Seeing It Different Ways

What we see is almost entirely governed by what we have learned to see before.

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No two people see anything the same way.

In a figurative sense most people would agree with that statement. It is a metaphor expressing a truism. What is seldom recognized is that this statement is also literally true. People do not see any thing the same way. This paper explores the meaning of this statement and its implications on problem solving and the future of Industrial Design.

Early psychologists saw vision in terms of a camera. Light rays come from an object, pass through a lens and an image is formed on the back of the eye, upside down, just as it is in a camera. Many, perhaps most, people think our eyes work something like this. They view the eyes as a sensory organ that merely passes an image of an unquestioned object on to the brain — a passive receptor and nothing more.

A closer examination of how the eye is constructed reveals a more complex situation. Visual acuity is the greatest in the center part of the retina called the fovea which subtends an arc of about 1 ½°. The fovea is made up entirely of cones which subtend an arc of ⅓° to ½° each. Right away we see a problem. When we look around, we certainly see far more than this small angle, in fact we see more than 45° all at once.

Our eyes have at least 6 degrees of freedom. They can move in and out, sideways, up and down, and rotate horizontally and vertically as well as around their own axis. Control theory tells us that such a system must have error if it is to function. (An air conditioner set to turn on at 80° and off at 80.1° would destroy itself turning on and off constantly.) So we are not surprised to learn there are small rotary motions called involuntary eye motions which look like a tremor. Also a drift occurs of about 2' to 3' per second. When this error reaches about 10' of arc the eye corrects itself with a sudden motion called a saccade. Thus, even if we try to fixate on one small thing, the retinal image is constantly shifting with respect to the retina. Yet, when we look we see a stable world. Things don't jump around. They are stable despite the fact that our eyes and entire head are constantly moving.

A famous experiment done at McGill University in 1962 showed us that if it were possible to fix the image on the retina (achieved with a mirror system attached to the eye itself), the perceived image disintegrates and disappears, only to reappear in fragments. Thus, not only is our visual system dynamic, it doesn't work if it is held static!

If we are only accurately seeing 1 ½°, and even that is in motion, what is it that we are experiencing as vision? Erich Neisser, in his book *Cognitive Psychology,* states that our visual experience is always a construction based only in part on currently arriving information. What raw material or information makes up the rest? "The only plausible possibility is that it consists of traces of prior processes of construction," and our memory is the same sort of construction.

A new born baby only senses light. This is an innate or reflexive reaction. He must use his sensory mechanism if perception is to develop. After this the brain becomes capable of separating one patch of light from another. At the next stage the patch becomes a vague figure. Finally, after trial and error and differential reinforcement, the brain develops the power to select patterns, forms, etc. Thus the cortex does not receive just information. The sensory contents of previous experience have built up associational contexts against which future sensory content is judged and coded. What we see is almost entirely governed by what we have learned to see before.

If no two people have had the same experience, follows that no two people perceive the same thing given the same visual field. Likewise, the

degree to which these perceptions agree depends on the similarity of their prior experience.

These shared experiences range from those shared by whole cultures to very personal ones shared by few, such as walking on the moon. Personal events such as experiences shared with an individual's family, siblings, mate and offspring are hard to generalize about. Larger scale experience generators include shared interests and hobbies, travel experiences, educational background and professional training. Large scale shared experiences include one's culture, language, philosophical heritage, environment, technological milieu, race, sex, and of course, biological species. Of these I am particularly interested in shared professional perceptions, but feel it is instructive to examine the larger sets first. This discussion will be necessarily brief, but I will cite source books which are good "eye openers."

A linguist named Benjamin Whorf, who studied North American Indians, concluded, "Reality can be viewed in an infinite number of ways and a language constitutes one particular way to look at a world." A language perpetrates the view of the world held by its speakers because it forces concept formation into a particular framework, dictated by labels to the learners. The users of any language are unaware of the inconsistency of many of its labels. For example, English nouns describe objects, verbs describe actions. Yet we call a fist an object, despite the fact that it disappears when we open our hand. Fist should be a verb. Oriental languages often have the same word for objects and events. Consequently Asians have little trouble seeing the world as a collection of processes or events. (See *The Way of Zen* by Alan Watts)

Philosophy and religion provide a structural framework for perception, thinking and language. Grossly oversimplified, there are three principal philosophic views. In the West, we have the Idealist/Platonic belief (there is nothing real outside of ourselves, our mind is everything) and the Realist/Aristotelian belief (there is order to everything irrespective of ourselves, the purest formulation of which is mathematical). In the East, the only reality is the instant, there is no separation between you and everything else; everyting is Tao. Which belief a person holds profoundly affects what he sees. (A fascinating book which traces much of this terrain is Pursig's *Zen and the Art of Motorcycle Maintenance).*

Fritjof Capra, in his remarkable book *The Tao of Physics*, traces the cyclic history of Western science from the ancient Greeks to today's nuclear scientists. This cycle began with an examination of the "physis" or essential nature of all things. Heraclitus believed in a world of eternal change where anything static was believed to be a deception. Slowly the notion of a divine principle overseeing the world developed. Parimenides saw change as the illusion, giving rise to the idea of indestructable matter. Reconciliation of these two points of view created the split of matter and spirit which was systematized by Aristotle and worked nicely into Christian thought. Change in this world view didn't come until the Renaissance when men such as Galileo began investigating the matter side of this duality. When he turned his telescope on Jupiter he was the first person to see objects revolving about something other than earth and, therefore, man.

Newton saw the solar system as a giant clock propelled by gravity. Developments of the late Nineteenth Century required revision of Newton's Mechanistic View. Einstein saw that energy and matter must be interchangeable, and that every thing is relative to the speed of light and that it is impossible to separate the observer from the observed (the Heisenburg uncertainty principle). Thus Capra's book demonstrates how modern science has evolved to a world view similar to Eastern mystics, returning us to the perception of

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Heraclitus 2500 years ago.

Marshall McLuhan's views provide an interesting explanation for these events. He believed the perceptual differences revealed by these beliefs could be explained by examining the technological (media) changes which were occuring at the same time. In his view (*Understanding Media*), technologies create certain relationships between the various senses, such as sight, smell, hearing and touch, and that is the real message of the media, not the content. This idea led to his statement, "The medium is the message." We tend to see things in terms of the latest media — so it is no surprise that psychologists 100 years ago saw the eye as a camera, or that Newton viewed the world as a clock.'

McLuhan explains the major philosophic and scientific shifts already discussed in terms of changes in technology. Socrates belonged to the oral/acoustical tradition of Homer. Verbal societies are all involving, tactile and all-at-once. Plato lived when writing was being converted to a phonetic alphabet, and Aristotle lived after this transition had been accomplished. Writing is linear, and characters are written one at a time. Writing allows specialization to occur because references are possible. The ability to make references established Aristotle's view that there is a real world out there separate from us. The difference between the Platonic (spiritualist) and Aristotelian (logical, deductive) world view is the effect of a phonetic alphabet. Eastern philosophies never encountered this difficulty because they use pictograms.

The Renaissance is explained by the invention of moveable type. The availability of inexpensive books allowed individual points of view to develop. Now entire societies could experience the effect of this linear, one at a time, detached, segmented media at their own leisure. Print created jobs, specializations and abstract money.

Beacuse we are literate we say "Let's go see what we can hear," while the preliterate Eskimo would say "Let's go hear what we can see." (See *Eskimo Realities* by Edmund Carpenter) Tools constitute new ways of perceiving things — they are extensions of our bodies. Man picked up a stone to throw it and so extended his fist. But in order to throw it he had to first stand up. The rock invented man.

Finally, of course, McLuhan tells us that we are now living in the biggest media change of the last 400 years — the shift to electronics. Electronic media are all-at-once and involving just like the oral/acoustical society of Homer. Thus it isn't coincidental that modern physics is turning to modes of thought similar to preliterate mysticism. Mechanical, linear thought no longer solves our problems. Electronic pattern recognition and systems thinking are required to cope with the complexity of our present situation.

This overview of language, philosophy, science and technology provides a framework for examining more immediate concerns. Within our own culture, professional training creates a most notable specialized perception. A doctor sees tumors on the pancreas in an X-ray where you and I see only grey smudges below fuzzy white bands that somehow remind us of ribs. I've been with sailors who see buoys in rough weather a mile before I can. Anthropologist Edward Hall (*The Silent Language, The Hidden Dimension*) describes picking up arrowheads that his entire class of students has overlooked. Mark Twain said the river is beautiful to everyone except the river boat captain who sees nothing but potential danger in the snags and sandbars. I think of this when I tell my students about sink marks, weld lines, flow lines, cam-marks, knockout pins and sprues. Once beautiful plastic parts become an ugly mass of imperfections. As another example, consider how carrying a camera changes how you look at things and tends to exclude you from the experience.

Each of design professions has a different way of looking at problems. Having been trained in two (engineering and architecture), raised in two others (naval architecture and art), and lived a fifth (industrial design), it is obvious to me that each profession "solves" problems with the tools with which it is familiar. Once, in an architecture studio, I was given the problem of humanizing the terrible trip from one side of an elevated highway to the other. It struck me that each profession would solve the same "problem" differently: an engineer would provide a transportation system, a designer would install good street furniture and a graphic system, and a landscape architect would plant trees. But since this was an architecture class, a building was expected.

Our profession is concerned with reconciling aesthetics, technology and human factors. However, a different solution results depending on whether a designer views himself as an artist.

problem solver, or designer manager.

What we refer to as a designer's style is largely determined by these perceptual priorities. A second determinant of style is the type of tools (or media or skills) chosen to execute the work. The stylist yields hard edge cars with felt-tip markers in the 1970's and round ones with airbrushes in the 1950's. Also, communication media have a profound effect on design because they control how we see ourselves. The architectural "shingle style" of 100 years ago may look wild in photographs today, but it looked terrific in the etchings of period architectural journals. When black and white photos did come along, the clean, crisp and white international style (modern design) looked great. With the lush color photography found in magazines today, is it any wonder that one of the post modernist styles is referred to as "prismacolor" architecture?

Questioning the effect of tools on what we design is particularly important as we enter the revolutionary computer age. This tool will first be used to replace old skills, but it too will quickly alter our perceptions as we discover its real potential. After just one semester of computers at Syracuse, students are already looking at products from new perspectives; for example, a microscope as seen just before you look in the eyepiece. The new views are child's play for the computer. Besides allowing us to view products from views other than the standard three-quarter view, they will allow us to add a much more complex mix of criteria to our solutions. Much will be gained and, just as surely, something will be lost.

With these rapid changes occurring it is a good time to be thinking about what it is that we do exactly do, and a very poor time to fix present practices at our design schools. This brings accreditation into question. One of industrial design's strengths lies precisely in the fact that it has never been well defined. As the tensegrity sculptor Kenneth Snelson said recently, "Hardening of the categories leads to Art failure."

Computers are sure to eliminate the need for many forms of drawing, especially for communication. On the other hand perception is the one thing computer experts are most pessimistic about computers ever mastering. Just how do we tell trees from people? We will have to give some thought to what goes and what stays. I suspect drawing will always be the best training ground for a designer's perception.

This discussion has indicated that perceptual differences lead to problems being solved in different ways. Perhaps a more pertinent question than to whom do we give problems is who decides what the problem is in the first place? Unfortunately, most of our problems are given to us by corporations whose vision is shown to be increasingly short-sighted and self serving. Even organizations whose motives are more altruistic do not necessarily have a clear view of what is needed. In India UNESCO recently installed central plumbing in an Indian village. Soon the people were demanding that it be removed. The village's whole social structure was being destroyed because it was based on the communal well.

But India understands that Shiva is the destroyer as well as the creator. In the West we have yet to learn this lesson, and consequently we are still surprised when the solution to one problem creates another. As our world becomes increasingly interrelated, problems also become intertwined. Modern science, our electronic media and our increasing contact with other cultures are all helping to create such an awareness. Our own space program brought us one step closer with the image of our Earth as a fragile spacecraft. (The medium is the message again.) True problem solving can only benefit from such a holistic approach.

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