Chapter Six  Section One

Knowledge: An Ecology of Images

A Body of Public Knowledge is an Ecosystem

An image almost always represents a set of phenomena in the real world that is shared by a community that recognizes it and responds predictably.

An image can be:
- photographic (iconic)
- abstracted (cartoonized)
- mapped (graphic)
- patterned (reduced)
- described (paragraphed)
- named (termed)

according to its degree of familiarity to members of the community. Some images exist only in imaginary worlds, such as mathematics, theoretical science, fiction, and fantasy. Others serve as symbols for religion, political power, luxurious life, social class, ethnicity, etc.

Knowledge has intimate associations with decisions of all kinds (Waldrop 1984). It is a necessary component of an approach to decision making that can differentiate between better and worse alternative consequences. Decision-related knowledge takes the form of networks of connected phenomena (which, in turn, are generated as sequences of statements), and such discourse guides the initiation of future transactions. Desired outcomes are most likely to influence the choice of transactions, while slippery slopes leading to catastrophes are avoided, not perfectly, but with recognizable likelihood.

Mapmaking precedes the storage of information. Any event must be located in the real world as well as the memory. Then communities can control situations for a while by knowing who, where, when, and how
much makes up the reporting of what happened. Animals learn how by guided exploration, while humans use surveying instruments, clocks and calendars the environment outside and neural nets in their brains.

Bio-ecologists recognize that the lifelong control system for whole organisms resides ultimately in the ordering of the DNA-RNA-protein molecules. A source of immediate control is found in the structure of the brain; it allows the organism to draw upon past experience and to fit the impression to a map of the present surroundings (LeDoux and Hirst 1986). Ordering in the brain is triggered by signals that have been seen or received through any of the channels of sensation. Patterns of signals coded to the environment are transformed into small nets of connectors in the frontal lobes of the brain; these represent images, which can be recognized (Smith and Jonides 1999) when encountered again, shared, and transmitted within the community. The image is to Knowledge what the species is to communities that make up ecosystems. As scientists gain greater detail in the study of nature, it appears that each level, from micro to human to macro scale, has ecosystem properties. With the aid of new instruments of technology, science is gaining the capacity to investigate and tie all of them together. These are the key features for understanding how knowledge operates in the ecosystem. It takes longer to depict the evolution and accretion of the stockpiles available to a community.

Mortality. Organisms use stocks of genetic information as a source for the knowledge to reproduce. One example of the difference between standard bio-ecology and urban ecology will be sufficient to show the role of knowledge: It is axiomatic for bio-ecologists that those species encountering serious difficulties in reproduction will very likely become extinct. Moreover, it is evident that the degree of attention paid to a biological species by the households, and the community itself, determines the rise and fall of animal and plant populations. Most birds are welcome; most insects are not. People make knowledgeable selections of characteristics displayed by the species with which they wish to live.

Urban communities in particular have been developing a concern for
longevity and "quality of life," so that species which conflict with these virtually universal goals are labeled pests or disease vectors (e.g., mosquitoes, houseflies, poisonous weeds, etc.), and are therefore expelled from the community. Co-evolution of species--each shaping the others over time--is observed in the history of mutual adjustments over numerous generations.

Genes operating together create enzymes and hormones to manipulate a cell millions of times larger than themselves.

As amplifiers, genes have high fidelity. Through interactions between cells, they control essential behaviors of an organism 10^8 to 10^{10} times their size (a gene of one microgram, the size of an invisible particle of dust, will trigger specific behaviors for an elephant).

Thus the amplification of effect (a prerequisite to control) in nature is astonishing in comparison with the urban ecosystem. Control from the top down -- starting from knowledge held by an organization -- also requires amplification. It is more difficult to calculate, however, due to much poorer fidelity in human communications. Nevertheless, the amplification potentials of the design of artifacts can now attains the scale achieved inside an organism.
Chapter Six  Section Two

Observable Composition of Knowledge

Designers are deeply involved in their perceptions of images. They model in three dimensions, or draw in two, what cannot be expressed with words. They spend a large part of their spare time paging through photographic representations in journals and books, thereby adding to the repertory of images of the built environment they can recognize. They expand the slide collections that contain the images they value highly.

Because the amplification power of the theories that lie behind their explorations and searches remains low, designers are often reduced to pure opportunism. They have no equivalent of the alphabet for a quick search. They badly need a system informed by the advances in science and technology in order to find the right image at the right time and place. Digitizers and photocopiers afford a capacity to manipulate images, but not to find, identify, and diagnose them.

"Intelligent systems" for the designer in art, architecture, engineering, and horticulture are under development. Images that map explicitly onto the "real" world would allow designers to handle larger, more complicated projects. Design engineers working with solids gain the greatest precision (Droege 1997).

Amplification can be obtained through principles that apply to all living systems. An introduction to such a system, an "ecology of images," is begun here in the hope that it can be quickly extended by others who are impressed with the uses of ecology in the expansion of knowledge.

How does knowledge control the built environment? Answers emphasize how the designer with special skills for ecology combined with image manipulation can guide these processes.

Public knowledge requires written language for its assembly, maintenance, and use, whether in the urban ecosystem or inside an organization.
The study of language and its transformations was already well established at the time that the concepts of ecology were formulated, so a private language evolved that enabled the company of investigators and disciples sophisticated in the use of computers and amplifiers to talk about language (Luhn 1968; Borko and Bernier 1978; Jones 1986; Kelly 1994; Kauffman 1993).

**Origins.**

To illustrate some basic principles it appears best to go back to the origins of civilization when language was quite simple, although the patterns of living had already become quite complex. At that time hunting and gathering hundreds of different kinds of things from the environment gained a reasonably secure livelihood, but their separation in space required the organization of migratory bands. These bands found it to their advantage to cluster at an appropriate time of the year and exchange "finds" and special artifacts.

The language of these humans is believed to have contained a few thousand different terms -- about ten to a hundred times the range of meaningful vocalizations of apes and chimpanzees living on similar terrain. That language contained only a few hundred terms to distinguish all the plants growing in the environment.

All the edible plants, and many of the most toxic ones, were assigned names. Some medicinal plants are likely to have been labeled verbally as well.

It will be noted that, for hunters and gatherers, the populations of the named plants will have been consumed as edible, or repressed when troublesome, while the unnamed ones will have been left alone. In this manner language, especially vocabulary, reflects the modifications imposed by humans upon the natural environment. We now are quite sure that small prehistoric communities made gigantic changes in plant life through strategic fire and stream diversion.
Hunting and gathering environments are usually less well endowed with species of fauna, even when counting the less visible populations of termites, grubs, and mollusks, so the fauna will have required fewer names to be assigned in the language than the species from the plant world.

However, among the extraordinary individuals, some fauna -- such as the giant of the species, or an albino -- will have warranted their own names. Similarly, prominent features of the landscape -- the mountains, rivers, outcrops, forests, swamps, and beaches -- required an assignment of terms when humans communicated about opportunities for food gathering and threats of territorial invasion. Thus, as a result of human transactions with the environment, popularly named species are hunted, chased, or collected, and therefore become scarcer. But later the species may be cultivated or bred for profit and co-evolve with humans to proliferate.

A rich source of new patterns arose out of the ancient institution of apprenticeship of a young person in training to a master of an art.

Apprenticeship is a means of transferring to the following generation what has been learned but cannot yet be put into words. Ancient peoples possessed much more knowledge than was remembered with the aid of language, but the secretiveness of the crafts resulted in extinction of the knowledge bearers during wars and epidemics, and thus this knowledge required rediscovery.

The arts of glassmaking and metallurgy seem to have endured such epochs.

Nevertheless, publicly shared knowledge needs a shared vocabulary.

Elders spoke of "mysteries" and "secrets" unreachable with words, even though they had as many as ten thousand from which to choose. Vocabulary represents a stock of concepts, a kind of free capital from which members of a community can draw. Trading and looting offered processes for an intermittent flow of valued goods and services between communities and a sharing of images.
After Writing was Available.

Now let us move up the evolutionary scale to a less primitive community, specifically a kingdom with an elementary script and a notation for numbers, that is, the beginning of written language. This is the stage reached by the societies reported upon in the book of Genesis in the Bible.

For them a reasonably comprehensive list of terms in common usage should exceed ten thousand, and the vegetative world should account for a few thousands of the total, a good share of which belong to a pharmacopoeia assembled to deal with the ailments of human and beast.

In such a society a wise person, who was a collector of knowledge, could achieve most of these specialized verbal distinctions within a lifetime by studying with a master, and sometimes could advance beyond him by consulting other masters and making observations of his own of invariant patterns, coining words for them, and transmitting them to apprentices.

With these early communities in mind it is easier to comprehend the complexity of the present state of knowledge.

The registered names of the plant species now approach a million. For each of the higher plants there are several coincident visual images that can be drawn upon for identification -- flower, pollen, seed, leaf, cell morphology, appearance when young and aged. A naming system uses two or three terms predominantly (just as modern societies do for humans), where the numbers to be distinguished between are of the same magnitudes. Many types of plants also have a variety of unique properties, or "species-specific" in ecological language.

Then a brief term, such as poison ivy, is sufficient to find in short lists of familiar species.

Many more species are extinct than are alive today, with evidence of their existence buried in fossiliferous strata. Extinct species also belong to the shared knowledge about plants and animals, and they provide evidence concerning the sequence of events in the evolution of contemporary communities. The repertory of images in the plant domain shared by the
scientific community approaches ten million for perhaps three million species..

Moreover, every year the total list of species grows by perhaps 1 percent. Most are newly discovered, and a few are newly evolved.

The listing of names of patterns is equally as large for molecules, the community of professional chemists has named which have been named more systematically. Only now (a century after their first graphic mental maps) are they sometimes visible as fuzzy globs with the assistance of the most powerful electron microscopes. Molecules of the same species are known by several different terms, some regional, others agreed upon internationally. One of these terms is a solution to an equation made up of imaginary numbers (wave equations). Altogether, chemists contribute quite a few more millions of named images to the stockpiles of public knowledge -- many more than the botanists. Chemicals are catalogued unambiguously and used routinely by other scientists.

In the realm of artifacts the sales catalogs alone pile up tens of millions of items with photographs, catalog numbers, names, and other descriptors. Moreover, the list of species of artifacts in general use continues to grow by an estimated 1 to 2 percent per year. Images associated with industries and the applied arts have become more numerous by far than the descriptors of the natural environment.

Each human participant in the community carries a small share of this public knowledge in the form of personal experience. Formal education is responsible for an important part of this common knowledge. An educated adult may associate images in the environment with their language descriptors (or signifiers) up to the level of one hundred thousand items, with specialists achieving several times this number. The many millions of terms that remain outside the memory can be retrieved by means of a few simple rules when looked up in files and libraries.

About ten thousand such images in the adult human memory take the form of visages and appearances of other people who can be named. This number appears to be a natural social limit. A face-to-face community that experiences few anonymous encounters, so that everyone learns to recognize
everyone else as a child, is called a village (Meier 1962). In it a resident
carries around in his or her experience, as a part of the knowledge essential
to his well-being, images so precise that he can identify whom he is meeting
well before they can greet each other with propriety.

Strangers are put into broad categories and addressed accordingly, or
simply ignored. About eighty to ninety non-redundant bits of computer
memory is the minimum needed to identify a human face without a lingering
doubt, while the written name of the person behind the face may require
only thirty to fifty bits, and the Social Security number somewhat fewer.
Compare these quantities with the standard telephone line capacity of
seventy-five bits per second.

An image may affect all of the senses, or only one of them. The greatest
capacity for discrimination lies in the visual channels of communication.
Therefore that medium of communication is populated with the greatest
number of natural and designed images.

The channels conveying voice, music, and environmentally generated sounds
are limited to a minor fraction of that capacity.

The senses of smell and touch possess even less capacity; therefore -
particularly when a person is fully endowed with normal sight and hearing --
touch and smell are often used to corroborate hypotheses produced from
fragmentary visual perceptions.

For example, when a flash of stripes and color is followed by a characteristic
odor, our experience tells us that the animal barely glimpsed was not feline
after all, but a skunk. Many fabrics resemble each other closely, so they
must be felt to discover the "hand" presented by the weave with its sizing in
order to verify the labeling. When the senses agree, we are no longer in
doubt.

This principle of identification by senses is important for the designer of
artifacts. A successful product should not only possess a distinctive,
convenient form: It should also have:

- appropriate color
- an unobtrusive, yet identifiable, sound
• a warm touch
• a faint, but appealing, aroma

If important, it really ought to have a poem, a song, or a dance associated with it to celebrate its presence. But this is still not enough.

Images also have "friends" with which they are often associated; "neighbors" they meet frequently; and predecessors or ancestors that had carved out a niche. The designer may encourage some of the neighbors of an image to remain associated with his version, and repress those that appear detrimental by putting them in a bad light. A designer may succeed in finding a new dress for a familiar image that adds to its frequency in attracting attention and extends its lifetime. Then it qualifies for a trademark.

Alternatively, he or she may have found a new niche for a distinctly different image that deserves a name of its own. Some of these names are applied to patentable materials. Artists, scientists, and research engineers are prolific inventors of new images. Designers are midwives who bring images into being, while managers nurture them to the scale of mature populations.
Chapter Six  Section Three

Outlooks from both Inside and Outside

Choosing a Point of View

We want to know now what an image is, and how it comes into being, establishes a context, matures into a cliché, becomes antiquated, and finally declines into a "sign of those times" -- an archaism.

This pragmatic argument must break out of the ecological observational traditions. Here the methods of objective observation and deductions of system structure must advance from census to survey of eco-structure and counts of entries and departures at the boundary. We must reach even further than discussions of life cycles of artifacts and organizations to gain the next higher level -- that of transactions.

How are familiar principles stretched to accommodate an ecology of images?

Surveying the phenomenon of images is a very difficult intellectual exercise. It pulls concepts from many arcane bodies of literature, only a few of which may have been familiar to the schooled explorer, and allows the construction of a multilevel model of a micro- macro living system from these concepts.

This systemic thinking is powerful, when compared to intuition and plausible local strategies, because it saves time and much trouble when shared. It is useful for refining the extension of "peer-reviewed" knowledge into visual domains that language has not yet reached, except perhaps with metaphor.

Planners, designers, and managers reading this argument have come from dozens of different cultures. They have already constructed a bridge to the outside by learning English. For them the scientist- as- objective- observer point of view is more quickly comprehended than the approach of "getting inside the heads" of members of a subculture that dominates design in the English- speaking world.
Initially a person totally immersed in an outside culture can only note the choices of imagery in the art, music, and politics of a culture being observed. This is because the expressions of response to these images by members of a "hyphenated" urban community (e.g., Chinese-American, suburban middle class, Slavic-socialist, born-again Christian, contemporary Islamic, etc.) belong to a different tradition of interaction than his own.

The older, elitist, urban ecological view from the inside, which has ruled the design schools of Europe and most of the Americas, rarely has access to the feelings beneath the labels. Only a few designers dig deep enough to encounter the meaning-laden questions put by their clients or consumers.

A person permanently situated in the English-speaking world may recognize that the choices that she or he makes are influenced by relationships lying between images and the signs that represent them, but most people prefer to deal with them internally and intuitively. Such people weigh many objective factors in making design choices, including convenience and whether input requirements are readily available.

Along with these factors are considered such incommensurable qualities as "naturalness," "authenticity," and "elegance" (qualities reached through internal judgments). Such persons seem anxious to escape from the objectivity required by ecology as a natural science.

The intuitive judgments made by architects and urban design critics are very frequently at odds with the tastes of the public concerning what is a good design.

Who is right?

Many review boards have been set up to stop the appearance of incongruous images in the cityscape. These boards have a strong tendency to prefer tradition and reject innovation, thus siding with a kind of purism rather than ecological diversity.

Why not allow both outlooks?
The non-market aesthetic factors, especially for the visual image, in a piece of urban property can now be assessed as well as any of the strictly utilitarian properties. By using multivariate analysis, Stamps (1989) can argue that an image that is appreciated by the public has at least as much value as one that designers would choose. Whatever is "good" or "interesting" to representative panels drawn from the public will communicate more broadly than "so-so" or aged renditions by trained or professional designers.

A fundamental question in the study of images has to do with the equivalence of a photograph of it, as compared to seeing the original in its actual environment, when making judgments of relative quality. Although earlier experts held different beliefs, Stamps (1990) answered this question in the course of a remarkable "meta-analysis" that reviewed all prior studies containing sufficient comparisons. He determined the correlation between qualities found in the original image in the environment and those perceived in the photograph to be at the r = 0.86 level, which is very strong. Unbelievers would lose money regularly and win very seldom when making bets about acceptability.

Reproducible psychological experiments assessing the quality of image clusters associated with artifacts, ranging from furniture to skyscrapers, can be formulated. Judgments about "interestingness," "goodness," and other quite vague qualities of a designed object seem to be shared by large segments, even a majority, of the urban public. Stamps (1980) has shown that these opinions can best be explained with theories of the philosopher Immanuel Kant; new theories advanced since the early nineteenth century have offered no improvements in consistency or ability to forecast preferences. This invariance over time suggests that something basic to human judgment has been tapped by the experiments.

It would require hundreds of investigator-years of effort to demonstrate that the first sample was significantly biased in some way.

The finding shows that experts relying upon unique collections of "originals" in the arts have only a moderate, frequently not noticeable, advantage over
those who examine photographic reproductions for determining what belongs to a set or for defining what is "good" art.

We can conclude that the experimental scientific point of view is well founded and, indeed, reproducible. It is a suitable basis for establishing public policy, whereas the opinions of "experts" who claim to judge quality of image from experience are less dependable (see Figure 6-1).
Figure VI-1.
When talking about life cycle phenomena for images we frequently use typical examples, such as 'Cadillac tail fin,' 'vitamin pills craze,' or 'the Internet phenomenon,' 'the bungalow,' etc.

People are judged by the styles they present; they show awareness by choosing images on the rise, to be 'hip' they must choose earlier.
Chapter Six  
Section Four

Life Cycle of Images

Images Have Life Cycles, Even When Mythical

Any repeated pattern sensed in the ecosystem can become an image.

If it is communicated in public, it is a candidate for joining the community of image species we call Knowledge. The concept is best understood with a commonplace example. Visualize a supermarket with about one hundred thousand labeled products together with a thousand varieties of perishable produce.

Each item has:
• a name
• shape
• taste
• use
• price
• order number
• a place on the shelf

Many of these products are advertised in the media. The community of brands and commodities retains the same macro-appearance, with minor modifications, over years, yet detailed analysis reveals that quite a few items have been relabeled with new visual statements, and that individual image styles have a median life expectancy of perhaps five years. Prices change frequently, the locations more slowly, and the order numbers are replaced in some kinds of revolutionary transformation imposed by top management every decade or so. Strong competition and defensive cooperation between images is evident, just as are found among supermarkets themselves.

Now look past the market to the urban community surrounding it. Millions of images are out there, but they exhibit much less order. Only a few are items for sale with quoted prices. Order numbers are replaced by a variety of
cataloging procedures; a few natural images, such as trees, stand alone unlabeled. They can all fit into the broad categories introduced in various ways earlier.

University neighborhoods have the greatest diversity of images. After one enters a university’s library, whether viewed on foot or by Internet, images from the whole world, past images along with present ones, are recorded and accessible. The numbers of different images there increase a hundredfold. Those images are the subject matter of economic, social, and cultural transactions that make up the life of the society.

Images are the specific nouns employed in discourse. Some of the past terms/images are parenthetically noted to be archaic, meaning that they have died out, and are not currently used for communication.

Frequently a cluster of successors supersedes these images. This replacement resulted in a population growth of images amounting to perhaps 3 to 5 percent per year during the twentieth century, as estimated from examining the community’s library catalog and telephone directories.

At this point a huge anomaly appears. When people look at a list of images/terms, they discover that it is impossible to find a "real world" lying behind many of them.

For example, most people have a clear image of what an angel looks like and what it is said to be able to do, but angels and other imaginary beings like them cannot be:

• measured
• touched
• photographed

When we claim that there is no Santa Claus, we are saying that the truths transmitted through images in an exchange can also contain fictions. A gift-giving culture would like to have its children believe for a while that there is such a saintly hero; therefore, rich, colorful, implausible myths are constructed around his presumed activities.

But they are, basically, all white lies!
The informatics approach to analyzing images cannot distinguish a communicated belief in a real thing from an unreality.

The scientific observer must conclude that belief counts as much as a fact when it goes through a communications channel. Some bits are tainted. Patterns sensed in the environment with the aid if instruments are differentiated from known patterns, discussed with skeptical colleagues, and then, when most doubters are persuaded, they are named and recorded, so as to become part of known reality.
Chapter Six   Section Five

Meta-Languages

The Metasystem Exposed

We use images (those that make up language) to communicate about images.

It is also apparent that such images of images are abstract; they depend upon shared modes of experience. These super-ordinate images are part of a meta-language. For example, architectural critics have constructed a meta-language so that they can use words and stylized photographs to comment upon facades and the most remarkable spaces within a building.

Linguists have similarly built a meta-language to analyze a patterned series of vocalized sounds.

Physical scientists are fortunate. They invented the images of atoms and molecules in the eighteenth and nineteenth centuries, and from their relationships, as discovered by experiments, built elaborate pictures of the submicroscopic "unseeable" world.

At the end of the twentieth century, microscopes and other instruments became so powerful they could find shadows of molecules of the size predicted and in places where they should be -- a direct confirmation of the images on which scientific research has depended. They even found an echo of the "big bang" of the creation of the universe at the wavelengths at which it was believed to have taken place. In these instances, terms in meta-language of the physicists also have joined the real observable images.

These meta-languages serve as media for control systems in the future production of plans, designs, and reports. They are used to reward or punish contemporary designers and investigators, and thereby they point in the direction to which the field should evolve. Michael Hough (1984) proceeds modestly in this manner and presents a picture of "natural outcomes" in urban ecology, showing the "greening of the city" through a multiplicity of examples. This guidance is still fashion-driven and therefore inefficient over
the middle to long run, but those who know the meta-language attest that it is far better than nothing at all.

The destroyers of perfunctory orderliness within the communications channels are the poets, artists, musicians, and inspired designers. They invent new metaphors, parables, dreams, fictions, myths, and even whole universes of discourse, such as Greek theology, with actors who have never existed and cannot in the future. Nevertheless, people pay attention and are sometimes able to carry on a conversation within the same system of thought.

One example should suffice. In the Renaissance and immediate post-Renaissance periods, artists and writers invented and borrowed images of a fantastic bestiary that included dragons, gryphons, and several others, but the most lovable of the lot were the unicorns.

Many were put into statuary form to "guard the roof" of palaces, churches, and other public buildings. Whole monographs were devoted to the appearance, diet, and behavior of these mythical creatures. The reports were so detailed and persuasive that students of community ecology could be asked to define a niche in which they could survive in a middle American biocenosis system. The students ultimately discovered incongruities in the reported reproductions of the unicorn (traceable to common inhibitions of that era), since it was required to rest its head in the lap of a maiden before it could foal (Meier 1975)!

Metaphors for change are the antitheses of standard models (Judge 1993). Under neutral conditions, an intriguing, challenging metaphor can be a self-fulfilling forecast and therefore useful for leaders and planners.

Sustainability, for example, is a metaphor that guides assertions and claims of many eco-enthusiasts, while the same term can be applied to models that meet the condition that feasible transitions can be found all the way to the horizon (pathway) that could maintain at least the present level of activity in the community/society.

So the design of feasible plans must insist upon the pathway model, but it will use convenient rhetoric to gain a consensus while being alert to
disconnections from the real world (booby traps) that a metaphor may contain (e.g., the "leap forward" into the dark unknown that encounters a real abyss).

Transactions that result from the use of metaphor appear to be weird or virtually inscrutable to the outside observer looking into a community. He sees that, out of a crafted juxtaposition of common images, through style, context, emphasis, color, and synchrony, a new set of synthetic images arises that people can somehow comprehend -- or at least persuade themselves that they have done so, because such fantasies are accepted without discomfort.

Writers and artists prefer to use a metaphor in their work when parsimony is expected. A complex relationship can be transmitted by a single metaphor that would otherwise require a paragraph, or a separate cartoon, to convey.

As suggested earlier, biologists working in ecology abhor myth and metaphor; they ruthlessly remove it from their formal publications. They go back to classical Greek roots for the naming of general phenomena, because those roots carry with them fewer extraneous associations, and to Latin in the labeling of species for the same reasons. Human ecologists have recognized both the value and the demand for these "aberrations" when writing for each other's consumption.

However, urban ecologists, anthropologists, managers of organizations, and psychiatrists revel in the richness of myth, metaphor, and dreams, often accepting the challenge of interpretation and analysis (Rogers 1978).
Donald Schon (1979) made a significant connection with the professional interests of planners and designers when he introduced the concept of generative metaphor. He uses the problems that planners and designers face to illustrate how metaphors can direct attention to "solutions." Thus, "urban renewal" becomes a natural response to the metaphor "urban blight," and it suggests reinforcement and rehabilitation as a substitute for clearance by bulldozer that is followed by rebuilding from the ground up.

Similarly, "sites and services" became a frame for generating metaphors that emphasized cooperation between urban authorities and squatters who were living outside the land law. He insists that the good or bad, safe or dangerous, connotations attributed to the metaphorical image are carried with it to the new context. Thus, the metaphor can become a stimulus for both protest and reform. If solutions to present problems are blocked, the strategy of searching for a new, powerful, generative metaphor should not be overlooked.

Donald Miller (1984) subdivides the use of metaphor into seven modes, expanding upon Aristotle's four types. Some metaphors, he points out, may not be new and fresh at all, but merely part of conventional wisdom. When we are concerned with human affairs, we are "constructing a system of understanding" that makes sense to us. His criticism of Schon is that the latter undertakes the admittedly uneasy task of "literary criticism," but ignores the lessons of modern literary criticism and textual analysis.
The
- renaming
- regrouping
- reordering

of percepts in a new frame may help solve some problems, but a good chance of being misled also exists. Moreover, we will never know how far we have been misled until much later when an historian reviewing the consequences contrasts that frame with its successors.

Two books digest various particularistic findings made in scattered places and propose some persuasive generalizations. Both are by geographers, and therefore wide-ranging in subject matter.

Carlstein, Parkes, and Thrift (1978) wrote and edited studies that use images as tracers of the channels that move knowledge over distance and through time. From the originations and adoptions of images, they infer some generalizations about the quality of life. They also offer a careful review of earlier thinking in the social sciences that connects advances in space-time accounting with social structure, environment, technology, and scale. Methodologies for reordering imagery are then proposed.

The other book addresses the subject of images in the urban ecosystem more directly. Pocock and Hudson (1978) start from the early days of U. S. urban development (the 1950s) and trace the expanding exploration into the contemporary period by weaving back and forth, issue by issue, between poles of "personal interpretation and universality." They closely examine the work of environmental psychologists who ask ordinary people to , and otherwise represent what they know about their own settlements, and from those responses they theorize about how images get established.

Thus when an individual tours a new environment ("sightseeing"), he or she sees facades and associations in space sequenced by the routes taken and with details determined by the mode of traverse, such as walking, bicycling, or riding in a vehicle.

From the first trips, the sightseer instantly recalls landmarks, high points, long views, zones of congestion, indicators of levels of maintenance, newness giving place to aging, and attempts to beautify (Lynch 1960). Repeated trips
on the same route cause most of what had been seen first to recede into the background, while images giving meaning to daily transactions with the environment stand out from all others. Sites with personal significance -- sources of income, supply, assistance, information, amusement, and psychological support -- are profiled, and then embroidered with detail in the observer’s mind.

The remainder drop back into a dark, subconscious pool, where they receive no attention, unless a picture or a recording of sounds is presented for recognition.
Chapter Six  Section Seven

Associations of Images

Images as Neighbors to Images

Amos Rapaport clarified some of this process by which a community member attributes meaning to the immediate environment. His most complete analysis of nonverbal communication is found in a book titled The Meaning of the Built Environment (1982).

Its argument starts by identifying the indicators of ideals, status, power, religious faith, health, good fortune, etc., in the built environment. These indicators are built according to design, while in the natural environment they are found "wild" in places favored by humans. Orientation, colors, scale, and pattern are coded by culture, which contains a set of rules or cues for "understanding" environmental settings. These tradition-based rules, interacting with cues, trigger human (and some animal) behavior in the built (and the preserved) environment.

Cultural coding processes are topical, not automatic. Individuals draw upon their own experience and set up filters and controls. Thus the well-trained dog will not always run off in pursuit of rabbits and cats; it may have been instructed to ignore them when accompanying the master. Most humans develop filters against threatening signals, refusing to accept them as "real," but specially trained police react with alacrity to the same signals, since they assume them to be actual threats, unless otherwise indicated. The rules defining propriety are held tenaciously while one regards images in various contexts, even to the extent of leading a person or group to propose censorship of the designed urban environment.

To illustrate the strength of this coding Rapaport recounts the instance of a suburban woman in Wisconsin who planted her vegetable garden in front of the house because exposure to the sun and drainage were better there. The neighbors and the community as a whole were outraged that the garden was not in the backyard. After many meetings, they took legal action to force
her to conform, taking the case all the way to the state supreme court. Eventually she won, but at the cost of virtual ostracism.

Sharp local changes in the cityscape superimpose fractured new images. Most residents are made uncomfortable by such abrupt changes, so they object strenuously before the event occurs in an effort to preserve the familiar urban fabric, or afterward they attempt to restore what has become familiar. Thus image change is a major source of the "not in my backyard" syndrome of resistance (NIMBYism) that is a major threat to modern planning.

Many instances of such behavior come to mind. When the authorities need more public space for transport in order to bring congestion under control, local interests opposing the change get sympathy and even active support from many of the people passing through, though it is the latter who suffer the most from the delays. With this broad support, it is frequently possible to push the congestion into some other territory for a while without the residents there knowing what has happened to them. If the authorities are unable to move quickly, before the protests against change mount, some spectacular fractured images may be sighted.

For a short period the edge of the business district of Seoul was presented with views of back room and backyard life when ten meters of frontage was neatly sliced away over a weekend. Then, over a period of months, each owner, shopkeeper, and resident fitted an appropriate facade over his amputated site, often enlarged with an extra story to take advantage of the more spacious avenue. A year later the passersby could not distinguish the strip from any of the nearby parts of the city.

In Yogyakarta in central Java, a three-meter slice was restored more slowly, with the reconstructed side looking much newer in style for years thereafter. In developed countries, the decision-making process is more transparent, and transport interest groups are often halted, or deflected, by local interest groups well before the proposed takeover of land.

The universality of metaphorical images is evident from the range of the few examples chosen. Their staying power is deduced from the intensity of
urban conflict that they can generate, and their usefulness in bringing about change is apparent.

These are not easy lessons to learn. However, metaphors are still images, and they survive in the ecology of images with life cycles almost as long as those of the images of reality bolstered by scientific verification.
After they have made many trips and associated transactions within a region, people are able to establish a sense of direction, an orientation, that enables them to find their way to a destination when taking routes never before navigated.

Tolman (1948) showed that even experimental rats could rather quickly generalize their experience in space to achieve a cognitive map, a supra-image, of territorial space.

Equivalent generalizations are reached in social and cultural spheres of life: An experienced person depends heavily upon these abstractions refined from the repertory of acquired images. They are a part of one’s personal knowledge that cannot be put into words.

The image is an "intervening construct" that an individual, be it human, animal, automaton, or organization, shares with others: it is attached to a preset framework -- a kind of filing system - which is sometimes inherited.

Children start developing a remarkable potential for acquiring urban images as soon as they learn to walk and are allowed to explore. Each human, it appears, first tries to establish the coordinates of a potential image - its "whatness," "whereness," and its outline.

Its qualities
- size
- strength
- gender
- beauty
- color
- stability
take a few hundred milliseconds more to appraise. Expectations about the image’s relationship to others -- the neighbors and roles in a scenario -- follow.

A person may be able to perceive as many as several established images, such as:

- animal species
- familiar people
- models of vehicles
- house types

per second. It takes a person seconds, or even minutes, to absorb the basic information in a new image, which distinguishes it from all others in the repertory, before he or she is really confident of its newness.

Quite often, some "schooling" is required, with sophisticates serving as teachers. The process of originating images in the mind is presented in Figure 6-2.
Figure VI-2. Just as scientists had to recognize elementary particles and photons, the fundamental components of images are percepts. An organism has learned to assemble them into patterns, which are matched against an inventory of images previously acquired. After identification, sequences are constructed for engaging in transactions. That behavior, and its outcomes, are recorded in a community memory bank to become shared knowledge. Understanding of a scene takes a little bit longer.
Just as scientists had to recognize elementary particles and photons, the fundamental components of images are percepts. An organism learns to assemble them into patterns, which are matched against an inventory of images previously acquired.

After identification, sequences are constructed for engaging in transactions. Those behaviors, and its outcomes, are recorded in a community memory bank for shared knowledge. An understanding of what transpired at a scene takes a little bit longer to comprehend.
Chapter Six  Section Nine

Economical Communication of Images

Digitizing the Images

The predecessor of perhaps 99 percent of the images extant today is a visual pattern (as compared to aroma, tonal sequence, or texture).

This pattern is later rehearsed in three spatial dimensions, plus color, time, and sometimes types of materials. After repeated trials, a new image finds a niche in the ecology of images. When simulated in a computer by an automaton, the bits are assembled into one or more packets.

Recent speculative research, believed to be as fundamental as relativity studies, reveals that the universe of all possible biological and physical visual forms is not infinite, as previously believed, but is restricted in much the same manner in which the physical universe has limits.

As Kevin Kelly (1994) describes it, this discovery began with the breeding of flowers, a tedious process that was carried over into a time-compressed computer program. It was found, after some exploration, that the genes controlling a flower's shape and form were a small minority of those that governed the process of expression, not those involved in the direct patterned outcome. Many developmental combinations of genes yield a gray, inchoate mess, but a few generate a family of forms that are aesthetically pleasing to humans, and which can be named, numbered, and reproduced.

Evolutionary processes for randomly mutating genes encounter many sterile domains and occasionally lead to nonviable dead ends.

The speed of exploration of this "image domain" is greatly enhanced by the redistributive features of sexual combination (including "multiple parents" and "antisex").
Artists with computers entered the world of biomorphs looking for the most aesthetically interesting patterns (Dawkins 1987, 1988). These patterns could be expanded into three dimensions and converted into multicolored sculptures. Karl Sims used a huge "Connection Machine" computer in a museum, in which evolution follows a path controlled by choices made by the visitors. Philip Latham thinks that there may be algorithms for efficient exploration of the domain of interesting images which parallel artists' intuitions. Arbitrary abstractions, such as corporate logos or mechanical devices, can evolve in a similar manner and create interesting offspring.

The human eye and its connections to the pleasure centers in the brain create the territory explored in the image domain. The shared design of the eye of the human species produces the potential for developing images that have the power to communicate to members of the species. What is an exciting form in one person’s eyes is therefore at least interesting or distinctive in the eyes of others.

We have arrived at an advanced point in the argument -- a frontier called semiotics in the out-of-the-way territory called rhetoric in the tradition-shrouded country of philosophy.

Architectural critics have made pilgrimages to ashrams in this semiotics domain -- a theory of the function and language of symbols and sign. They have come away with assessments of the quality and significance of images, which are, for the most part, impossible to verify empirically and therefore cannot be incorporated into the ecological design that looks forward to the establishment of sustainable communities. One of the newer leaders, when writing about how to conduct fieldwork, notes that the semiotics world has been invaded by forces which demand that the new signs and images be determined by categories previously set up for the computer (Manning 1987). In particular, they need to be digitized to become permanently useful.

Since a community of any size will have a name, a map, and a built environment, people are forced to assign it a composite image, a distillate of all impressions related to it. People can ascribe attributes and properties to it, even if they have never visited there. People do the same for complex organizations. Both accumulate a kind of persona that is recognized, even in distant places.
This dissection of an image is like the peeling of an onion. After several layers have been removed, it is apparent that more layers lie inside.

However, the simile stops there, because the respective levels in an onion are more homogeneous than those of an image.
Chapter Six  Section Ten

Scientists and Artists Originate Most Images

Kenneth Boulding, in an influential small book called The Image (1969), aggregated our publicly held, but personally comprehended, knowledge into an all-embracing "IMAGE."

At any given time it would prescribe how the world around us was constituted. It contained expectations about the future as well as convictions about the past. His IMAGE was a patterned mosaic of things people "knew" and other things they firmly believed, but which were based upon much less firm evidence. In those days he was not forced to consider the role played by the files of a personal computer in the makeup of the IMAGE, but experience suggests that these additions to memory conform to his insights.

A host of small, unitary images make up Boulding's totality. These small images have inbuilt properties for linking up with each other -- percepts manipulated by our imaginations. They continue to accrete to the larger-than-life view of the IMAGE, which is still growing and rapidly evolving, since it actually comprises a representation of civilization.

The small images, therefore, resemble species participating in a community. They, too, have origins, experience periods of population expansion, diffuse to new locales, reach a peak in prevalence, and eventually show a decline, sometimes to extinction.

Images require full attention for a brief period, and creative effort is needed to persuade a community to adopt them.

They exist first as components of personal knowledge (Polanyi 1958), but once they have been tied to phenomena that have been mutually experienced, these images percolate into the records used to manage artifacts and living species. There they become a countable and durable component of the community's Knowledge resource (see Figure 6-3).
As recently as the mid-nineteenth century many images in industries such as wooden shipbuilding and harness making were associated with specialized crafts and were not recorded. When those modes of production were rendered obsolete by more advanced mechanical technologies, their images died with the unemployed crafts practitioners. They can be retrieved only through careful historical research that reviews diaries, letters, sketches, and other personal records of that time.

When a technology died in the late twentieth century, its records lived after it for an indefinite period. Whenever an image has been labeled with a term in the language, or a catalog number, it can be rediscovered rather quickly with the aid of alphanumeric indexes. The current situation for purely visual patterns is more complicated and expensive, and therefore not so promising. Thus cinematic content and uncataloged art are examples of images that cannot yet be found with search engines.

Retrieval of purely visual images from the inventories is still in a primitive state, and the archives are fragmentary. Therefore much creative work in the arts is effectively lost. Those images also have high early mortality.

However, the survivors in the international community seem to be accumulating at least at the rate of 1 to 2 percent per year. (Growth in the repertory of indexed items compiled in information retrieval systems servers as one indicator of the growth of those kinds of knowledge.)

Death for images with names is unlikely to occur for a while, because published records are widely diffused and digitally recorded. A life for an image as a "ghostly metaphor," unconnected to real, observable things, may continue indefinitely.

The most likely cause of decease for indexed images henceforth is apt to be the same as that for the human race itself -- global catastrophe.
Chapter Six  Section Eleven

How Images Are Created

The source of growth of image species, it has been argued, lies in the incremental progress of science and art. Organizations exhibit superior products and services that can enhance their capacities or status. Similarly, scientists and artists gain prestige when the images they create become recognized, and even more from authorship in publications and showings introducing them.

Each scientific investigator and artist gropes in the shadowy territory between the known and the unknown, the recognizable and the strange, using instruments and intuitive methods more powerful than those available to predecessors, sharpening and polishing older images when invention fails. A scientist who believes he has succeeded in identifying abstract phenomena outside direct human perception, and persuades others that his interpretations of the readings of the instruments are truly new, feels he is adding to the stock of useful knowledge.

He wins only when colleagues are convinced through corroboratory observations and experiments of their own that he must be right (Figure 6-4). Scientists, too, are cultural entrepreneurs.
Figure VI-4. Personal Effort and Private Investment

These life histories of images show costs in the form of attention given to them. The frequency of use of an image represents a measure of the attention assigned to it. The top life cycle exemplifies an image drawn from Nature which could have originated from a scientist making a claim to a discovery. The second depicts the artist in his role as a cultural entrepreneur deriving an image from a void.

People’s judgements are fickle when it comes to deciding what is worth keeping.
An artist probes the environment and his own psyche for significant qualitative differences; he conducts a search for a possible niche in the population of known images.

For example, if his expertise is in music, he attempts to synthesize a style that can be distinguished from its predecessors, and one that promises to capture a significant number of appreciators for his work. The efforts of such artists have pushed far beyond the capabilities of the instruments and systems of notation that support their respective fields.

Software Contributes to Dissemination

In the 1980s many people became aware of the existence of a medium for knowledge known as software.

What working drawings and operating manuals are to the construction of buildings and mechanical equipment, software is to electronic devices. With the growing flow of technological developments in the 1990s, the major share of the effort needed to create something new for the community swung from infrastructure hardware to software. The change in emphasis was dramatic.

Around 1980 the cost of intellectual effort attributed to software in the purchase of computing, telecommunications, and control systems was only about 10 percent, but by 1990 it approximated half the investment, and by 2000 it was about 80 percent. A definition of software must be translated into ecological terms and concepts already introduced.

"Fragments of artificial intelligence" is not a bad description of software, although multitask replacement of human intelligence is still not at a high level.

The performance has very often been disappointing. A limited purpose program, however, seems feasible for the near term.
One can imagine a "house-sitter" microcomputer, for example, that can be induced to:

- control energy consumption
- alert owners to penetration of moisture within the structure
- frustrate human and animal intruders
- detect smoke
- turn lights on and off when an occupant moves about
- prevent high levels of indoor air pollution
- water the plants
- answer the telephone
- monitor the infants
- let in the dog

A set of program modules can now be bought and adapted to a specific household. Then a small "intranet" could be installed with the aid of a consultant, to fit the lifestyle of the adult occupants.

The "intelligent building" evolution takes off in this direction, managing with a restricted set of about one thousand images and an operating manual for documentation and consultation in times of trouble. The residents of such buildings, who might well be "telecommuters," are then able to concentrate their attention upon organizational transactions and creative activities, which are felt to be far more rewarding to themselves and the community.

Contributors to Droege's Intelligent Environments (1997) take the concepts one or two steps farther in several directions.

Complete operating programs for managing images for manufacture, traffic control, health services, and other community activities are new kinds of inventions. They may be regarded as "brain children" that spring into action in cyberspace. These are the modern-day automata which were positioned in the community ecostructure in Figure 2-2.

Robots transacting in factories and the physical community constitute a very small share of the total and the proportion seems likely to remain the case. Cyberspace is a medium in which terms for images can be digitized quickly and with far greater precision than in any other.
Software instructions have been "image-sparse" and "operator-rich." Its numbers and symbols can refer, as pronouns do, to almost any of the many millions of images (nouns) in the common repertory. Software at the moment presents verbs -- elaborate assemblies of them. Software therefore complements the long lists of images compiled by scientists, the symbols and metaphors wielded by writers and artists, and the entries in databanks.

Software is the category of knowledge that now controls much of the urban system. It is an umbrella term for a population of programs used for manipulating images at ever higher speeds with an exceedingly low rate of internal error.

A long-term trend expected to take hold is the matching of life cycles. Software will become more long-lived, but will not exceed the life cycles of the things to which it is commonly tied. In an era in which the manufacturer of an automobile is allowed only a one percent failure rate, or less when life-threatening, before facing lawsuits in the civil courts, all aspects of design must be precise.

Software gives consumers an ability to follow the life cycles of each component of an automobile so as to discover the offending elements. Redesigning the components makes the vehicle an increasingly close approximation of the "Deacon's One-Hoss Shay" (see Box 3-1).

The government of Germany announced that it would soon require manufacturing firms to take back broken-down artifacts to reprocess and reuse, so that recycling would also be internalized as part of the production program (Callenbach et al. 1993). Since then thousands of firms have actively cooperated with the directive. The "green" perspective for conservation is further reinforced by the increasing availability of software for maintaining detailed accounts of inputs and transactions of the artifact as well as the firm.

Quite simple conclusions can be derived from this description of digitizing images. The fact that the city is able to conserve much more knowledge than any other kind of locale makes the modern urban ecosystem a strong force
that accelerates evolution, not only for buildings and machines, which has always been obvious, but also for the rise and fall of living species.

A city can intervene with regulations of the flow of transactions. To put it still more persuasively, the leap to digital image manipulation reduces service costs significantly as modern cities evolve. Thus it should be the aim of any society that is poorly endowed with natural resources to acquire resource-conserving knowledge. Expediting the acquisition of that knowledge would require cities to develop as quick-acting open systems.
## Index

### A

animal: 234, 241, 258, 261, 262, 273  
apprenticeship: 238  
architecture: 236  
artists: 253, 254, 266, 270, 272, 274

### B

beauty: 261

### C

channels: 234, 241, 253, 256  
Chinese-American: 244  
Christian: 244  
color: 241, 254, 261, 265  
corporate: 266  
crafts: 238, 269

### D

dragons: 253

### E

engineering: 236

### F

familiar: 239, 242, 243, 259, 262  
fauna: 238

### G

gender: 261  
generative: 255  
genes: 235, 265  
Germany: 274  
graphic: 233, 240  
gryphons: 253

### H

horticulture: 236  
house: 258, 262

### I

iconic: 233  
ideals: 258  
indicators: 256, 258  
Islamic: 244

### J

Java: 259

### K


### M

map: 234, 236, 261, 266  
memory: 233, 240, 241, 264, 268  
metaphor: 243, 253, 254, 255, 269  
Metasystem: 252  
middle class: 244  
models: 253, 262

### O

ostracism: 259

### P

people: 240, 244, 250, 253, 254, 256, 259, 261, 262, 266, 268, 272  
photographic: 233, 236, 246  
photographs: 240, 252  
power: 233, 236, 258, 259, 266
recognize: 234, 236, 240, 244, 264
regrouping: 256
Renaissance: 253
renaming: 256
reordering: 256

scientists: 234, 240, 242, 252, 264, 270, 274
semiotics: 266
Seoul: 259
size: 235, 252, 261, 266
social: 233, 240, 250, 256, 261
space: 237, 256, 259, 261
spatial: 265
stability: 261
status: 258, 270
strength: 258, 261

suburban: 244, 258
supermarket: 249

termed: 233

unicorns: 253

vehicles: 262

Yogyakarta: 259
References


