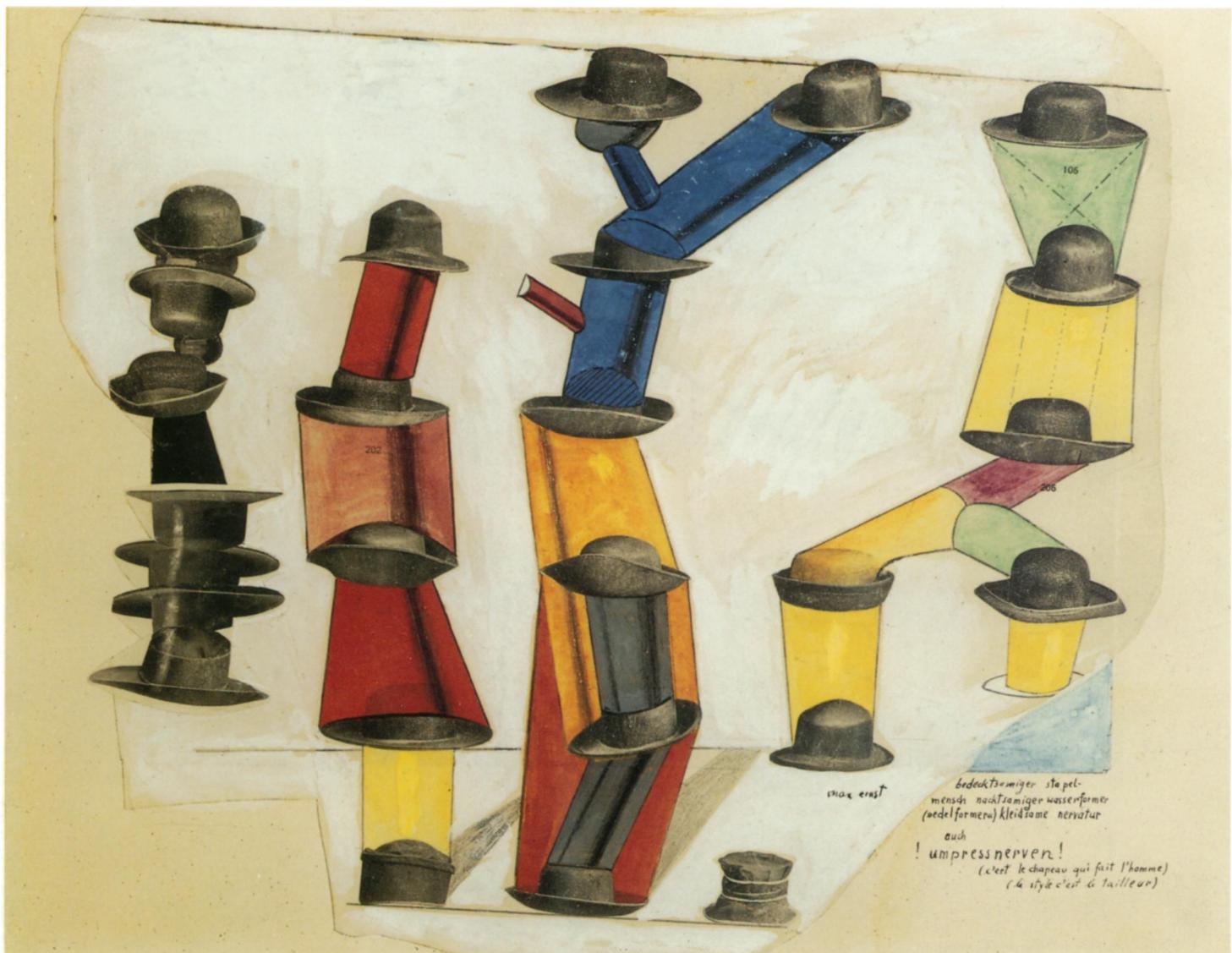


HATS



This issue of *Design Quarterly* is not about hats.

Richard Saul Wurman

Editor's Notes

For over twenty years Richard Saul Wurman has maintained that information about the places we live and the roads we travel is neither readily accessible nor easily understood. And he has devoted himself to an effort to correct that situation by making understanding his business.

It is fair to ask whether the “understanding problem” discerned by Wurman actually exists. A considered reply would have to be an unequivocal yes. For how many of us can easily assemble components of the stereo, TV, VCR, and CD equipment we have acquired with such innocent expectations? Or who among us can actually put together a “knock-down” lawn chair purchased from a mail-order catalogue? Can most people you know read a city map, or follow a subway guide with ease? If you are the exception to the rule, read no further. But if, like most of us, the ability to cope with such daily challenges alludes you, the light at the end of the proverbial tunnel may be found on the pages that follow. In them, Wurman analyzes the basic ways that we organize information in order to communicate clearly and easily with one another—in other words, how we hang the hats on the information racks. We hope that designers, editors, and manufacturers are listening.

Wurman’s first essay for *Design Quarterly*, “*Making the City Observable*” (1971), was a collection of the best means then available to acquire information about our surroundings. Exemplary maps, guides, atlases and comparative charts from around the world were listed and described. Since that time, through Access Press and The Understanding Business, Wurman has created his own series of extraordinary maps and guides to major world cities, and to medicine, baseball, the Olympics, and even *The Wall Street Journal*. This issue of *DQ* is a summary of the ideas that go into the creation of these information systems.

MSF

This issue of *Design Quarterly* is not about hats. It's about hats as a metaphor for units of information.

It's also about the hat rack as a model for the understanding of relationships and the finding of information.

This issue of *Design Quarterly* is about the visual hat racks (maps, diagrams, charts, lists, time lines) that help us understand how our world is organized. Information hats may be hung on these racks so that patterns, connections, and relationships formed from such adjacencies are revealed.

Most people start to organize information by making lists. We make “to do” lists—lists for shopping and phone calls. We’re comfortable with lists because we read lists in the form of book indexes, store directories, and restaurant menus every day. They become the “hat racks” upon which we organize our activities.

Mental Hat Racks

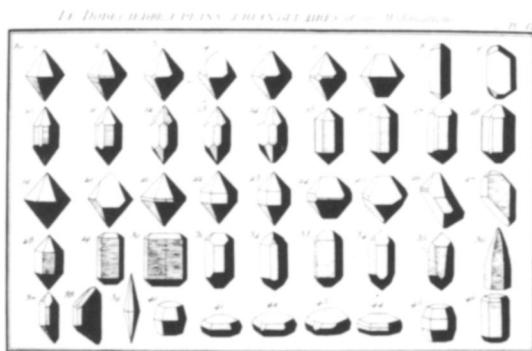
While it may seem that the methods are infinite, there are really only five general ways to organize information—what I call the *Five Ultimate Hat Racks*:

- Alphabet*
- Time*
- Location*
- Continuum or Magnitude*
- Category*

Rearranging hats on a hat rack can reveal meaning, depending on how the hats are organized. The best way to organize information is the way that most easily reveals the aspects of a subject that you want to communicate.

If a hat-check clerk arranges hats according to the time of each guest's arrival, he will have a chronological record—a time line of hats (12:20PM, 12:25PM...).

Manipulating finite information in various ways is crucial to critical thinking. Evaluation of information in these different terms can lead you to find the one that works best for your needs. It is the only way to discover the meanings and relationships between information. Once you've done this, you can decide which pieces are most important and which are secondary. Then, a possible organization almost reveals itself.



Romé de l'Isle's 1763 diagrams from the field of crystallography include these variations of the hexagonal dodecahedron with twelve triangular surfaces.





The same hats may be grouped by category (feathers, ribbons, protectiveness, religious, military, style...); according to their location of manufacture (Holland, Africa, Japan...); alphabetically (bowler, cap, fedora...); or by continuum, such as size or cost.

When a hat is alone, it may tell us little about itself or the wearer, but in comparison with other hats it may indicate authority, membership, occupation, or interest.

The creative organization of information creates new information.

The hats never change, but hanging them in different patterns or with different rules or on different hat racks can affect what we learn about them.

More complex relationships may be shown when one type of organization or hat rack is combined or juxtaposed with another. Units of information may be organized by category, then arranged by location under each category.

The same information may be organized in a number of different ways and when the results are analyzed new patterns emerge.



Every breed recognized by the American Kennel Club, from the smallest to the largest of man's best friends, appears in the two diagrams shown here.

Keeping Tabs on Your

At first glance, stock listings look like numbers. This has more to do with the way they are presented and the use of small type than with the actual information.

To read the listings, remember that stock prices are given in fractions of dollars. Thus $8\frac{1}{2}$ equals \$8.50; $8\frac{1}{4}$ equals \$8.25. The fraction $\frac{1}{8}$ refers to $12\frac{1}{2}$ cents; and $8\frac{1}{8}$ equals about \$8.13.

Highest and lowest prices of the stock are shown for the last 52 weeks. Stocks reaching a new high or low for the year are marked with an arrow in the lefthand margin. These figures show you the **volatility** of a stock – an indicator of both profit potential and risk. The percentage gain or loss is often more significant than the dollar gain or loss: a \$5 change in a \$10 stock indicates more volatility than a \$5 move in a \$30 stock.

For instance, Harcourt Brace Jovanovich, Inc. was more volatile over the past year (swinging $9\frac{1}{2}$ points, or 71%, between $13\frac{1}{4}$, and $3\frac{3}{4}$) than was Harris Corp. which moved $18\frac{1}{8}$ points between $40\frac{1}{8}$ and 22, or roughly 45%.

If you organize hats into a category of performance and then into one of materials, you might see that hats made from harder and stronger materials tend to be used as protection. You not only learn the fact but you understand the basis of it. You begin to recognize all sorts of new relationships.

The essence of leaps of understanding relates to connections.

The joining and connecting of two things is a joy, an art, and the beginning of a map of learning.

A wonderful chair is wonderful in part because it's put together well, because the connections are good. A good building has wonderful connections, and it's the architecture of these connections, their design, that is compelling. I believe that encouraging awareness of connections leads to recognition of the patterns that are the core of understanding.

Understanding is a path, not a point. It's a path of connections between thought and thought; patterns over patterns. It is relationships.

Pages from The Wall Street Journal Guide to Money and Markets show how parts of the Journal are pulled out and explained. The explanations are connected to the page with a series of lines. This forms a kind of map of the pages and helps the reader understand how the pieces of information relate to one another. At once, the reader learns about the individual aspects of money and investments, learns how to find them in the Journal, is encouraged and supported to open up the periodical, and sees how these pieces are interconnected.

52 Weeks			
Hi	Lo	Stock	Sym
$13\frac{1}{4}$	$3\frac{3}{8}$	HarBraceJ	HBJ
$11\frac{1}{2}$	$5\frac{1}{4}$	HarBraceJ pf	
$25\frac{1}{4}$	$16\frac{3}{8}$	Harland	JH
$29\frac{1}{8}$	$9\frac{1}{4}$	HarleyDav	HD
$17\frac{1}{8}$	$6\frac{3}{8}$	HarmanInt	HAR
$29\frac{1}{4}$	$8\frac{1}{2}$	Harnisch	HPH
$40\frac{1}{8}$	22	Harris	HRS
$37\frac{1}{8}$	$23\frac{1}{2}$	Harsco	HSC
$33\frac{1}{4}$	$18\frac{1}{4}$	Hartmarx	HMX
$19\frac{1}{8}$	$13\frac{1}{2}$	HattersSec	HAT
$33\frac{1}{8}$	$22\frac{1}{4}$	HawaiiElec	HE
$9\frac{1}{2}$	$6\frac{3}{4}$	HlthRehab	HRP
		HlthCareProp	HCP

Company names are abbreviated, listed alphabetically, and followed by the ticker symbol. Most symbols are closely related to the name of the company – HMX for Hartmarx Corp. – though some may be more related to what the company does. CAF, for instance, is the symbol for Furr's/Bishop's Cafeterias (not shown).

pf or pr following the name of a company refers to **preferred stock** rather than common stock (stocks listed without Pf or pr are common stock). Preferred stock pays dividends at a fixed rate, and the company's obligation to pay them is stronger than for common stock.

Stock

book like an endless sea of
with the volume of listings
with the complexity of the

Cash dividend per share is given in dollars and cents. A dividend is a payment to shareholders of part of a company's profit. His figure is an estimate of the anticipated early dividend per share. Hartmarx's yearly dividend is estimated at \$1.10 per share. If you owned 100 shares, you'd receive \$110 in dividend payments each year, probably in quarterly payments of \$27.50.

Sometimes the dividend column for a company is blank, indicating that the company doesn't pay cash dividends.

PE	Vol 100s	Hi	Lo	Close	Net Chg
10	2314	12½	11½	12¼ + ½	
	142	11	10¾	10½ - ½	
16	792	21¾	20½	21¼ + ½	
8	444	26¾	26	26¼ + ½	
11	256	16¼	15¾	16½ + ½	
22	3021	17¾	17½	17½ - ½	
17	1020	28¼	27	27½ + ½	
11	417	30¾	30½	30½ + ½	
13	244	26¾	26½	26½ - ½	
11	2	16	16	16 + ½	
6.6	12	495	29	28¾ 29	...
12.3	11	901	9½	9	9½ + ½
9.5	15	560	27½	27½ + ½	
					23½ + 3½

Per cent yield is a way of expressing the stock's current value: it tells you how much **dividend** you get for what you pay. The table calculates yield for you; you could do it yourself by dividing the dividend by the **closing price** (next to last column). For Hartmarx Corp.'s yield, divide \$1.10 by 26.5 to get .042 or **4.2% yield**. Think of it this way: *I will get 4.2% of my purchase price in dividends each year.*

If no dividend has been quoted, of course, the yield cannot be calculated and the yield column will be blank.

It following the company name means the vote is not for stocks but for **warrants**. A warrant is the right to buy stock during a certain period for a certain price.

It is not the things themselves but the meanings or patterns that we associate with them that determine our understanding.

Understanding is the first part of communication.

An interactive partner is the second.

You can only understand something relative to something you already understand.

A measure of successful design is communication of meaning and comprehension. But this doesn't mean that successful design must be sterile or uncomplicated. It can be wonderfully sophisticated and rich—even dense, textured, and beautiful—as long as it is understandable.

Making things understandable should not be confused with simplification. Most people think that the way to make something clearer is to simplify it, and vice versa. But this isn't true. Many times information becomes vague and meaningless when there is nothing to relate it to—it is the idea of simplification that has led to the "dumbing" of America.

Understanding is not about simplification and minimalization, it's about organization and clarification.

We learn when clear patterns are presented that provide an opportunity to make connections. Things of extraordinary density can be understandable if they are well organized and not merely simplified or beautified.

Most people would not be able to tell you exactly how big an acre is because it is an area that most of us do not usually need to know or understand. To know that an acre is equal to 6,272,640 square inches doesn't help either. It is a number too high to visualize for such a small unit of measure. But if you think of an acre as about the size of an American football field (without the end zones), it becomes more understandable and memorable because it is an area we are familiar with and are able to visualize.

HOW BIG

1 acre = 6,272,640 square inches



Facts in only mean can grasp factual but hand, if I American

Style can be a passenger on the train of design, but not the engine.

Performance is the engine.

The power to run that engine comes from the ability to perform and not the desire to please.

In a parallel way, architecture is the thoughtful making of space.

Organization of performance? Isn't it organization of spaces to promote various performances?

Question: how do we choose what sort of hat rack to create?

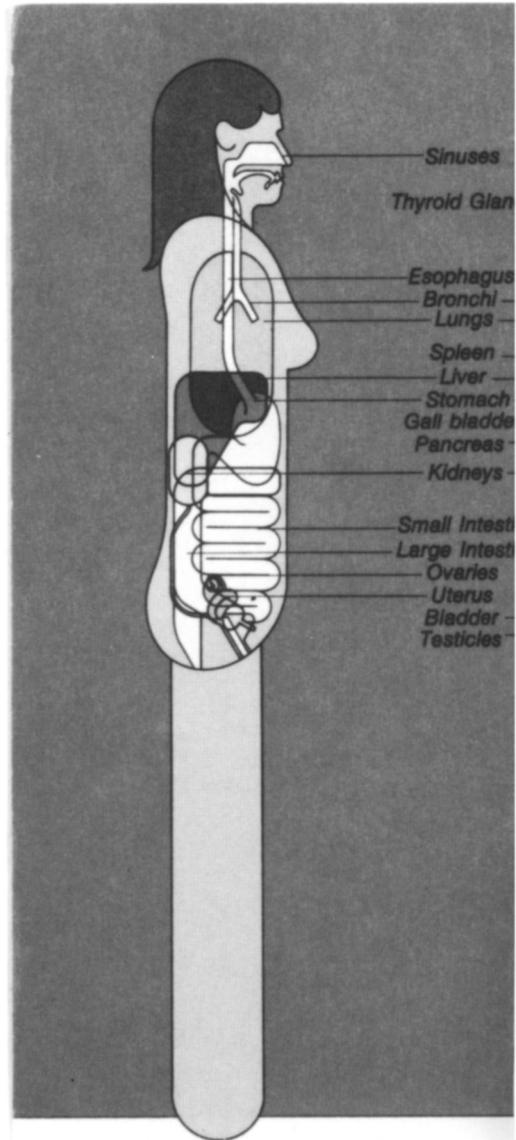
Answer: by trying different kinds of hat racks and seeing which one makes the information come alive.

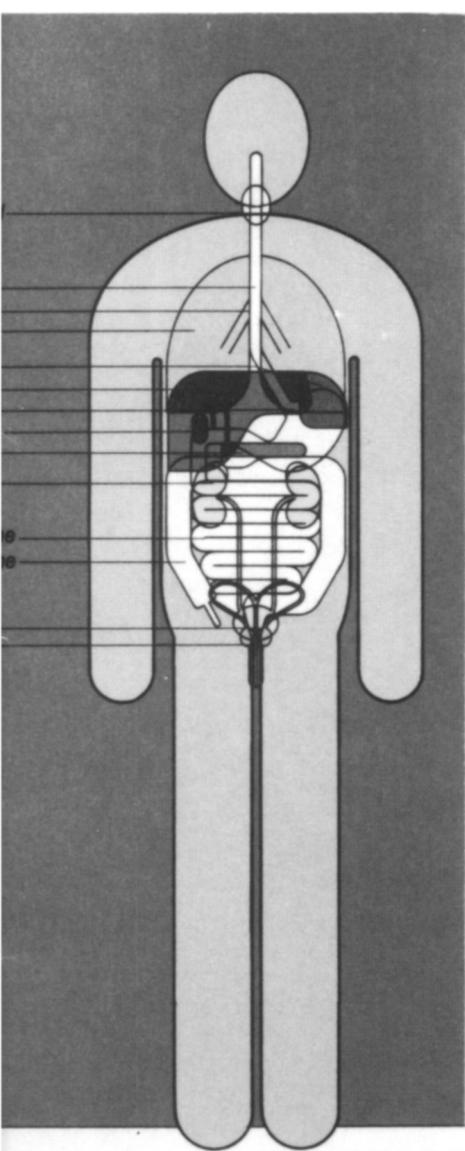
One is designed—the other is not (unless you credit the master architect).

It is the hierarchical organization of performance in three dimensions instead of two. Spatial organization is based on what is served and what serves. Specifically: a closet serves a room; rooms serve other rooms; a hallway serves several rooms. The hat rack here is location based on the relationships rooms have to each other.

Our bodies work the same way: organs serve particular purposes and they serve other organs. We have skin and skeletons and so do our buildings.

The airport is an example of how structure and meaning might work together. In an airport, the space itself should indicate paths and alternative paths through a series of functions that eventually get you on to a plane. Designed effectively, this is the *architecture of information*.



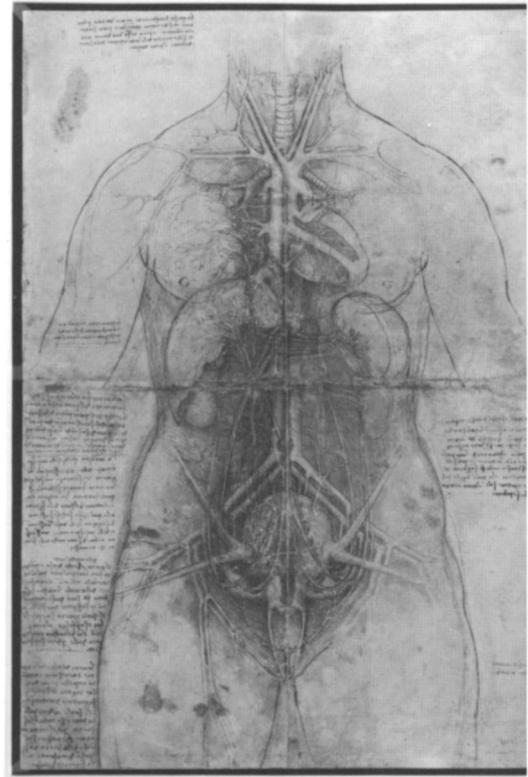


A parallel may be found in graphic design. Designing a guidebook that takes you through an airport or a city should be the same as designing an airport, or a city. Each should be inherently understandable through its structure.

Complexity of information varies, but the parallel still holds. Architecture should be created like graphic design, graphic design like teaching, teaching like managing, managing like conversation, conversation like architecture.

When you approach a problem, you must go backward to find the beginning before going forward to find the solution. Seldom, if ever, is the problem correctly stated. The classic, pervasive seduction to designers has been to find a *solution* instead of *the truth*. You must be a few steps behind where others usually start when solving a problem if you want to discover the forces behind the problem. Only then can you ask yourself the questions that will lead to productive solutions.

Mapping the body has been an intriguing pursuit throughout our history. Because the connections between different structures and systems in our bodies are the basis of how they work, displaying them is the basis for our understanding of those connections.



Leonardo da Vinci's fifteenth-century dissection of the principal organs and the arterial system of a female figure documents the complexity of the subject and functions as its own elegant system (pen and ink over black crayon; Windsor Castle, Royal Library. © Her Majesty Queen Elizabeth II).

Massachusetts soldiers. Lacking any winnings to pay for the cost of the fight, the colony issued **promissory notes** to the soldiers for payment. Soon other colonies followed suit.

Where does "money" come from?

The term **money** goes back to the French *monnaie* (coin), and even farther, to the Latin *moneta*, which also gave us **mint**.

Salary is really salt money, harking back to the days when Romans paid soldiers in salt—a precious commodity needed to preserve perishable food. A **fee**, however, originated in



One way we remember things is with mnemonic phrases, songs, and stories. These aids use rhythm and rhyme to cue our memories. Here are just a few:

Spring Forward, Fall Back
Setting clocks for Daylight Saving Time.

SOH CAH TOA
Trigonometric Functions: Sine equals the Opposite over the Hypotenuse, Cosine equals the Adjacent over the Hypotenuse, and Tangent equals the Opposite over the Adjacent.

Every Good Boy Does Fine
The notes of the treble clef lines in sheet music: E, G, B, D, F.

Good questions lead to good answers.

In asking a question you set up a structure for learning; in looking for an answer you learn; but when answering the question, since you have already found the answer, there is no learning—there is no expansion of your knowledge.

The goal in life isn't to answer questions, but to challenge yourself by asking good questions and to let those questions guide your learning.

You can only learn when you accept not knowing. You learn by examining what doesn't work.

You need to develop a set of patterns that you can take with you and make into your own mental map. These patterns are like templates. You can recognize sets of information by matching the patterns they form against similar patterns, even if the information in the patterns is vastly different. Once you have identified and understood the patterns, you can put them together to form new ones. The creation of these hat racks, or connecting trees, comes from these pattern relationships.

Learning is remembering what you are interested in.

One way to ask yourself good questions is to look for opposites of what it is you think you should be doing. Ask yourself something ridiculous or implausible. You may find an answer that provides clues to your ultimate solution. You may find a completely new direction or discover that your previous assumptions were wrong. It is very often in the opposites of things that we learn the most about them. The negative space leads us to new views about the positive.

If two people meet on the street and one says to the other "How do you feel?," and the other replies "My leg hurts," then who's doing the learning? Obviously, the first has learned something about the second by asking a question and getting an answer. By answering the question the second person hasn't learned anything. He already knew his leg hurt.



Sometimes it's necessary to figure out a way to make something uninteresting interesting.

It's important not to feel guilty about things that aren't personally interesting. People feel pressure to be informed and enthusiastic about things and memorize things that are of no interest to them.

You have to make connections, to bring subjects into the realm of your interests. While hat manufacturing may be uninteresting to you, there may be something about hats that does interest you (like the materials hats are made from, how they are bought and sold, or where they come from). If you cannot find interest in what you are designing, it is doubtful that you can make it interesting and understandable to anyone else no matter how hard you try, no matter how beautiful it is.

Innocence allows your mind the freedom it needs to make and form patterns.

Training for innocence is part of understanding and organizing. This is antithetical to much that we've been taught. We're taught to be knowing people, yet a key to success is to be unknowing. How does one train for this? Imagine going to a meeting and saying, "Look, I don't understand anything. I have no expertise at all. I can find out a lot through my inabilities."

The movie *Rain Man* illustrates the meaninglessness of extraordinary but indiscriminate memory.

It is additionally interesting to note that when this movie is shown on an airplane, the critical scene of the central character's fear of flying is edited out although it is essential to the viewer's understanding of why the brothers journey west by car.



If innocence is a word that seems peculiar or corny here, let me explain. To me, innocence is the lack of preconceptions that prevents you from finding connecting trees and seeing patterns.

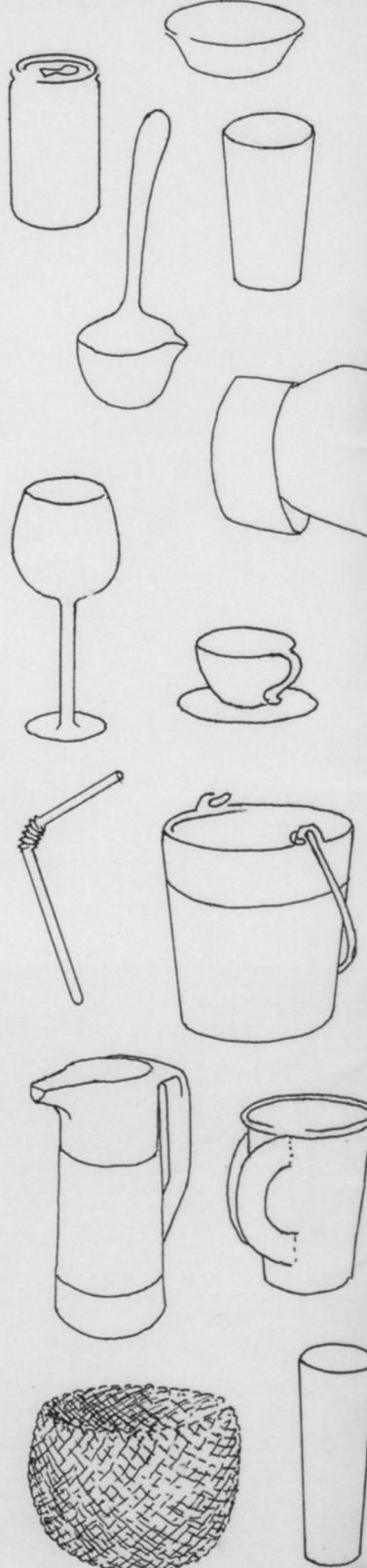
There are many different ways to describe how different aspects of our minds function. Maps of the Mind, by Charles Hampden-Turner, is a book that attempts to explain some of them, both graphically and in the text (Illustration by Dave Fernandez).

One of the biggest lies we believe is that there is only one way of learning or doing most things. This promotes flash card or gin rummy memory and we usually discard information we learn this way as soon as we take the test.

Learning comes from admitting ignorance. Your expertise should develop from your inabilitys. A passion for understanding comes from wanting to understand what you don't. It is innocence, lack of understanding, and the joyous refrain "I don't know" that allows us to discover patterns and utilize the best hat rack.

Innocence is like an empty bucket, and the job is to fill it up.

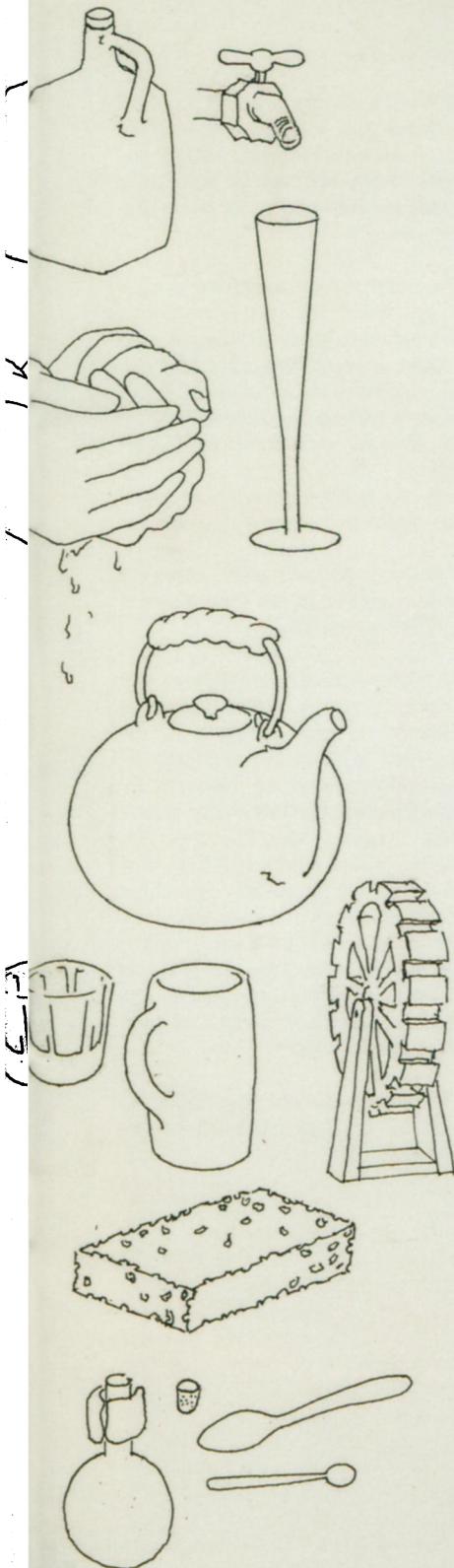
We all accumulate a lot of information, and we all want to be informed, yet these things don't necessarily interrupt our innocence, our ability to recognize patterns. What's being accumulated is a deeper understanding of patterns and connections.



Water in the Desert

Here is a story about **what is** and **how to**. I'm in a desert. I'm dying of thirst. I see a trickle of water. It is not a mirage. *I want that liquid in my mouth. Getting the water in my mouth is the what. How am I going to get it?*

Only one what, but many hows. Each how has its moment in the sun.



This sun-absorption diagram makes it very clear how energy flows between the earth, sun, and the earth's clouds. The use of color is clear and appropriate and the width of the arrows is proportional to the amount of energy flowing.

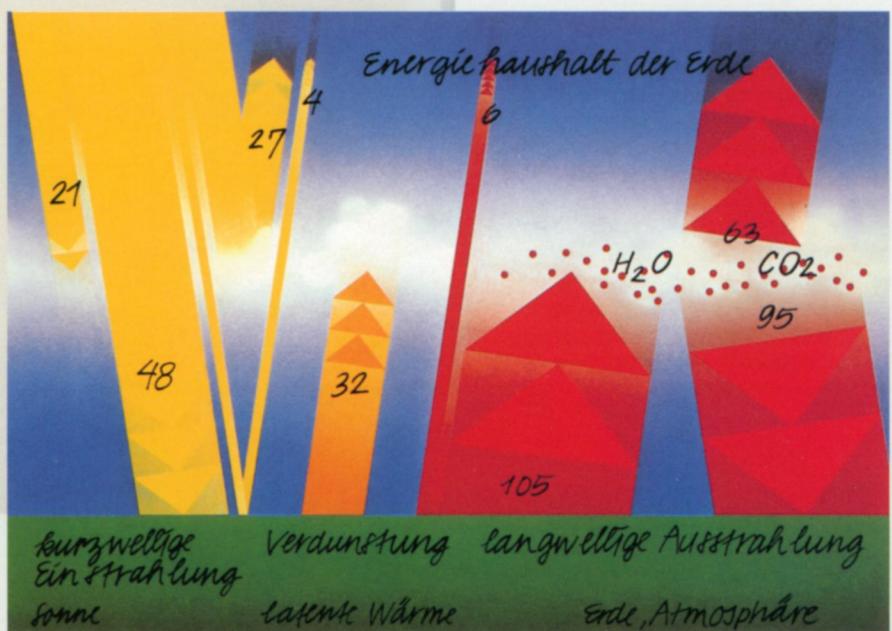
There are essentially two kinds of people: *how* people and *what* people. There are those who think about how they are going to accomplish something, and there are those who stop to think about what it is they want to accomplish in the first place.

What and *how* are important in doing almost anything. I try to think about *what* is to be done rather than *how* to do it. It's important to consciously state: "No, that's a *how*, not a *what*; think of *what* it is and not *how* you're going to do it."

With so many media through which to express ourselves, it's seductive to think in terms of how a thing is to be done rather than what it essentially is. It's useful to describe an idea and say: "Am I describing what I want to do? Or am I prematurely describing how I want to do it?" The test is to ask "What is the goal, independent of how a thing works?" Then things can be evaluated based on what the goal is. The best hat racks are designed out of realizing the *what* before the *how*.

The Age of Also

The paper-less office predicted with the creation of the computer has instead turned into the use of more paper with the explosion of desktop publishing. Other predictions that have misfired include the death of movies due to television and the VCR. Instead, what has transpired are more movies and more television. The **Age of Also** has created more and better magazines well after the death of the magazine was predicted due to the creation of the television magazine. These predictions, and more like them, are made by those who are so seduced by the technology that they fail to realize that these systems encompass much more than just technology. In fact, many times the technology of choice often creates more use of competing technologies. As an example, it is common to phone before sending a FAX, phone afterward to make sure it was received, and express mail the original as well. I think it's safe to say that the electronic version of the yellow pages will be a product that we will use along with the print version. Even some extraordinary versions of our daily newspapers will survive the electronic revolution.





I've tried to make this process automatic. I've tried to think so much about the difference between *what* and *how* that I don't have to think about it anymore. And still, from time to time, I find I have to think about it and say "no, that's a *how*, not a *what*; think of *what* it is, not *how* you're going to do it."

Schools of design, journalism, and communication should develop a focus on finding personal paths through learning and on the training of *what* people. Schools in general should deal with interests and interest-connections rather than requirements.

I believe that if schools focused on interests rather than memorization and requirements, people would be able to ask the questions of *what* and *how* more easily. The reality of education is intellectual jail when it should be intellectual hedonism.

Schools should be a smorgasbord of availabilities with people around to counsel students on what goes well together, the order in which to ingest things, the gastronomical consequences, and the nourishments that can be obtained. Everybody's meal construct might vary, as well as the speed with which they eat—whether they eat alone or with many others, how many times they chew their food, their utensils, their eating habits. The compartmentalized ladder on which you put these things is another form of hat rack.

The solution to most of the problems in the last half of the twentieth century has been based on wanting **more** of what already doesn't work. More highways, more schools, more regulations.... When we found that this was beginning to fail, we started answering **no**. But neither response gets to the roots of the problems they try to correct.

Much of what is said here is a thinly veiled indictment of our education system. I don't see a modicum of hope that we can make the changes necessary in our education system, because the solutions within it are always based on **more**. These are only Band-Aids and will always be so. If we really want to change the quality of education, we will have to develop completely new means and mechanisms that have nothing to do with the present system.

R.O. Bleckman illustration from What If, Could Be; An Historical Fable of the Future by RSW.

Q: We have access to a vast quantity of information. How does that affect how we choose? In some ways it becomes more difficult to make any choice. Do we need to be more discriminating?

RSW: I don't think that discriminating is the right word. We must learn to trust our interests to guide us through what we want to know. We have to make these decisions for ourselves. It is important to generate a personal system of interests, of connections from interest to interest. Once we take care of our needs, the quality of our lives is based on our interests and how we follow them.

Q: Following your own interests seems opposed to the recent desire for "cultural literacy."

RSW: Cultural literacy is merely another form of trivial pursuit, and it's dangerous if we model our education system on the completion of some sort of cultural inventory. We will all be prepared for **God's Ultimate Cocktail Party** but not for life. Cultural literacy has to do with facts that are like leaves on a tree. All of these different facts are connected through branches down to the trunk which is the access to all knowledge. It is the learning about how to learn, how to make connections, and how to find and organize things that form the roots of the tree and support it.

Q: But how can a writer or designer create things that are more understandable?

RSW: It may sound mystical, but by becoming more innocent and ignorant about what it is you are doing. Think about how people who don't know all the things you know about a project are going to use what you are creating. Realize what they do and do not understand. Your projects should be a conversation with the user. You must be able to say "I don't know" yourself and confront your own insecurities about information and interests.

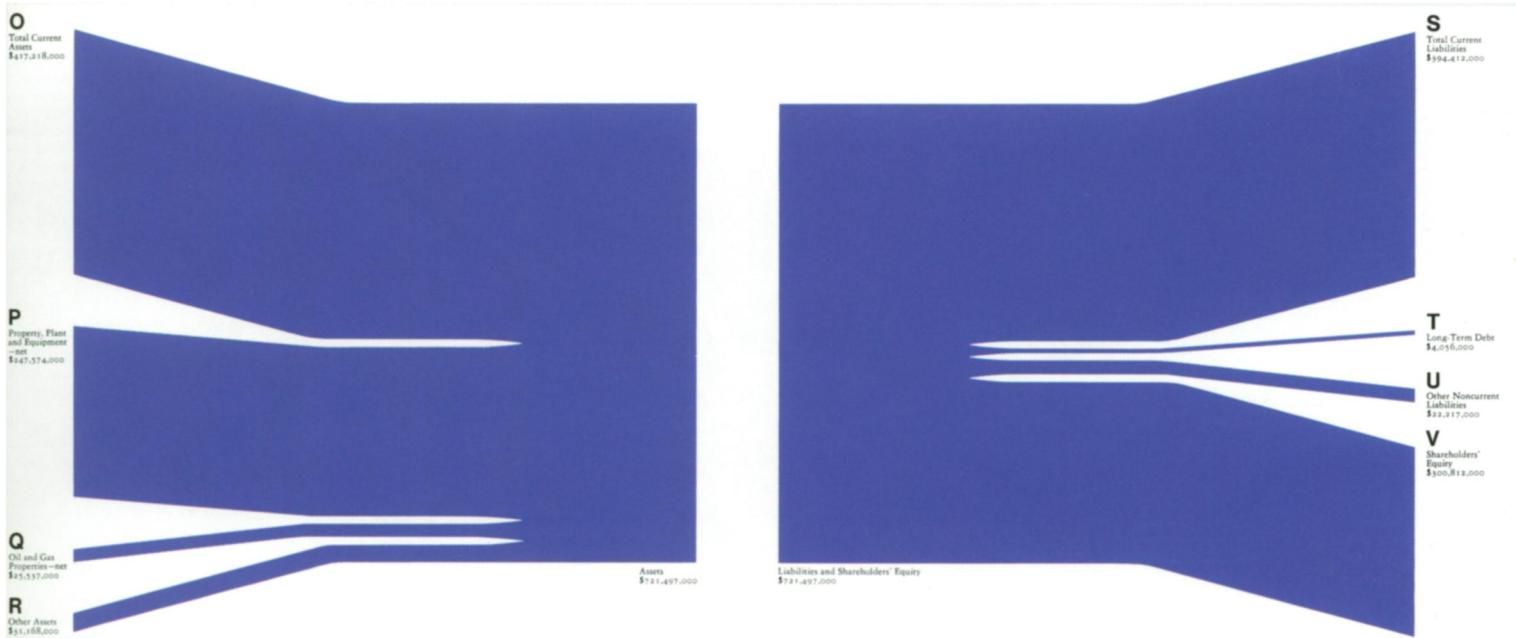
Q: But without an interactive, multi-media presentation, how can a graphic piece or a publication be a conversation?

RSW: Conversation is the best model of how we communicate. The implied concept is that neither party will exit the conversation without both understanding what has been said. There are all kinds of cues that we employ—body language, tone, inflection, eye contact ... that help communicate, and conversation is self-adjusting and active, not passive. Published pieces can attempt to do all of these things.

One old adage is that form follows function. But function is a basic requirement and it is artless. It is a word that has to do with adequacy. It is a very basic term and that is why I take exception to it, unless you elevate it to an art form. Then it becomes the art of information, not the function of information. At best, it is both an art and an entertainment that performs well.

I believe that information made understandable, information that performs, becomes absolutely and magnificently beautiful; particularly when you don't try to make it beautiful. I have a great belief in the beauty of graphics that perform wonderfully—not function wonderfully—but perform wonderfully.

The art of function is performance.



This diagram for the Fluor Corporation 1976 Annual Report by the James Cross Design Office is an exceptional example of the way to make information understandable. It not only explains the qualities of the different groups of money in the text, but visually shows the relationships between them in size and flow.

The simplest map locates a point by referencing it to two known paths.

Everything is a map of something.

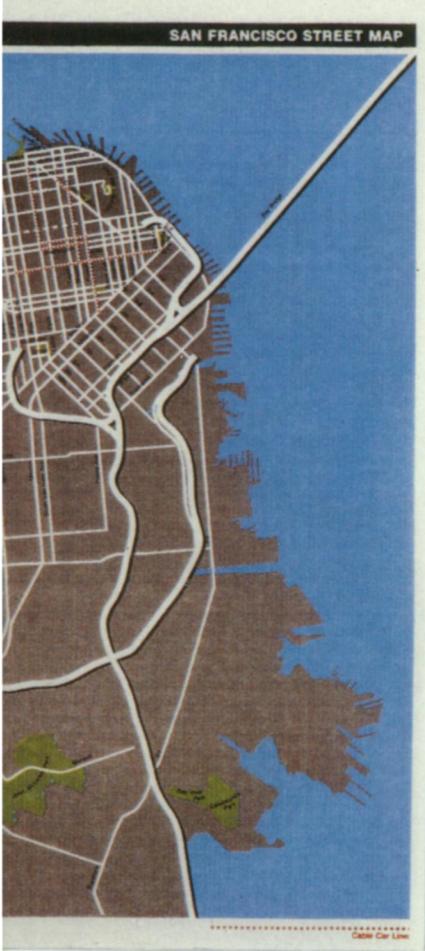
Everything can be looked at as if it were a map.

When I look at a person sometimes I mentally slice that person in half and make myself an imaginary cutaway body map. A bar graph is a map that describes how well or poorly a business is doing.

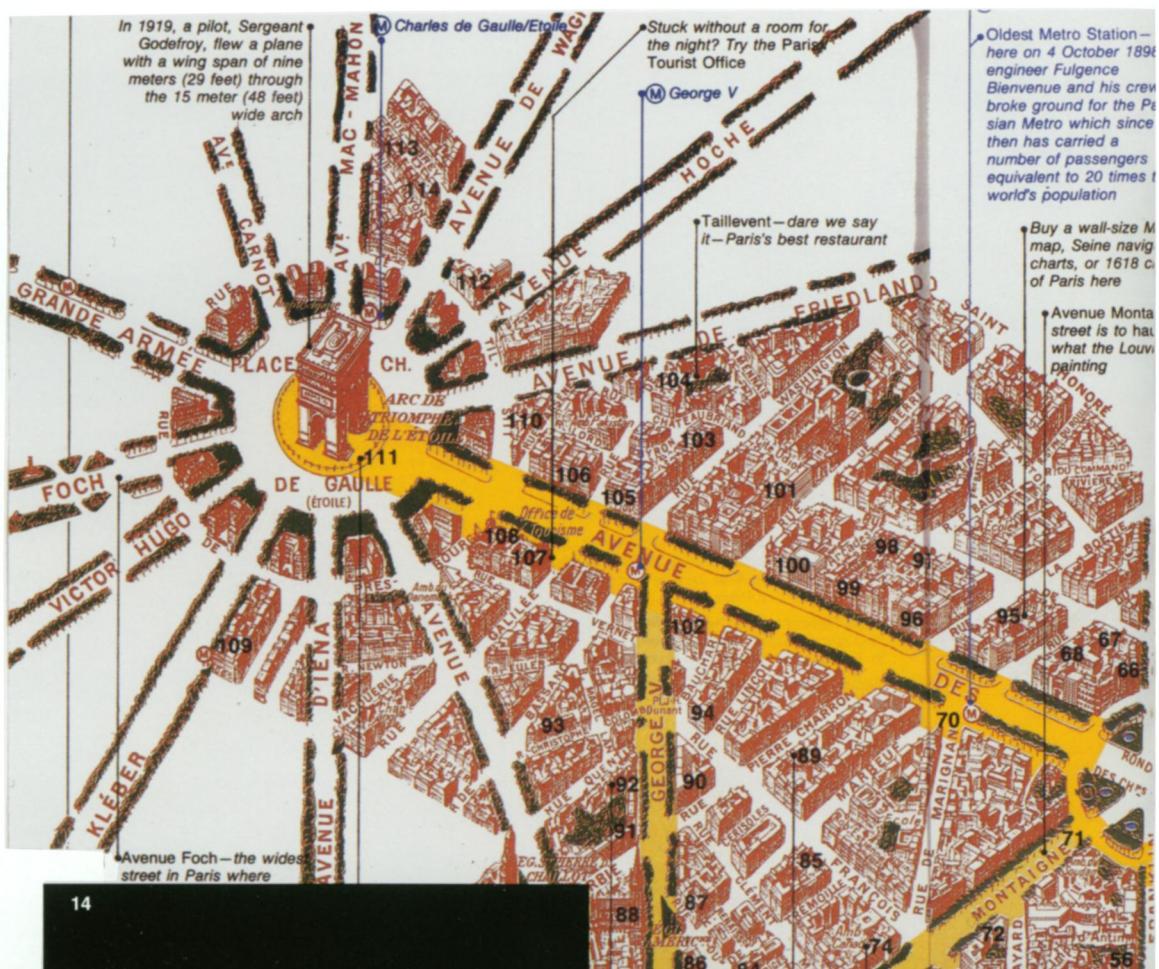
A map is a pattern made understandable.

A pattern performs best when it represents a single idea and not the complex layering of a multitude of patterns.

I believe there are maps that don't occur on paper. There is a map in your mind, a mental map. There is the map memory that speaks about remembered relationships.



The ACCESS maps usually highlight streets and geological features so that the shape of the city becomes more apparent and memorable. Not only does this help readers navigate the city, but it gives them a knowledge of the city that encourages them to strike out on their own and discover. It also prevents them from easily losing their way.



Maps are usually based on the hat rack of location. They are concerned with proximities and relationships.

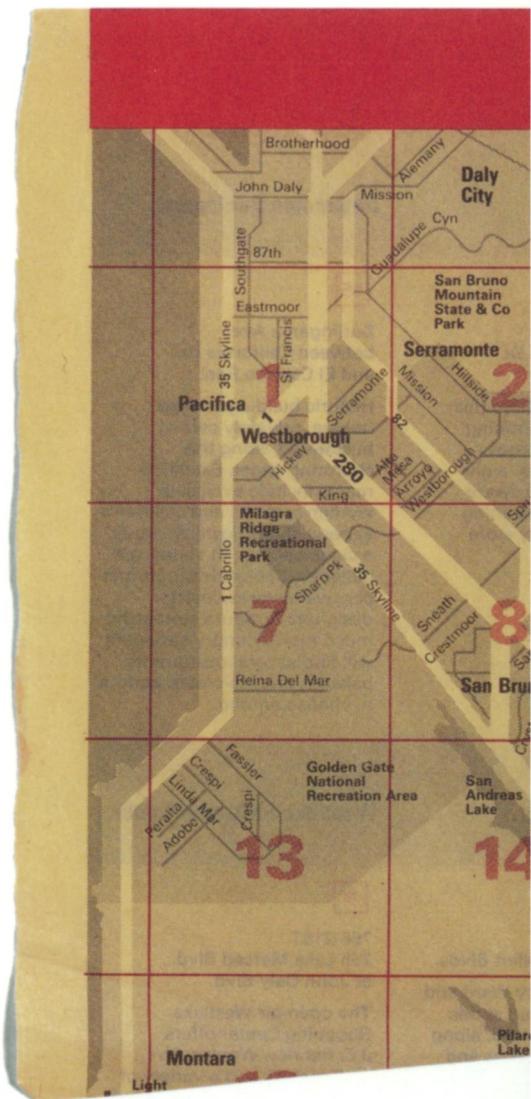
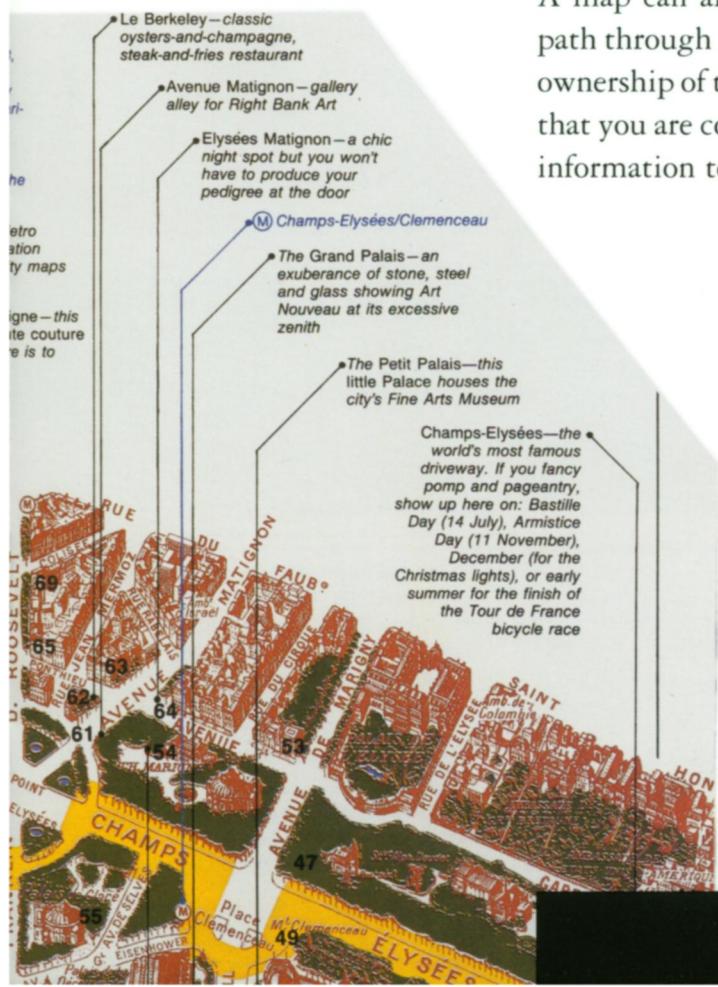
Real-time conversation is the only self-adjusting system of understanding. Eye contact and physical language assure the speaker that he or she is being understood, or show them that contact is or is not being made and that they should adjust what they are saying for clarification.

The maps in the PARISACCESS book are segments from Blondel's remarkable map: *Plan de Paris à Vol d'Oiseau*, first published in 1739.

The seven area maps represent the modeling of a map based on the idea of conversation: conversation through the printed word juxtaposed with a line that represents my finger pointing out something.

Conversation is a wonderful device, and it has been my quest, with a picture and with a map, to enable the formerly passive viewer to become an active participant—to have a conversation with the printed page.

A map can allow you to find a personal path through information and to give you ownership of that path. Ownership means that you are comfortable enough with the information to feel that you possess it.



The specifications for the maps in the Pacific Bell Yellow Pages were developed to deal with the type of information presented and the level of detail, the printing limitations of color and resolution, the page formats, and the geography of the areas. The specifications that make these maps clear and usable are not necessarily appropriate for other maps.

The organization of information on a map and the patterns that are clarified by that organization are just as meaningful as the individual bits of information that you put down.

How many patterns can you put on a map? If you have piece of information A and piece of information B, you also get AB. If you have A, B, and C you get not only A, B, and AB, but also AC, BC, ABC, ACB, CBA, and so on. You can see, however, that as you add information, the number of relationships grows very rapidly. It is easy to build too many relationships, and then the map quickly becomes confusing.

YAMANOTE LINE

The Japanese National Railways (JNR) is the world's busiest railroad, carrying over 19.4 billion passengers per year. In 2007, 7 billion passengers per year on its 28,000 daily trains. JNR covers a network of 13,000 miles of track, around 27 percent of the lines are double track and triple track. 40 percent are electrified and over 30 percent are used for diesel equipment.

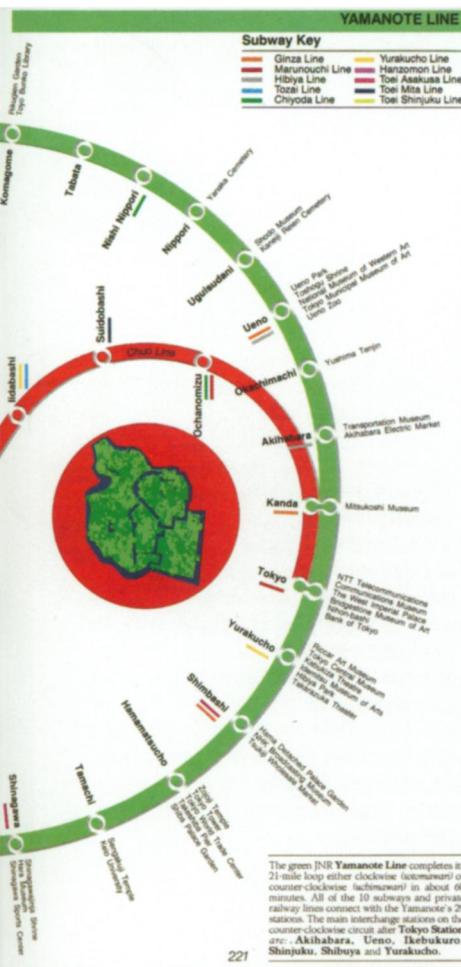


You can save a lot of money on transportation throughout Japan by purchasing a Japan Rail Pass. Valid for one month, the Japan National Railways' efficient buses, trains and boats, the passes come in 7-, 14-, and 21-day versions. Green car idelxess passes for unlimited travel cost about one-third extra.



©Copyright London Regional Transport

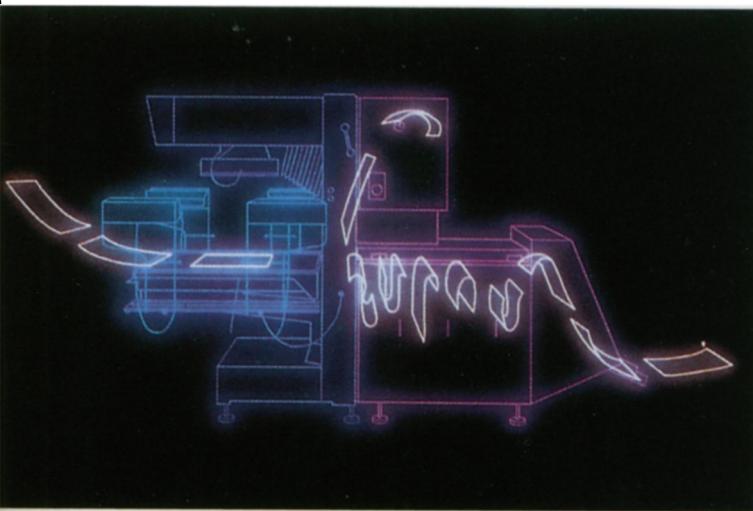
These rail maps differ in the way they represent stops. The Yamanote line map from TokyoACCESS is more abstract than the London map. Because the distance between stops is not controllable by the rider, it follows the route generally, not exactly. It forfeits specific detail and gains memorability and clarity. The London Underground map is less abstract and uses the convention of limited line angles to retain clarity. Here also, distance is not true—it's a map of connections.



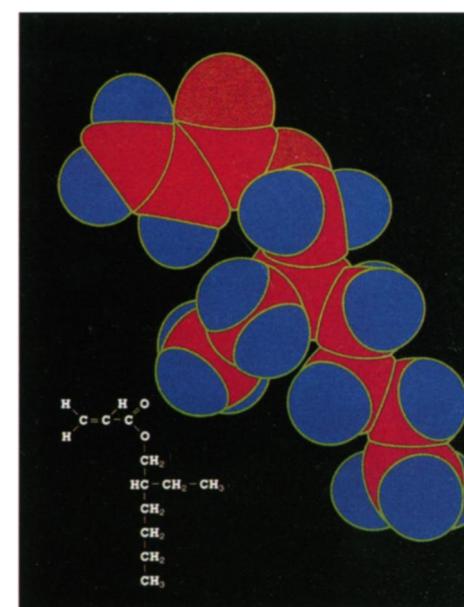
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The same principles may be applied to most graphic information, especially diagrams. In fact, every diagram is really a map of something. And just like a map, a good diagram gives insights to structure, meaning, and function. Again, the goal is to let the data become information—to become active and expressive—and not to smother it with useless decoration.

There are many different kinds of diagrams, too many to show here, but some of the most interesting are *flow charts* that illustrate decision-making processes, *exploded views* that show relationships of parts to a whole, elevations that show buildings and products in a consistent and relative way, cross sections that show specific slices through something that is put together.



The copier path illustration here functions as a map of the route a piece of paper takes through the copying process.



Here are two different maps of the same molecule. One is more realistic in its depiction of the molecule in three dimensions. The other is more abstract and carries additional information. They are both valuable in different ways (Illustration from the Avery International Annual Report, 1983).



Scale and color are important components of diagrams, charts, and maps — even page layouts. In many diagrams the most prominent information is the most useless, and the important information or structure is buried.

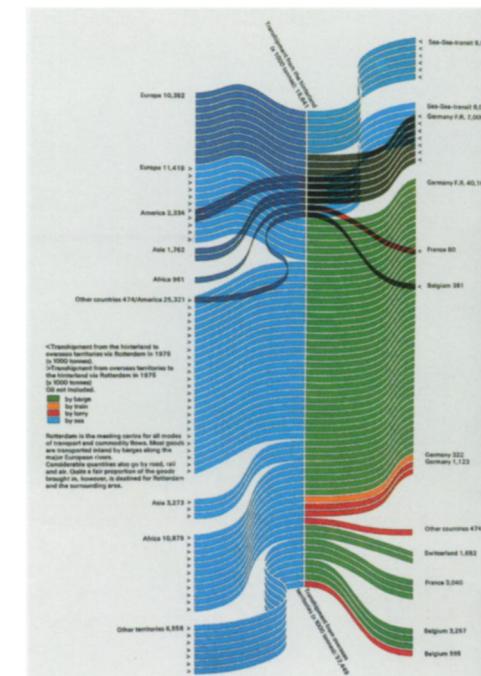
Relative size is especially important in making comparisons. If you have maps of countries at different scales, you get a false relationship and understanding of them.

It can also be beneficial to take information that is in values difficult for us to comprehend (millions of miles, light-years, billions of dollars, millionths of an inch ...) and put it in “common” terms.

Color can be misleading because it has different meanings for different people. It can have symbolic meanings that may or may not be commonly agreed upon (red meaning danger or important, green meaning OK, and so on).

Most people do not understand color theory, and thus, chroma shifts (red to orange to yellow) cannot be relied upon to convey information such as change in magnitude. At best, color can be used to differentiate parts and should be readily understood if it is used at all.

The sun is 865,400 miles in diameter. The earth is 7,927 miles in diameter and is 93,000,000 miles away from the sun. We have no way to really grasp what that means without an analogy. But if we were to say this in a different way, for example: if the sun were about the size of a four foot beach ball, placed at the outside edge of the end zone of a football field, then the earth would be a little less than half an inch in diameter, situated just beyond the opposite end zone. That description is one we can comprehend.



This diagram of shipping in and out of Rotterdam uses color to distinguish types of transportation. The color is used to differentiate the ways in which merchandise reaches Rotterdam, and carries no other meaning.

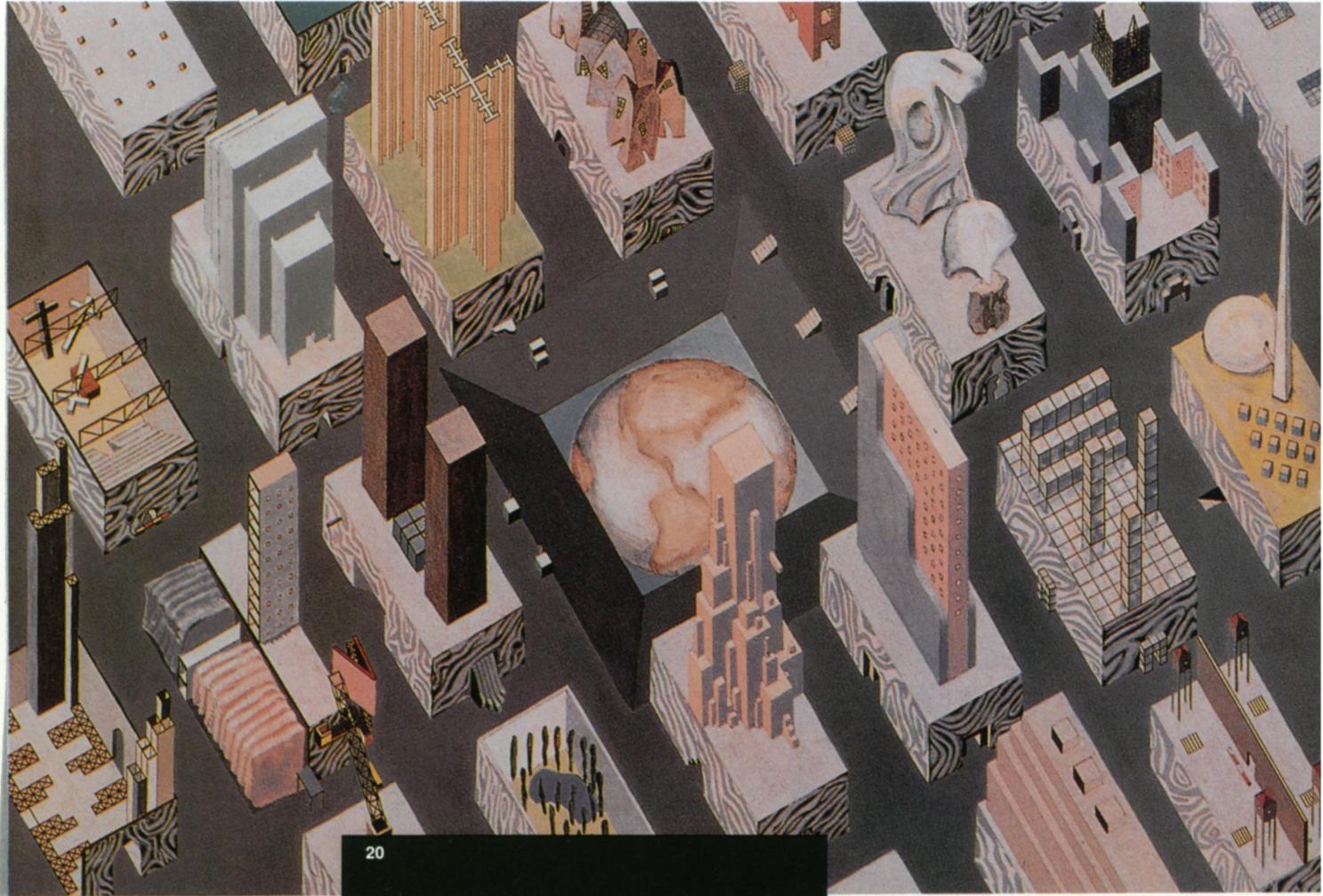
Color added to information purely to “spice it up” usually has the opposite effect. This is called “rainbow worship,” and it often makes things confusing and distracting.

The ease with which we can do things is directly related to the ease with which we can abuse things. Color is a good example of this. Our ability to make information more colorful (from magic markers to computer screens) leads to color being used simply to beautify. Color can be an extremely valuable tool to express different categories. But using color to show differences in any of the other four hat racks often results in misinformation.

Color and scale are both examples of how presentation affects communication. You can’t begin to design the presentation (the how) until you have structured the information well (the what). But if you aren’t attentive to the nature of the presentation you can unravel the effectiveness of the communication.

In architecture, the elegance of form, model making, and illustrating have often preceded the presentation of ideas and their meaning—and so we have buildings that look like models. We have buildings that look like paintings, buildings that look like lithographs, buildings that look like puzzles, buildings that look like center-pieces, buildings that look like sculpture, and buildings that look like misunderstood historical revivals.

We have architecture that looks like the presentation—the art of the presentation—rather than the meaning or the intent or the performance of the buildings themselves. This mistaken emphasis has favored the ability to create impressive presentations over the ability to create meaning, and it holds true for all design.



Each style and technique of presentation has its own integrity and peculiarities, and these must be understood when developing a particular presentation. For example, the discovery of perspective (I like to think everything is discovered and nothing is invented) in the quattrocento in Italy allowed people to describe buildings and spaces between buildings and spaces in buildings in a way that hadn't been possible earlier; this discovery affected the subsequent design of space, place, and building.

Each time a means of presenting information has evolved, whether ball-point pens or computer screens, the means has affected the actual design. I do not mean that technical innovations make a design better, but that the means used to describe a design have an affect on the design itself.

Louis Kahn's architecture and the evolution of his geometries were influenced by his use of charcoal. He rubbed his sketches out with his palm and drew them again and rubbed them out again. Often there were twelve layers to the development of an idea rather than a single precise drawing.

Charts

The purpose of displaying information in a chart is to make related data understandable. The goal is to induce the reader to think about the *substance*, not the *style*, of the chart. Therefore an appropriate type of chart must be used. If you haven't figured out which hat rack to use or how the information is to be structured, graphics won't help you.

Remember that there are only three ways to show a change in magnitude visually: increase by the number of units (more compared to less), increase by size (some larger than others), and increase by value (darker or lighter than others). These principles can relate to all kinds of information graphics (maps, diagrams) and not just to charts.

Successful charts, like all successful information graphics, reveal more than just the data contained within them. They ultimately reveal the relationships and meanings within the data, and thus, the data become information.

This chart from OlympicACCESS 1984 illustrate the records held in different events. By showing the laps of each event the area formed by the lines makes comparisons more understandable.

OLYMPIC & WORLD RECORDS

100 Meters

Men

Olympic Record: 9.95
Jim Hines, USA, 1968
World Record: 9.93
Calvin Smith, USA, 1983

Women

Olympic Record: 11.01
Annegret Richter, FRG, 1976
World Record: 10.79
Evelyn Ashford, USA, 1983

one length = 100m

100 Meter Hurdles

Women

Olympic Record: 12.56
Vera Komisova, USSR, 1980
World Record: 12.36
Grazyna Rabsztyn, POL, 1980

one length = 100m

1500 Meters

Men

Olympic Record: 3:34.91
Kipchoge Keino, KEN, 1968
World Record: 3:31.24
Sydney Maree, USA, 1983

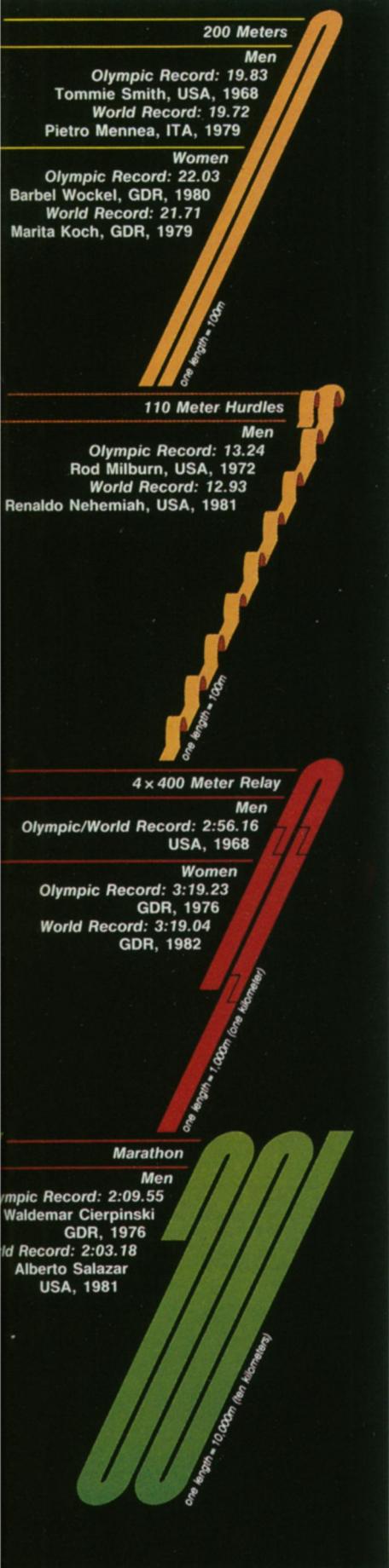
one length = 1,000m (one kilometer)

10,000 Meters

Men

Olympic Record: 27:38.35
Lasse Viren, FIN, 1972
World Record: 27:22.4
Henry Rono, KEN, 1978

one length = 10,000m (ten kilometers)



There are four basic types of charts:

Bar

Pie

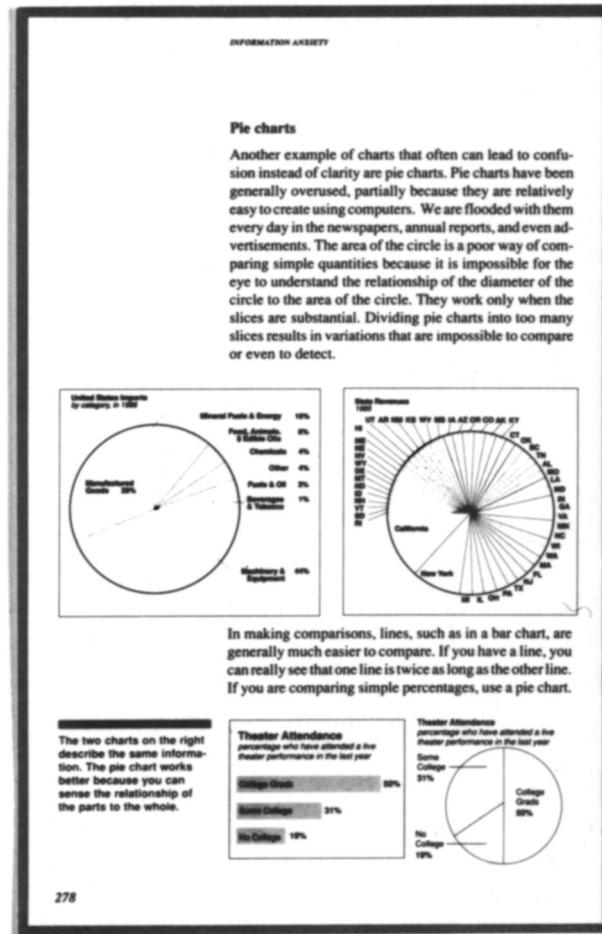
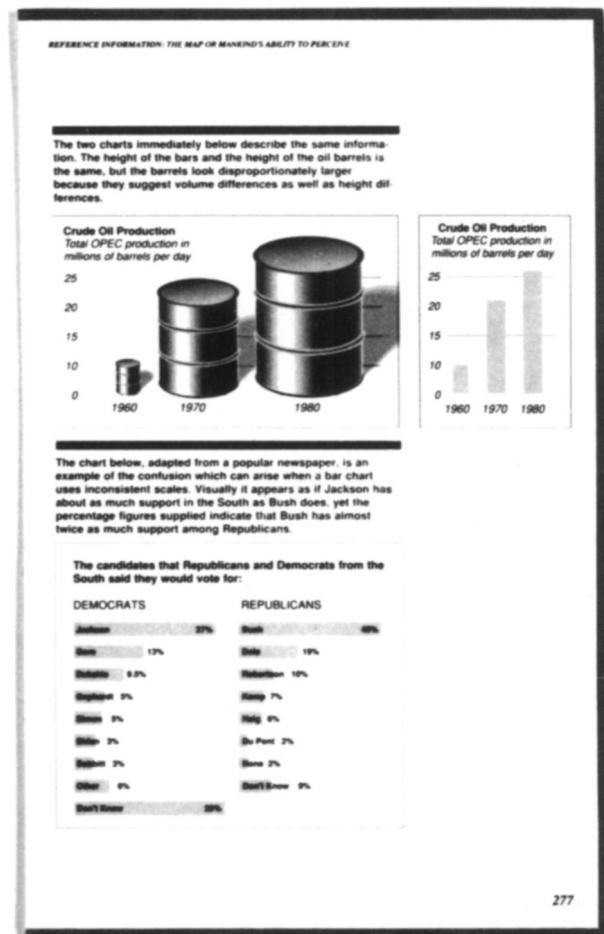
Fever

Table

The bar chart can be used for most kinds of information. It compares varying quantities of the same data. The key to a good bar chart is the use of consistent and constant scales. The area of ink in the bar is seen by the eye as a quantity, so if a shape other than a bar is used, it must not imply a distortion of the data. If that shape implies a volume, then the matter is complicated further, because the volume implied by each piece may distort the data even more. The grid should be minimized as much as possible so that it doesn't compete with the information.

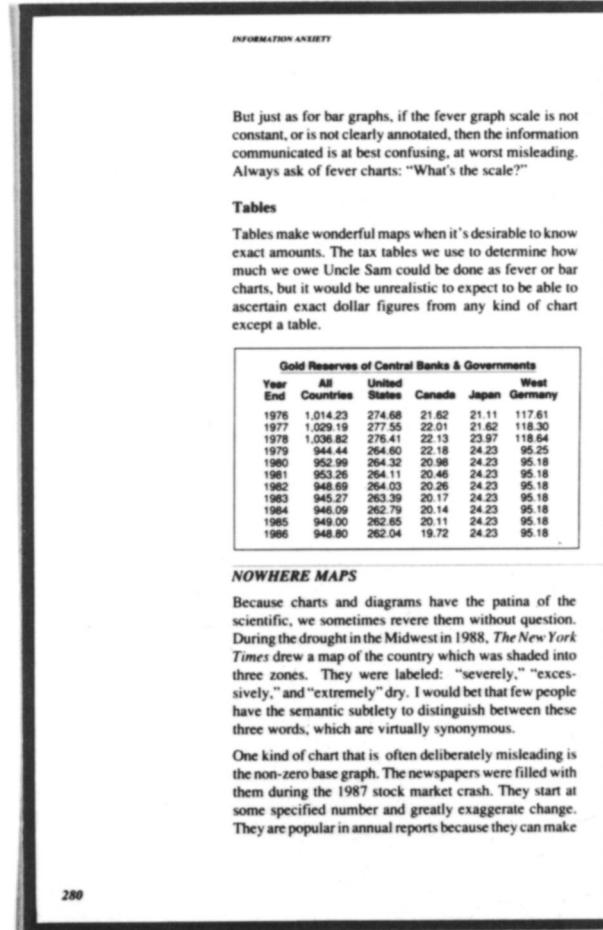
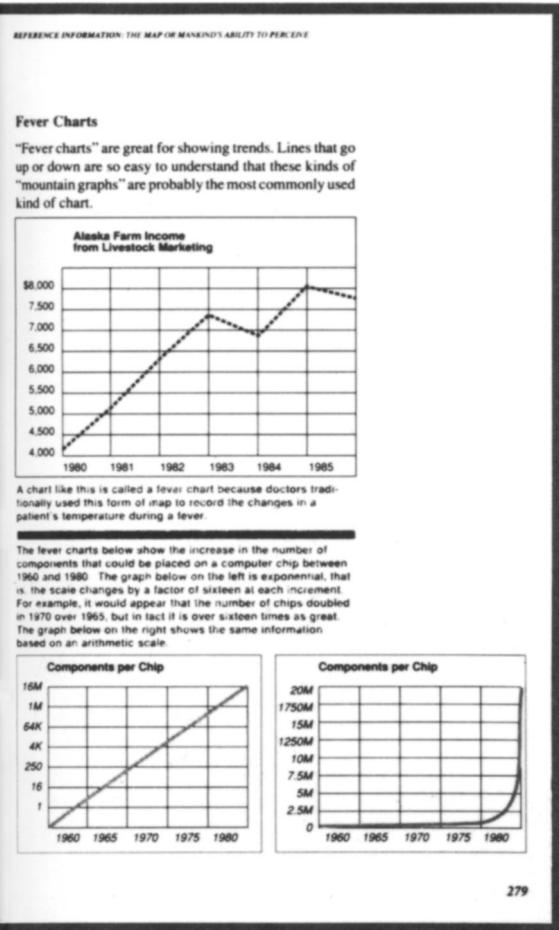
Pie charts are overused. They should only be used to show percentages of a quantity and only when there are not a lot of comparisons to be made. The inherent problem is that it is difficult for the eye to relate the size of the slice to the area of the entire circle. This means that when there are too many slices or when the slices are too thin the reader can never get a sense of comparable quantities.

Fever charts usually show the change in a quantity over time. In fact, they perform this function beautifully because the movement of the line up and down is very apparent. Stay away from exponential scales (measurements that increase exponentially rather than arithmetically) because they distort the information. To be effective, a scale should start at zero.



Tables are generally used for precise values. It isn't necessarily the values that are important in other types of charts, but the relationship between them. Here, it is the values themselves that are important. But don't feel that accuracy is necessarily informative. In some cases, rounding off numbers is much more effective than numbers to the fourth decimal place. It depends on the nature of the data and how it is to be interpreted. If the values are in dollars and cents, they should line up in columns by the decimal point.

In this type of chart, it is usually unnecessary to have many rules (especially vertical ones). They add density to the chart and the columns, and if properly tabbed and spaced, should provide all the structure necessary to make the chart cohesive.



Time lines are an appropriate way to show historical or sequential information and events. One of the five ways to organize information, they are perhaps the purest hat rack of all. They can give the reader a great sense of the flow of events and the linkages between them. They also provide a great opportunity to merge text, image, and design to make events understandable.

There are some inherent problems with time lines, however. One is that history is reduced to basic, separate units instead of continuous flowing actions. It is very easy to lose the sense of one action affecting another and of how rich and textural history really is. It can also be difficult to convey the patterns that occur within history. Also, time lines tend to make the *when* more important than the *what* or the *how*.

There are three types of time lines:

Diagram

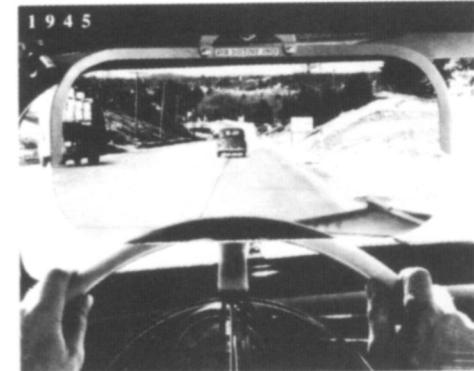
Text

Tree

A diagrammatic time line attempts to create a visual image of history by including illustrative examples related to the written entries. This type of collage approach can help build a coherent understanding of the sequence of events.

These time lines from Polaroid ACCESS are text-based. Color and location differentiate types of information running throughout the book. The blocks set near the bottom of the book are on beige backgrounds and contain corporate news and general headlines of the time. The type on white backgrounds explains the products, history, and advertising of the corporation, and the type on black backgrounds discusses the ongoing research and technical development by Polaroid.

Research is underway for an electric-eye accessory which will provide correct exposure in any outdoor light.



A polarized Day Driving visor is developed as a result of research into a polarizing system to eliminate glare from oncoming headlights.

Corporate Culture: The standard 40-hour week is reduced in all departments except Research. The company also introduces a salary increase for hourly employees.

Honor: Polaroid receives a congratulatory message from the Army and the Navy for being one of the first to be awarded a fifth renewal of the Army-Navy "E" award.

Personnel: Robert Brown is promoted to Director. Donald Brown is appointed Vice President and Patent Counsel and remains Director.

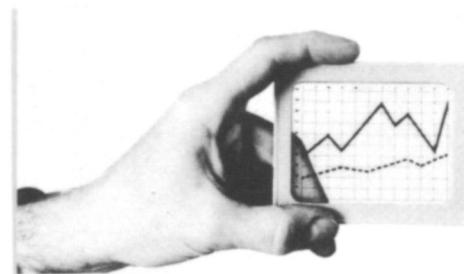
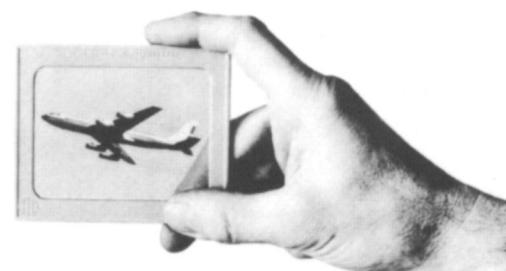
E. H. Land is awarded the Roosevelt Medal by the American Academy of Arts and Sciences.

Net Sales: \$16,752,465
Net Earnings: \$49,424
Employees: 1,760

ATOMIC BOMB BLASTS JAPAN
Tanks Lure Most Destructive Force in History

"Our Rejoicing Soldiers by Terrific Power We Have Paid to Rid World of Hitler."
Advises Japan to Surrender
Work, Work, Work

OFFICIAL
President Truman Announces



Polaroid products
sold in 45 countries
in the fall, the com-
pany exhibits at the Photo-

Corporate Culture: Polaroid initiates a Tuition Assistance Plan for employees, refunding full tuition to employees who complete approved courses.

Personnel: I.M. Booth begins working in Polaroid's Film and Engineering Division. Dr. Elkan R. Blout is elected Vice President and General Manager of Research and is appointed a member of the Operating Policy Committee.

Dr. Land is appointed Fellow, Royal Photographic Society of



Just before Christmas several hundred employees of the 9-year-old company gathered at a movie theater on Harvard Square. A trumpeter blows a fanfare, and the lights go down. On the screen appears a scene from a cartoon film comedy, *The Horn Blower*. An angel in a white robe and halo, bound for a mission on earth, poses in front of an 8x10 studio camera for a passport photo. Another angel stands by the picture, and the trumpeter continues to play until the camera instantaneous. When the theater lights go back on, Land tells the employees, "Now you know what 8x10 is." No, they say, "What's 8x10?" (8x10 is the code name for the Land one-step developing process.) Employers will wait in suspense from December 1946 to February 1947 for further details.

Corporate Culture: The company works on a new profit-sharing plan.

Honor: Polacolor receives the Navy Ordnance Award for distinguished service to the research and development of naval ordnance, especially for contributions to the development of guided missiles and other significant devices.

Research continues on one-step photography, a new method of color motion picture processing (called Polacolor), and videography. The Office of Naval Research and the American Cancer Society fund research on a color-translating, ultraviolet microscope.

A textual time line merely lists the events in sequence. These entries can be more or less detailed and may even be split into adjacent categories that run next to each other. This is, perhaps, the most disjointed type since the entries have dates and are in order, but there is no visible time line with constant increments that provides structure. It does, however, provide an efficient way to list vast quantities of information in very little space.

The tree time line attempts to provide the linkages that are normally lost in time lines. These help the reader understand the connections between events. This is a good way to convey the richness of history as well as the events themselves, but since history is rarely neat and organized, a tree time line can quickly become overly busy.

If you are comparing two or more sequences of events, the increments of the time lines must match to be effective.

Men of Modern Mathematics, a history chart of mathematicians from 1000 to 1900, was produced in 1966 for IBM by the office of Charles Eames. It is an example of a dia-grammatic time line. The connections between events are not presented, but events overlay a set of running time lines at the bottom. This implies connections, and conveys a richness when all this information is referenced together.



CAYLEY
1821-1895

ARTHUR CAYLEY TRACED HIS DESCENT EARLY — DID NOT INTERFERE WITH HIS AND EXCHANGED HIS LAWYER CAREER INFLUENTIAL IN GETTING WOMEN ADMITTED



SYLVESTER
1814-1897 LONDON, ENGLAND

JAMES JOSEPH SYLVESTER ATTENDED PRIVATE SCHOOLS AT 25, HE SPENT 10 YEARS AS ACTUARY, LAWYER AND TUTOR, AMATEUR MUSICIAN, CLASSICAL SCHOLAR IN 6 LANGUAGES PLUS A PAMPHLET ENTITLED "THE LAWS OF VERSE." AT 80



HAMILTON
1805-1865 DUBLIN

WILLIAM ROWAN HAMILTON WAS MASTER OF 13 LANGUAGES AT 13, EVEN TO THE WRITING OF PASSABLE VERSE. (HIS FRIEND WORDSWORTH DENIED IT WAS POETRY.) ENTERING UNIVERSITY WITHOUT EVER HAVING ATTENDED SCHOOL, HE GOT PRACTICALLY EVERYTHING INCLUDING A PROFESSORSHIP AT 22. JUST BEFORE HE DIED THE NEWLY FOUNDED U. S. ACADEMY MADE HIM ITS FIRST FOREIGN ASSOCIATE.



WEIERSTRASS
1815-1897

KARL THEODOR WILHELM WEIERSTRASS WON 6 OR 7 PRIZES IN MATH. PUSHED HIM INTO LAW, HE MAJORED IN BEER DRINKING. FOR 15 YEARS, HE SPENT 15 AS A HIGH-SCHOOL TEACHER, CRIMINAL AS PENMANSHIP (IN WHICH HE RECEIVED NO PRIZE). GOT PROFESSORSHIP . . . AND AT LAST, KARL WEIERSTRASS

LOS ANGE

Richard Saul W

Section

1	DOWNTOWN/CIV
2	DOWNTOWN/BUSINES
3	DOWNTOWN/COMMERCIAL
4	MID-WILS
5	HOLLYW
6	BEVERLY
7	WESTS
8	SANTA MO
9	MOUNTAIN
10	SOUTH BAY/I
11	GRIFFITH
12	NORTH CENT
13	PASADE
14	SAN GABRIEL
15	GLENDALE/B
16	SAN FERNAND
17	SOUTH AND EAST
18	ORANGE COUN
19	ORANGE COUN
20	CATALINA I
21	DESERT A

Trees are a special type of diagram that allow the connections between pieces of information to become the structure of the diagram itself. It can also be the basis for the structure of an entire book or database. The connections then define the path between different pieces of information.

Trees can be systems of connections of any interacting elements (interests, relationships, systems ...) and are a way to describe interconnected subjects. In a way, they are another type of hat rack—one that is a combination of the other five. They are maps or paths that guide us through relationships.

There are two different types of tree diagrams: *plain trees*, those whose elements are divided into sets that are only connected to other elements through larger sets; and *semi-lattices*, whose elements can be cross-connected to others, regardless of the larger sets they are a part of.

Although the *semi-lattice* seems less organized,” it is only less compartmentalized. It is no more chaotic and no less organized than a *plain tree*, but it is usually more complex and richer; and appropriately, it is more challenging to display all the connections.

A *semi-lattice* is more like a “natural” system, where connections are established based on needs and interests outside of a structure, whereas *plain trees* are typical of “man-made” organizations where connections are usually made within the rules of a structure of some sort.

These interest trees show connections between subjects. It is through these connections that one can follow and develop one's interests. It is conceivable that by starting at one subject one can find a path to just about any other subject as long as there is something even slightly in common between them.



Lists

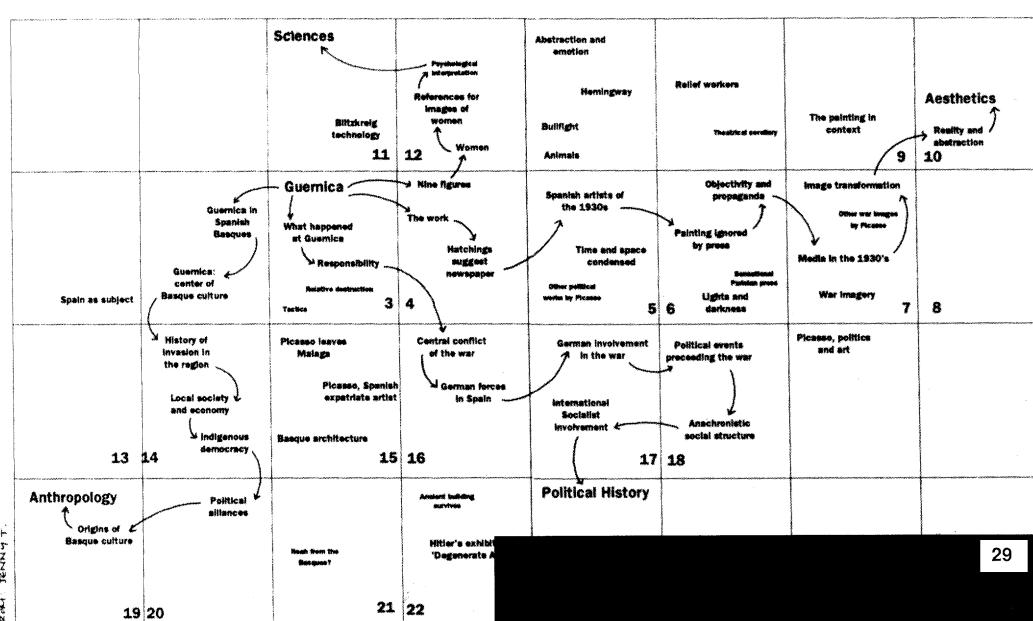
We encounter lists so often that we seldom realize how efficient a road map they are to information.

Tables of contents form the primary outlines that guide us through a mass of information, however complex and dense. To understand the outline is to understand the structure of the connections of the information.

Indexes help guide us through different aspects of the same bulk of information. They organize the information into direct and quick paths along specific requirements (alphabetical, numerical, by location, by time, special categories). They have nothing to do with the primary organization but are different ways to access it.

Glossaries, bibliographies, etc..., are further attempts to slice information in different ways in order to reveal new aspects, or new access.

Once you decide on the primary organizational system to be employed, the information falls into place. The more care you give the former, the more easily done the latter.



Instructions

Instructions are among the most basic things we communicate. We give and receive them all day, every day, but we seldom think about how to ensure that they are understandable.

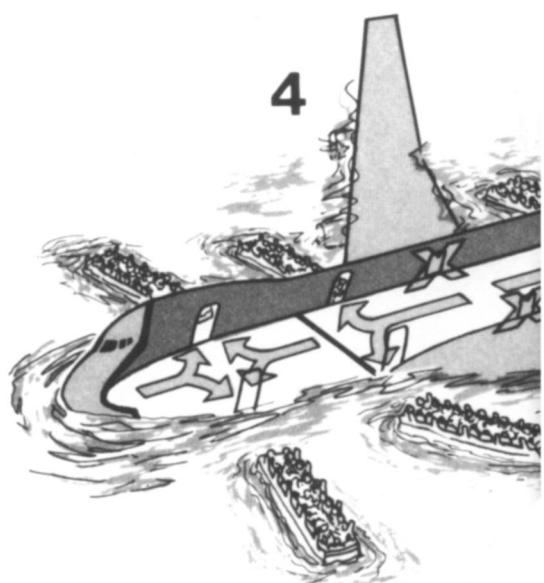
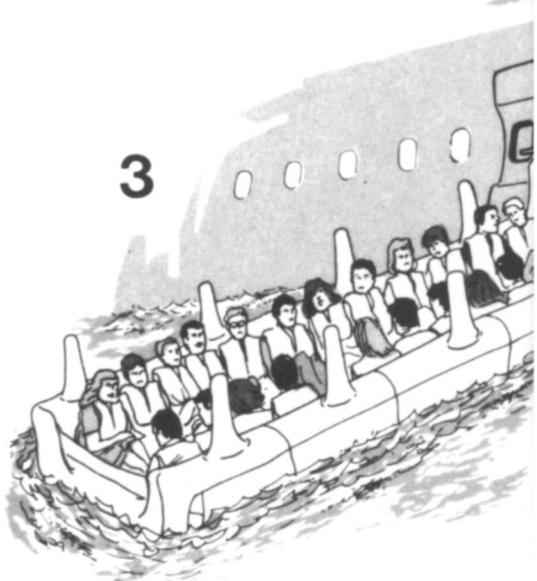
There are different types of instructions: emotional ones, operating procedures, geographic directions, and mission statements.

They can take the form of posters, charts, diagrams, quick-reference cards, manuals, handbooks, even conversation. The common elements of instructions, however, remain the same.

The *level of understanding* of the person with whom you are communicating is not necessarily the same as your own. It is easy to forget that terms you understand, especially the jargon of your profession, may be new and unfamiliar to others.

You may suffer the *disease of familiarity*, meaning you are too familiar with a subject to know how others will view it. Things that seem redundant or irrelevant to you may not be at all obvious to newcomers.

Checkpoints along the way are crucial to good instructions. You need to include a sense of what the follower can expect at any given point. This will not only let a person know when he or she has gone too far, taken a wrong turn, or made a wrong decision; it will offer reassurance.





Most airline safety diagrams give only the minimum of information and impart little sense of security to the reader. They are usually poorly drawn and not very adaptable. It is probably asking too much of these diagrams to function well in an emergency when people are overcome with panic. It is a much better solution to have instructions built directly into the plane's structure and environment, such as bright arrows that light up on the floor to show the best escape route.

Should you want to put together a bicycle, for example, instructions should let you anticipate how the pieces go together. It should also describe the mistakes you might make.

Failure is implicit in giving directions. They should describe which course to take if the instructions don't work, or if they lead you too far. Good instructions have a cyclical potential of success and failure.

Instructions are fundamental to architecture because the architect doesn't build the building; the architect gives instruction on how it should be built. The idea of giving instructions is a wonderful metaphor implicit in the mapping of all things. Instructions should contain explicitly and implicitly both anticipation and failure.

Instructions in the workplace should allow people to perform better and inspire a sense of personal creativity.

Designers should give the user instructions in how to understand information and how to cut a path through it.

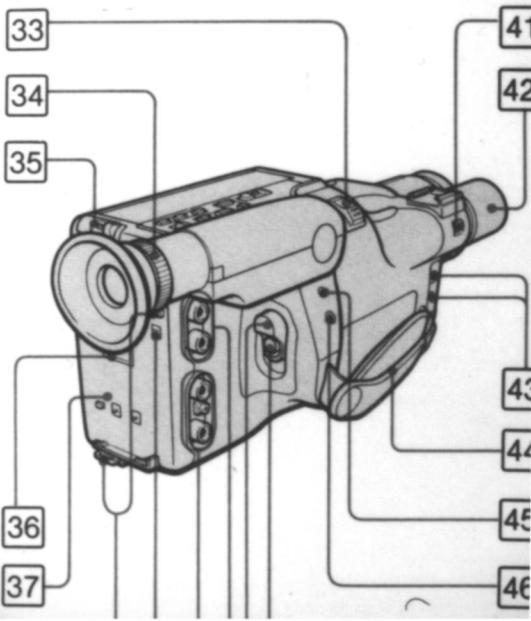
Instructions can be more than merely a list of commands. They can be informative, reassuring, helpful, and clear. They can be a conversation.

It is the job of the designer to treat the structure of instructions with more attention than the display of instructions. When the instructions perform well, understanding follows.



Most camera instruction manuals describe information that is too technical and too involved too early. The first thing most people want to know is how to take a picture right away. The technical details like contrast and auto-lock can come later when the user has already satisfied his or her curiosity and anxiety with a few tries.

A-6



This issue of *Design Quarterly* is about a singular passion: making things of personal interest understandable to others.

Interest is the key word to one's passion and the key to learning. It's the word that holds memory and learning in a constant embrace. Memory, interest, and learning define our existence.

Learning is remembering what you are interested in.

The core of a word has deeper, more essential meaning than the entire word. As the core of an idea (the *what* as opposed to the *how*) has a deep, essential meaning.

The word *inform* is richer than the word *information*.

Realize is more intriguing than the word *realization*.

The word *wonder* is more compelling than the word *wonderful*.

These words represent the beginnings, the formation of things, the blueprint of that which is about to happen.

This issue of *Design Quarterly* is about understanding the organization that leads to learning.

RSW



Richard Wurman has devoted much of his career to making various kinds of visual information understandable through his inventive design of maps and guides. In 1959 he received his M.A. from the University of Pennsylvania, Philadelphia, where he studied with and worked for the architect Louis Kahn. From 1963 to 1976 he was a partner in the Philadelphia architecture and urban-planning firm of Murphy Levy Wurman. At the same time, Wurman became well known for his writing, teaching, and exhibition development. In 1981 he founded Access Press, which has produced guidebooks for Los Angeles, New York City, Washington, D.C., San Francisco, and Paris, among other cities, as well as a 1990 United States road atlas. In addition, Wurman's San Francisco office (The Understanding Business) has designed Pacific Bell's *Smart Yellow Pages* (1988).

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