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Where Meanings Escape Functions

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Abstract

KLAUS KRIPPENDORFF and Reinhart Butter explain why, in our high-tech era, the traditional dictum "form follows function" is no longer valid. In its place, they propose that "form follows meaning, not function," and suggest that designers accept the challenges of this new awareness in design by creating products that can afford the multiplicity of meanings users develop for them in practice. The authors delineate four likely consequences for design management in an era in which meaning matters, including a call for empirical inquiries that would expand the scope of traditional market research.

Disciplines

Communication Technology and New Media

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By Klaus Krippendorff and Reinhart Butter

Industrial design has evolved during a long history of uneasy alliances: in 19th-century England with crafts, in the Bauhaus with industrial culture, during US styling with marketing, in the Ulm School of Design with methodology and technology, through the fame of elite designers with culture and the arts, and through the Italian Memphis group with popular culture and entertainment.

Throughout its checkered and fad-ridden history, except perhaps for its involvement with Memphis, industrial design has sought to legitimize its efforts largely in functional terms. In this respect design has stayed within the very rational consensus that supports a positivist science and technology. While functionalism in design has been declining, at least nominally, we shall argue that its remaining hegemony is now being overcome by a concern for meaning. With this semantic turn, industrial design is developing, perhaps for the first time in its history, a language, a theory, a methodology, and a conception of itself that is not derivative of other disciplines' interest in design.

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In this article, we will show what functionalism entails, suggest four major challenges to its role in design, offer a sketch of the semantic alternative, and explore some implications of this new turn for design management. Since the scope of this article is vast and space is limited, what we wish to say will have to be accomplished by a mere sketch.

Functionalism in Design

Functionalism can be said to provide a mechanism-based, psychologically satisfying but socially oppressive explanatory teleology. We offer a five-point account of its logic:

1. Functionalism is grounded in the construction of a world as a single, stable, coherent, and well-articulated system, whose very existence is taken as proof of its purposiveness.
2. It views all working parts as subordinate to a system's purpose, each contributing its share to the maintenance of the whole, its individual contribution being its unique function. We may speak of the function of the heart

within the human organism, the function of design within society, or the function of a computer in the writing of this article.

Functional explanations of living systems in biology and of social systems in sociology attest to the popularity of mechanistic conceptions. Such explanations, however, are most appropriate, and have in fact originated, in engineering.

3. Engineers do not merely explain what they observe, they also evaluate their structural interventions and therefore require measures of functionality, the degree to which desired functions are approximated by the performance of a designed part—efficiency, reliability, replacement costs, for example.
4. The nominal decline of functionalism in design has not affected designers' conviction that there are "natural forms" satisfying required functions, and that design seeks to find or develop these. The formula "form follows function" expresses the belief that a careful examination of the function an artifact needs to serve necessarily leads to its appropriate form. The coherence of form and function is often elevated to an aesthetic ideal.

We must note that functions do not exist outside a logic of the relations between subordinate parts and superordinate purposes. They arise in the language of functionalism, not from nature. Failing to recognize this simple difference can lead designers into all kinds of epistemological confusions. For example, for Aristotle, the human heart was the seat of emotions and intelligence. Today it is described as a pump that keeps blood circulating within the body. Obviously, functional explanations reflect an observer's interests and are completely irrelevant to how an organ does what it does. This holds true not only for natural phenomena, such as the much celebrated—among designers—functional form of an egg, but also for the forms of mechanical devices, all of which can afford many explanations without being in the least affected by them.

This is very different in social systems, which are constituted in the understanding their human participants have of them. This understanding surely includes explanations of what things do and how they work. The difference is crucial for the design of artifacts. Their undoubtedly mechanical interiors, whose workings are, as we said, not affected by how they are explained, must equally undoubtedly participate in various social systems. The *explanations* offered by their human users *make them into what they are for them*. Cups, cars, computers, and even continents are semantic, and hence social, categories not natural ones. The claim that functions are objective and unique effectively denies their socially constructed nature and upholds superordinate mechanisms—which says a lot about how little functionalists (scientists, designers, and users) are aware of their use of language.

5. Denying their own semantic involvement in functional explanations creates the ground—perhaps unconscious—on which industrial designers define themselves as unquestionable authorities on how others—the producers, distributors, and particularly the users of industrial products—do or ought to understand their designs. Witness the frequency of such assertions as "the real function of . . . is . . ."; "after all, I designed it for this purpose"; "they just don't understand." There are many variations on this theme, all claiming authority over others' understanding.

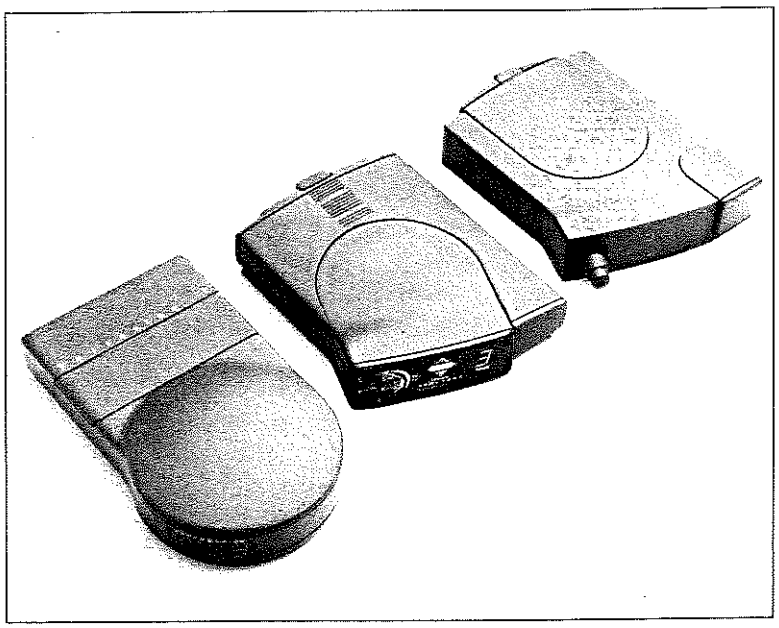
Challenges

While functional explanations have their place in mechanical engineering, industrial designers are now faced with numerous challenges to using them. Following are four:

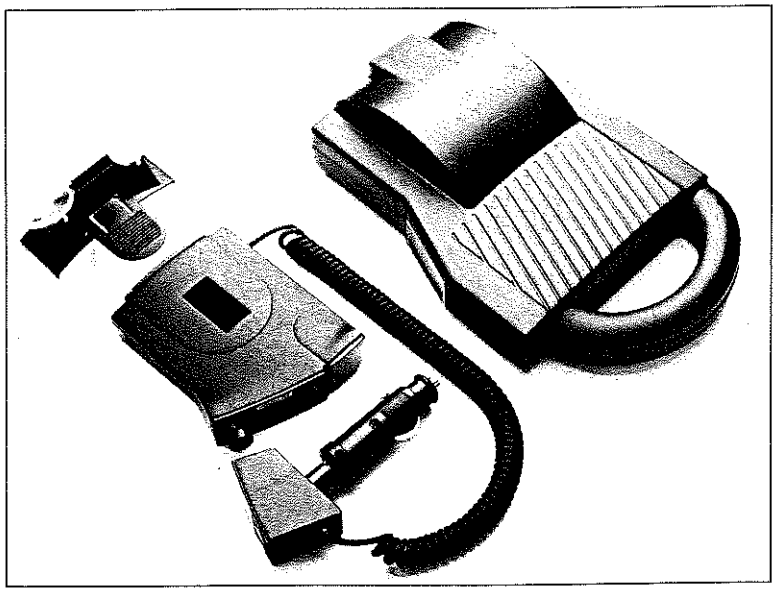
Technology. Largely a child of functional reasoning, technology is slowly undermining its own logic. New materials have become available—new plastics, new ceramics, and new media for the transmission of energy and information—that vastly increase the repertoire of forms possible, and significantly weaken the connections between form and function. Miniaturization has shrunk the size of many traditional products to a point where the determinants of form have either disappeared or shifted to a previously less important feature. Modern electronic equipment can be packed into virtually anything, boxes or sculptures. The forms of desk calculators, for example, are no longer dominated by their computational apparatus but by the requirements of their previously less prominent human interfaces—displays and controls. Data gloves have realized the latter function in the form of a wearable skin. Smart products do not even have a natural behavior, much less a necessary appearance; they can be designed to suit a user's fancy, and may soon go so far as to adapt themselves to changing intellectual climates.

Post-structural Critiques. Critiques of (structural-) functional explanations focus on the absence of human agency in these explanations. We have already observed above that functional explanations of human participation are constitutive of systems quite different from those into which explanations cannot enter. These critiques take the unwillingness to make such distinctions, coupled with the commitment to a rational consensus on what artifacts are (or ought to be) for everyone, as

proof of designers' entanglement in oppressive institutions. In contrast, the very act of contemplating this connection demonstrates an awareness of the linguistically constructed nature of our world, in which knowledgeable human agents are seen to participate creatively. We believe that design can easily embrace the new awareness emerging from these critiques, but this would mean a radical paradigm shift away from functional conceptions.



Early study models of the Valentine One radar detector by Valentine Research, Inc. illustrate that the inner workings of modern technologies hardly constrain a product's shape, or provide guidelines for a "functional" form.



The desire to express this radar detector's distinctive feature—both front and rear sensitivity—determined its design details and overall configuration, including the carrying case, which allows ready-to-use storage of all components, and proudly communicates that fact through its shape. Design by Design Central and Roche Harkins, Inc.

Ecological Perspectives. In functionalism, goals are largely conceived as states at which a problem is solved, particular functions are materialized, and attendant responsibilities have ceased to exist. Designers have fallen into this functionalist trap by their pursuit of end-products. However, artifacts never act in isolation. They form cooperatives and whole complexes, such as the system of industries, regulatory agencies, markets, and drivers, all supporting the car complex. Artifacts also never stay the same. One model supersedes another in a seemingly endless succession of improvements. Identified users do not act alone either, but have reference groups within which the use of artifacts is negotiated. There are numerous institutions that virtually feed on their practices. Thus, design concerns can no longer be limited to isolated products; they must acknowledge the context of larger ecologies of artifacts bound together by a network of meanings.

Decentralizing of Design. This is evident in the increasing awareness that ordinary people are indeed quite capable of surrounding themselves with artifacts of their own choosing and of creating their own meanings for them. Such processes are in fact processes of design, albeit in everyday life. They are supported, for example, by the availability of a greater variety of industrial products, by the manufacture of systems (as opposed to singular products) whose combinatorial possibilities are vast, by the possibility of "customized mass production," by the immense openness and inexhaustible reconfigurability of human-computer interfaces, and not least, by popular design education, and self-help and instructional literature. All can support rather different styles of interaction. This radical redistribution, if not democratization, of design responsibilities severely challenges the monopoly position of professional designers. Having learned to plan products to their last detail, designers now have to learn to share their efforts with "designers" who have good reasons to claim expertise in creating their own lives.

The New Awareness

Product semantics meets these challenges head-on. It treats human beings as able to make sense of their environments, able to give each other accounts of the reasons for their semantic involvement with artifacts, and able to unfold their understanding into their own practices of living with others through the artifacts they share. It recognizes that people do not respond to the "objective qualities" of things, but act on what they mean to them. Hence, for the design of industrial products

that must interact with and be of use not merely to their designers, *meaning is or should be design's most central concern.*

Meanings are not entities. They are neither objectively (without any human involvement) measurable, nor can they be designed into products or attached to their surfaces. This makes the design of artifacts that people can use fundamentally different and infinitely more challenging than the design of entirely mechanical and hence functional systems. Yet meanings are not entirely subjective either. They become manifest in the interactive practices that keep an artifact in motion and alive relative to its human user. We call these interactive practices an interface, and suggest that "product semantics seeks to understand users' understanding of their practices of interfacing with artifacts and provide strategies for designing products that can either afford or supportively intervene in that understanding."[1]

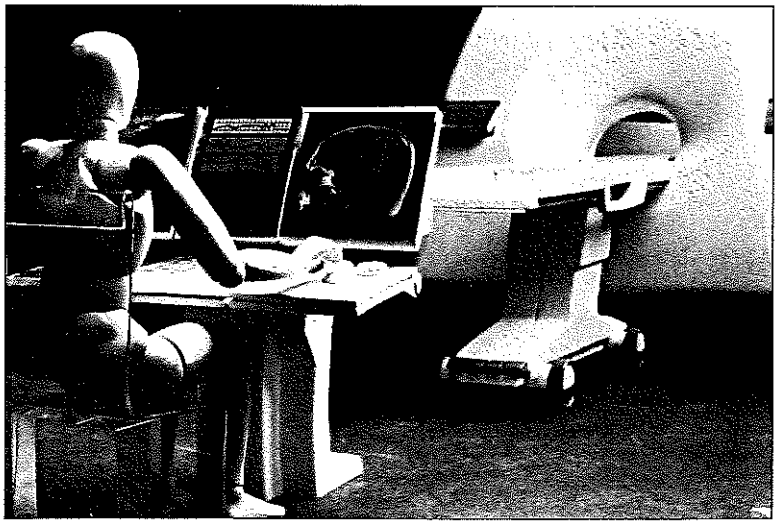
The following will show how this new awareness in design transcends and relativizes the above-mentioned five characteristics of functional theory:

1. The idea of a single "system," in the context of which artifacts are expected to take their places, we suggest, is a product of the rational consensus, and a myth. Systems are cognitive constructions by individuals and created in a language they use to talk among one another and about their own worlds. Quite naturally, lawyers, artists, plumbers, tour guides, therapists, and, of course, designers, all have good reasons to construct and live in different worlds, not without coordinating these in practice. There can exist as many cognitive systems as there are people involved. The mechanistic uni-verse of engineers is hardly common to all. Industrial designers are always confronted with *a multi-verse of distributed reality constructions, not one.*
2. It would follow, then, that artifacts rarely ever have unique functions. They must play different roles in different people's lives and often in different moments of one life. Hence, the aim of industrial design cannot be to symbolically express "the" function a product is to serve under the most restricted circumstances, in the mechanistic world of engineers for example, but to create interfaces capable of informing a diverse group of potential users of what can be done with them and how. *It is meaning, not function, that guides the use of artifacts.*

   Obviously, no product will ever reach its market if it has no meaning and does not motivate all those instrumentally involved in the production sequence: designers, corporate decision-makers, production engineers, salespeople, buyers, etc. Equally axiomatic is that a product will never be of use to anyone if it doesn't make sense to someone, and this may involve a potential user's reference group, experts and friends, and other competing or cooperating products in her or his environment. Interfaces must be understandable in different circumstances and in several people's worlds—ideally self-evident, compelling, where necessary self-instructing—or at least provide meaningful entry points for users to explore the opportunities they afford.
3. Efficiency, reliability, and replacement costs are important *functional criteria*, but secondary if not *irrelevant* where the use of artifacts is voluntary and knowledgeable, *where meaning matters.*

In the language of product semantics, meanings are said to arise when we see something in the context of its possible uses, when we place our sensations (of what designers may call form) into the context of the cognitive models we have constructed to cope with similar situations. Meanings inform us of what we could do and whether we can do what we are disposed to do. One important criterion for a good interface design is that it doesn't lead to failures we call "breakdowns," which occur when something does not afford what its user's cognitive model suggests it does. The consequences of breakdowns range from simple public embarrassments (not being able to operate the video recorder in front of an impatient audience) to injury.

1. Klaus Krippendorff, "Product Semantics: A Triangulation and Four Design Theories," in Seppo Vekeva, ed., *Product Semantics '89* (Helsinki: University of Applied Arts, 1990), pp. a1-a23.



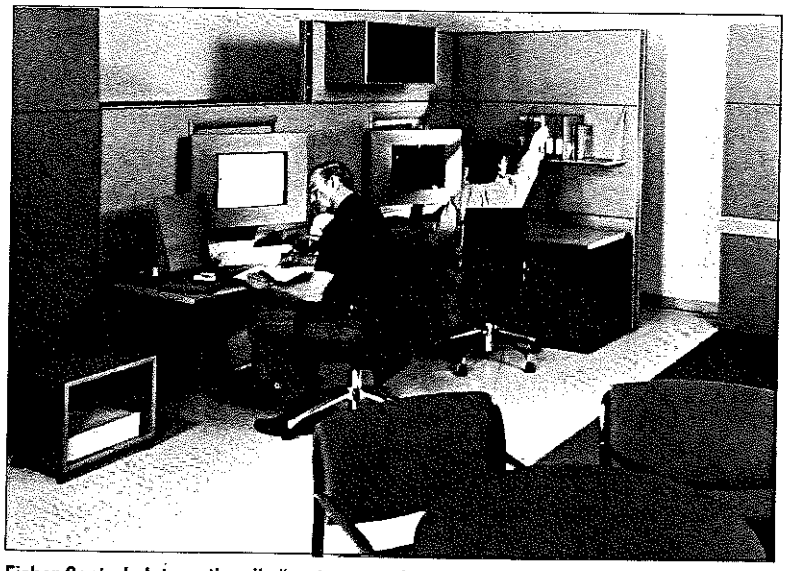
This study of a magnetic resonance imaging (MRI) system aims to humanize the experience for patients, nurses, technicians, and accompanying relatives. The sculpted shapes and soft color scheme of the magnet's frontal access area, as well as the system's bed support and control console, are meant to lower anxiety and maintain a sense of trust. Student designers: Bill Fenton, Mike Kopczewski, Kevin Vititoe, The Ohio State University.

The functional theory of design always puts the burden of mistakes on users, blaming them for all misunderstandings, and insisting that these be overcome by more training and instruction. The new awareness calls for acknowledging and respecting the wealth of cognitive models a population of users brings to the scene or is willing to construct. Under these circumstances, it is the designer's responsibility to avoid breakdowns. In practice, this means creating interfaces that ideally afford all cognitive models that a population of users considers appropriate when facing them, and discouraging users from trying those cognitive models that could lead them to harm themselves, the public, or whatever needs to be preserved.

The cognitive models that lend meaning to an artifact's use imply their own evaluative criteria. For example, a car may mean profit for the salesperson, social status for its owner, a risk for the insurance agent, a job for the repair shop, etc. Indeed some cars are not designed primarily for driving, relegating efficiency and reliability to subordinate criteria.

4. Unless we are concerned with mechanically transparent and typically uni-functional artifacts—cardboard boxes, hand tools, sports implements, and simple bicycles—which are less subject to the above-mentioned challenges, *forms generally escape functions*. This is well known for the socially expressive symbolism of jewelry, at the one extreme, and for the language-governed interactivity of interfacing with modern computers, at the other. How computers actually do their work—what hardware designers can tell their peers—is not only incomprehensible to most of us, but also irrelevant in practice. Interfaces may be justified, not in the language of their designers, but in terms of the interpersonal discourses through which users' conceptions are acquired, sustained, and shared. In other words, forms must be chosen to be understandable and talked about. In opposition to the worn-out formula, we suggest: *form follows meaning, not function.*
5. With this new awareness, designers can no longer rest their professional authority on privileging functionalist discourses. Adding cognitive functions, semiotic functions, social functions, and aesthetic functions to one's vocabulary does not overcome the fundamental flaw of the functionalist paradigm. Its implied structural determinism is simply incompatible with the notion that individuals develop and act on their own understanding, are competent in designing at least parts of their own environments in their own terms, and then become, in fact, designers in their own right.

The historical fact that professional designers have degrees and are paid by industry whereas ordinary people do not, and are not, does not disqualify their separate and mutually necessary contributions. We suggest that the authority of industrial designers lies in their ability to understand others' understanding, in their ability to negotiate the meanings artifacts have for clients and users, and in their ability to delegate an appreciable portion of design decisions to others, enabling them to realize themselves in whatever industry can manufacture. From the perspective of product semantics, *design is a cooperative and, hence, social venture.* In fact, *it cannot succeed otherwise.*



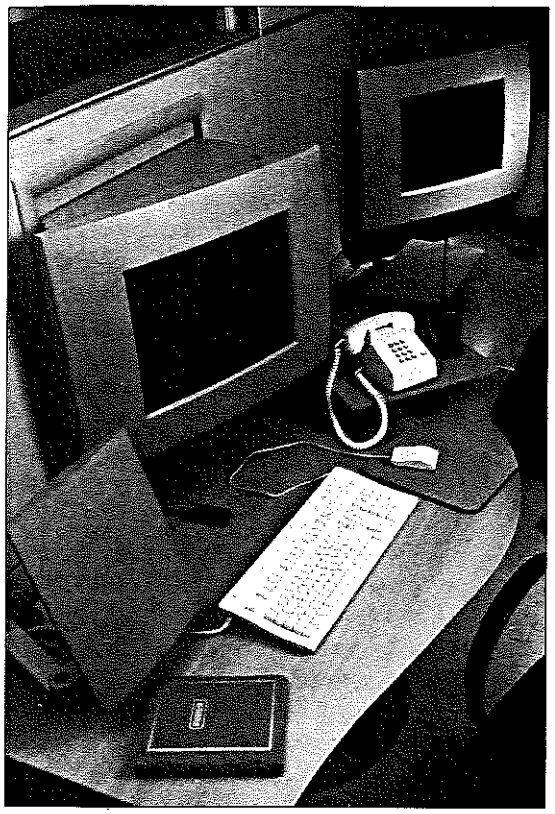
Fisher Controls International's "next-generation series" by Fitch represents an integrated design for process-control room environments, furniture, workstations, and computer interfaces that redefines the role and work of the operator through self-evident arrangements of familiar elements.

Consequences for Design Management

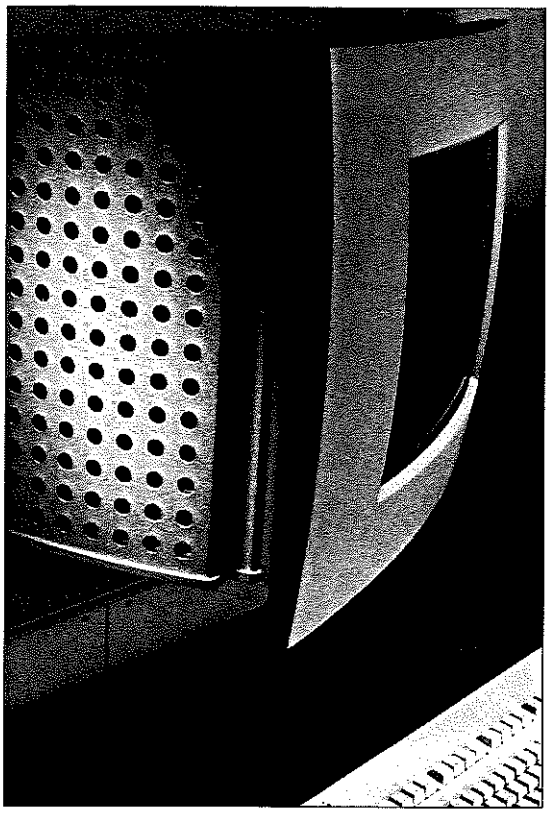
This newly gained awareness has profound implications for how design can be managed both in product design and development,[2] and in the formulation of larger corporate-environmental strategies. The following is a brief sketch of four likely areas of impact.

Design Discourse. The shift from functionalist discourse to one concerned with meanings has clarified what design is all about: *creative intervention into the social network of meaningful human interfaces with artifacts.* The language of product semantics is a start in this direction. It does not rule out engineering, artistic, economic, or anthropological

2. See Robert Blaich, "Philips Corporate Industrial Design: A Personal Account," *Design Issues*, Vol. 5, No. 2, 1989, pp. 1-8, for an instructive example.



"Distributed" rather than centralized control stations with intimate office character promote collaboration and communication among operating personnel, which is further enhanced by an intuitively understandable interface design.



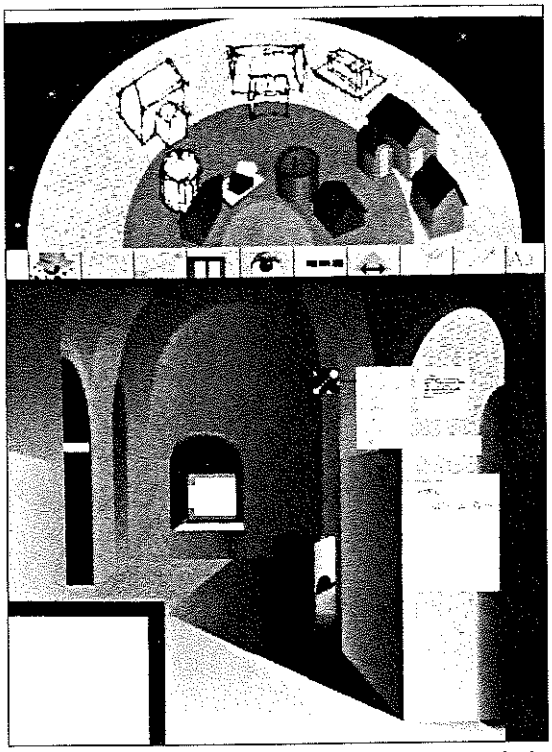
Semantic considerations guided much of the design and its details—the adjustable height and shapes of the desktops, the turning monitors with their bold perforation—producing the user-oriented yet distinctly industrial character of the system.

discourses concerning material culture, but delineates a domain of professional competence that other players do not have and have not claimed for themselves. We see this concern with meaning reflected in the design of interfaces in the broadest possible sense. To this end, we have delineated elsewhere four design theories, respectively focusing on the use, language, genesis, and ecology of artifacts.[3] We believe design managers will have to embrace this emerging discourse in order to clarify design objectives and to distribute creative tasks to those best qualified. We are convinced that this discourse can become as compelling as that of engineers and market researchers while addressing issues neither can handle.

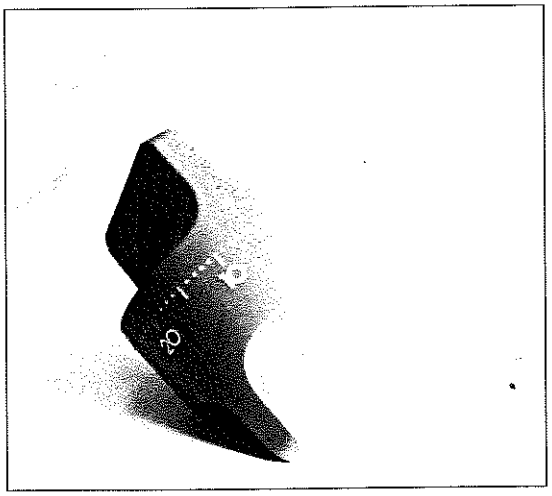
Information Needs. Functionalism in design directs research efforts largely in three directions: understanding the "real" functions of a projected product, knowing the production costs of available materials that could realize these functions, and understanding consumer preferences, especially aesthetic ones. In the new approach to design, functions appear as merely one, and an unnecessarily restricted, way of situating a product within a market. Research efforts need to be redirected to uncover the many ways potential users could understand a conceived product and interface with it in various situations. As new products always intervene in the fabric of enacted meanings, designers find little use for survey data on consumer preferences (which always presuppose full knowledge) or for information on who the typical or average user is.

Preparatory research needs not only to inquire into the distribution of cognitive models in a population of potential users and to investigate users' willingness to embrace newness, but also to address the socio-psychological costs associated with breakdowns. Within such parameters the opportunities of new products can be defined more clearly and their potential markets can be predicted. Traditional market research techniques have largely failed to provide adequate information on meanings. In this context, ethnographic methods,

3. Klaus Krippendorff, "On the Essential Context of Artifacts or On the Proposition That 'Design is Making Sense (of Things),'" *Design Issues*, Vol. 5, No. 2, 1989, pp. 9-39.



New metaphors for computer-screen organization, which allow users to recognize meaning and act "naturally," can greatly enhance the ease of operation of the screen-based interfaces of modern electronic equipment. This "spatial" design, developed by Fitch for Xerox, is part of a network-based document-processing system.



The semantics of simple products require as much attention as those of complex product systems. This kitchen timer by Jaeger, France, achieves self-explanation through the use of common clues and their interaction—twisting knobs for setting the time, which elapses on a stationary scale. Displaying the internal function is irrelevant.

discourse analysis techniques, and perception experiments might prove more productive.[4]

Techniques of Integration. Systematic design methods addressing the meanings products have for users are slowly being developed. Our eight-step process moves from verbal accounts of desired semantic characteristics via the generation of possible manifestations to a synthesis of form.[5] Helga and Juergen Lannoch have worked with a method called "semantic transfer," which proceeds from an analysis of the network of verbal images in discourse about space and the orientation of activities in that space to objects that express word meanings without alluding to the functional aspects of a desired product.[6] Methods practiced at Fitch have concentrated on metaphors capable of restructuring the perception of whole artifacts, adding understanding.[7] Jochen Gros and collaborators have been working on a product language, essentially cataloguing meaningful features of form.[8] However, possibly because of their embryonic state, the use of such techniques is not yet widespread.

Testing of Meanings. Testing should be predictive of users' discourse, understanding, and practices. The earliest system of testing meanings is Charles Osgood *et al.*'s widely familiar semantic differential.[9] Although it claims to describe connotative meanings, it turns out to be a measure of verbal attribution, exclusively in polar scales. Tests for more complicated meanings are generally less codified. Our above-mentioned method entails asking subjects to generate verbal descriptions which are then matched with the semantic definition of the design problem.[10] While this predicts how users characterize a product once they see it, it does not penetrate into the nature of the cognitive models in use. An exploration of such models

4. Krippendorff, "Product Semantics."
5. Reinhart Butter, "Putting Theory into Practice: An Application of Product Semantics to Transportation Design," *Design Issues*, Vol. 5, No. 2, 1989, pp. 51-67.
6. Helga Lannoch and Hans Juergen Lannoch, "Toward a Semantic Notion of Space," *Design Issues*, Vol. 5, No. 2, 1989, pp. 40-50.
7. From personal experience and communications with John Rheinfrank.
8. Jochen Gros, "Reporting Progress through Product Language," *Innovation*, Vol. 3, No. 2, 1984, pp. 10-11.
9. Charles E. Osgood, G. J. Suci, and Percy H. Tannenbaum, *The Measurement of Meaning* (Urbana, IL: University of Illinois Press, 1957).
10. Butter, "Putting Theory into Practice."

is the aim of Protocol Analysis,[11] which can reveal users' conceptions and how they bootstrap their cognitive models on what is afforded by a given interface. Research on the eye movements of people viewing photographic images of products can reveal differential attention to details,[12] but the relation of these data to meanings is not yet fully explored.

Conclusion

The new awareness in design attends to individuals' meaningful involvement with artifacts and the larger environment users create for them. It emphasizes the design of interfaces in support of knowledgeable interactivity. We maintain that these concerns have been part of design all along but, by stripping off what other disciplines do as well or better, and by developing a discourse about this semantic involvement, these originally barely noticed concerns have now become its core. We gave four compelling reasons for transcending functionalism in design. We believe that the concern for meaning becomes increasingly important as technology moves on to greater complexities, as interfaces become more language-like, and as we become more aware of our own involvement in this process. We find these opportunities exciting. Design management can aid this process and become moved by it as well. ♦

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Suggested Readings

Krippendorff, Klaus and Butter, Reinhart, eds. *Products Semantics*, a special issue of *Design Issues*, Vol. 5, No. 2, 1989.

Krippendorff, Klaus and Butter, Reinhart, eds. *The Semantics of Form*, a special issue of *Innovation*, Vol. 3, No. 2, 1984.

Vekeva, Seppo, ed. *Product Semantics '89*. Helsinki: University of Applied Arts, 1990.

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Vihma, Susann, ed. *Objects and Images*. Helsinki: University of Applied Arts, 1992.

11. K. Anders Ericsson, and Herbert A. Simon, *Protocol Analysis: Verbal Reports as Data* (Cambridge, MA: MIT Press, 1984).
12. Stefan Lengyel and Attila Bruckner, "Tracking Eye Movements as a Key to Semantic Analysis," *Innovation*, Vol. 3, No. 2, 1984, pp. 25-27, and Norbert Hammer and Stefan Lengyel, "Do We Perceive What the Design Expresses?" in Susann Vihma, ed., *Semantic Visions in Design* (Helsinki: University of Applied Arts, 1990), pp. m1-m8.