The Field Museum*

*Galaxy:*
*Rand McNally Book of the Universe*

*Bear diorama*
*Chicago, The Field Museum*

*Fish diorama*
*Chicago, The Field Museum*