The Union of Intuitive And Logical Design

There are two ways to design: intuitively and logical. Intuitive designers muster all their training, experience, intelligence and talent to produce a holistic vision of what they imagine an ideal answer to a problem should be. Great intuitive designers—DaVinci, Mies, Eames, Nizzoli, Bill, Rams—produce many exciting visions that they elegantly articulate. Ordinary intuitive designers produce trite visions that they present in the current cliche.

Logical design is the opposite of intuitive design. Although logical design includes scores of methods from value analysis to flow charting, the first widely acclaimed method was offered by Christopher Alexander in his book, Notes on the Synthesis of Form (1964). His method begins with analysis that turns reality into some form of information. The process starts with the meticulous development of a list of requirements that, if satisfied, would render a satisfactory solution. Synthesis begins with a computer procedure that clusters these requirements into related sets where a solution to one requirement helps to solve the others. The final product emerges from a prescribed process, guided by the model itself, which forces the designer to systematically consider all the requirements.

Alexander’s brilliant conception externalized how intuitive design should really work. It turned the black box of intuition into a glass box process of logical design where every operation can be observed, checked, corrected and so on.

Experience has shown that the systematic procedures of logical design, although tedious to the undisciplined, can provoke more visions than does intuitive design. The reason is that logical design short-circuits routine design procedures and the personal biases that predetermine solutions (what we call the grooving of the mind). Curiously, the more famous an intuitive designer becomes, the more likely it is that this grooving will force all problems, whatever they are, into a limited framework, a Procrustean bed of prior successes that makes output highly predictable. What begins as creative soon becomes limited to a few dominant but arbitrary and maybe unimportant requirements. This trait is what made Mies, Mies. People who went to Mies knew what the results would be before the work was commissioned. Such greats have an overwhelming influence on lesser designers, shaping whole periods of style.

Logical Design at IIT

In 1965, Charles Owen, who was then teaching human factors to product design students at the Institute of Design at IIT, adapted Christopher Alexander’s logical process to a series of five test projects. The following year, to demonstrate the power of this process, a group of 12 students working on an Armoq project produced an entire hydropower environment. As Owen’s teaching programs matured, freshly graduated designers from IIT (assisted by Owen as a consultant) applied some of these methods to Unimark’s clients. Two are of particular interest.

The first project was the computer design of a service station for Standard Oil of Indiana. Thirty-six operating requirements were developed and interacted to design an efficient station in which motorists drove their cars directly to the services they wanted.

The second project was to layout full-line department stores for J.C. Penney Co., Inc. A big store has 269 merchandise categories ranging from major appliances to women’s dresses. To place each category adjacent to its most logical neighbors requires dealing with millions of possible combinations, a mind-boggling task. Owen wrote a program that logically identified merchandise categories by scoring 52 questions. From this data, similar types of merchandise could be clustered into trial store layouts.

More recently, Owen has focused on specific operations with the design processes. Now, after two decades, computer-supported design
Research is coalescing into the responsibility of the newly established Design Processes Laboratory at the Institute of Design. The laboratory provides support for the undergraduate program, but its main role is to further research in design methods at the graduate level.

While 21 Master's theses on design processes, written under Owen's guidance, can be broadly classified into analysis, synthesis and evaluation, most detailed investigations into specific operations within these areas were geared to achieving a deeper understanding of the design process. Analysis was dissected into three subtopics: problem definition, information search methods and analytic techniques.

The following theses on file at the Institute of Design address one or more of the issues covered in this article. Copies are available for a nominal fee. For ordering information, contact: Dale Fahnstrom, director, The Institute of Design, Illinois Institute of Technology, 3360 S. State St., Chicago, IL 60616.

- "Communications Interaction Analysis Within the Office Environment;" Warren Rudolph Koepf; 1968.

Another group of theses dealt with synthesis and included two major subtopics: solution generation and modeling.


Two theses were written on evaluation.


As this diagram illustrates, the 36 problem requirements in designing a service station for Standard Oil (Indiana) are developed into sets which result in a hierarchical structure that represents the station's services. This model guides the design process.

The computer-designed service station that emerged for Standard Oil (Indiana) offers easy access to the fuel dispensing facilities. The motorist may then choose among a car wash, parking for amenities, major or minor service, underhood service, or express exit.
Finally, a group of theses dealt with many peripheral or general, theoretical topics. These include:

- "Adaptivity In Design;" Hiroaki Kozu; 1980.

**Two Theses Abstracted**

Two theses are abstracted here as examples: "An Evaluation Model for Testing the Effectiveness of Systems and Their Components," by Robert F. Holloway, is an attempt to develop a method for evaluating how people make decisions as they make self-directed trips through complex facilities such as transit stations, hospitals and airline terminals.

Holloway developed a four-phase method. First, the system's purpose is defined; the users' types and needs are identified; and the relevant features are classified. Second, the operation of similar facilities is observed and the users' behavior is noted. Next, a series of analytical operations occurs to determine user paths and the significance of relevant features. Finally, the process enables the analyst to discover latent conflicting interactions between users and features that cause operational problems. From this work, a more effective solution to the new facility can be produced.

The second example is a thesis for manipulating three-dimensional forms, "A Model for Computer-Aided Form Manipulation," by David J. Harman. Harman's method allows designers to explore form on an interactive terminal and permits immediate subjective response to forms as they evolve.

The program begins with a cube with section lines that can be directly tapered, twisted, chamfered, stretched, compressed and so on. The object can be rotated so that any view can be presented on the screen. Should the viewer wish to experience the form in solid materials, the computer can generate templates from which an accurate model can be easily built.

**The Performance- Appearance Scale**

The purpose for discussing both intuitive and logical design is to point out that both are potent, but in a complementary way. To explain this symbiotic relationship, a scale can be drawn with product performance at one end and product appearance at the other. At the performance end are products such as paper clips, crowbars, jet fighters and punch presses. At the appearance end are such products as paintings, brooches, trophies and neckties. The center of the scale holds refrigerators, automobiles, sofas and dinnerware, products with both performance and appearance values.

Logical design is potent at the performance end, especially on complex problems. But it loses power as it approaches appearance: It can't manage subjective requirements as well as intuitive design can. Intuitive design is the opposite. It has the power to manage elegance, style, humor, drama, excitement, symbolism and more. In the middle, which is where most industrial design occurs, the two should combine, the one stimulating and modulating the other to produce a better design. A case in point is an attempt we made to design a simple appearance product using a logical procedure.

**Cup Design Done Logically**

You can tell whether a product is performance or appearance design by counting the variations. Crowbars come in only two sizes and with no pattern or color choices. But watches, lamps, chairs and cups come in hundreds of patterns, shapes, prices and colors, and, at this moment, hundreds of designers are scheming up more versions. As an experiment, we proposed to end all this effort by using logical design to make the perfect cup.

After identifying the cup's requirements (the ability to stack, lift, drink and clean easily, a slow heat loss and resistance to slosh, among
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The design of a Heat-Sink Cup to solve the heat loss problem all cups share is profiled here. The chart shows the curve of heat loss exhibited by the Heat-Sink Cup in contrast to the curves exhibited by other cup designs. The diagram shows a cross section of the Heat-Sink Cup.

A few talented individuals have been able to achieve this fusion of processes for specific subjects: Christopher Alexander with architectural work; Ed Hall with sociological applications; and William Whyte with urban plazas and parks. But no design firms appear to have successfully met this challenge.

One of the many reasons this balance has yet to be struck by design firms is the satisfaction with which the older intuitive designers view their approach. Another reason is that most design education is art based. When the design methods concept was first introduced at the Institute of Design, many faculty members responded furiously that "This isn't how the Bauhaus did it." And yet a more basic reason logical design doesn't more frequently complement intuitive design may lie in a mental schism between intuitive and logical designers. This schism doesn't necessarily mean that intuitive designers are illogical and vice versa. Rather, it means that each is programmed, by nature, to take a certain approach. This reason reflects the recent psychological findings that identify right brain people as holistic, visual and intuitive and left brain people as logical, numerical, analytical and sequential.

All reasons aside, the logical approach tempered by the intuitive may have to become the modus operandi of important design firms. They will need the methodological systems to solve complex problems, the intuitive skills to supply vision and the wisdom to balance the two. Only with such a new order can design make the important contributions that are desperately needed today.

Although intuitive design has gotten us to where we are with all our mechanical comforts and pleasures, it is still relatively weak. It takes endless iterations to reline a product and produce these comforts. And, even then, most of our products are 65 percent good and 45 percent bad. It is this ten percent trade-off that keeps us avidly designing, making and buying products. For example, comfortable personal transportation exacts an enormous price in such ways as operating expense, maneuverability in traffic, and space taken. The way to increase the efficiency of products from 55 percent to 95 percent is to develop logical design and then combine it with intuitive design to produce new, more powerful design processes.