



3-21-1984

## Product Semantics: Exploring the Symbolic Qualities of Form

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### Recommended Citation (OVERRIDE)

English version:

Krippendorff, K., & Butter, R. (1984). Product semantics: Exploring the symbolic qualities of form. *Innovation*, 3(2), 4-9. Retrieved from [http://repository.upenn.edu/asc\\_papers/40](http://repository.upenn.edu/asc_papers/40)

Japanese version:

Krippendorff, K., & Butter, R. (1987). Product semantics: Exploring the symbolic qualities of form. *Industrial Design*, 139-140, 10-13. Retrieved from [http://repository.upenn.edu/asc\\_papers/40](http://repository.upenn.edu/asc_papers/40)

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## Product Semantics: Exploring the Symbolic Qualities of Form

### Keywords

semantic triangle, communication process, product semantics in the design and use of artifacts

### Disciplines

Communication | Social and Behavioral Sciences

# Product Semantics:

## Exploring the Symbolic Qualities of Form

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In its broadest sense, design is the conscious creation of forms to serve human needs. It sharply contrasts with the habitual reproduction of forms. While the history of design is not free of faddish and sometimes unconscious shifts in focus (witness the merging of craftsmanship with mass production by the Bauhaus, of technology with ergonomics at the Ulm School and of styling with market considerations on Madison Avenue), design has also broadened its scope of consciousness.

Probably the most noteworthy development in design today, giving evidence of this greater scope, is its concern for the cognitive meanings, symbolic functions and cultural histories of form. We can trace this concern to developments in Ulm some 25 years ago which are now coming to fruition by the name of "product semantics." *Product semantics is the study of the symbolic qualities of man-made forms in the context of their use and the application of this knowledge to industrial design.* It takes into account not only the physical and physiological functions, but the psychological, social and cultural context, which we call the symbolic environment. Product semantics is an effort to understand and to take full responsibility for the symbolic environment into which industrial products are placed and where they should function by virtue of their own communicative qualities. Through product semantics, designers can demystify complex technology, improve the interaction between artifacts and their users and enhance opportunities for self-expression.

### Challenges for Traditional Semantics

Emphasizing linguistic expressions, traditional semantic theory distinguishes between sign, referent and thought: that is between something that is intended to represent, something that is represented thereby and someone who makes the connection. Ogden and Richards' triangle in Figure 1 depicts this concept. (From *The Meaning of Meaning*, London: Routledge and Kegan Paul, 1923.)

Product semantics poses several challenges to these traditional distinctions. An object's form says: first, something about the object itself; second, something about the larger context of its use; and both to the user who interacts with it and develops the conceptual connection. An object's form does not say what it is. Rather, the object is what it says

to the user: A push button, when recognized as such, suggests "Push me," and its place in the configuration of parts or its label may suggest what consequence pushing it will have. The push button refers to itself and to the whole of which it is a part. Thus, in product semantics, the sign and referent in Figure 1 becomes one, the imputed relationship largely disappears, and the remaining links between the object and its user form a circle: The user man-

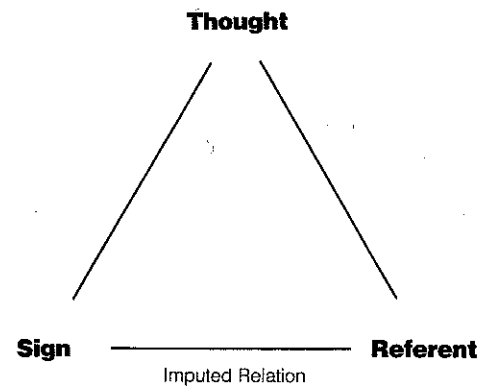


Figure 1:  
Semantic triangle

ipulates the object, and receives feedback through the consequences of those actions, leading to further manipulations and so forth. In this ongoing process, the user and the object finally adjust to each other, cognitively and behaviorally.

This circular process involves not only control in the narrower sense, of driving a car, for example. It involves the whole symbolic environment, from the human interaction a car facilitates across large distances to the personalities a driver seeks to acquire by owning a particular model; from the language used in its advertisement to the language in which social approval/disapproval or style classifications are expressed; from the system of road signs to the legal intricacies of licensing and inspection. All man-made forms have socio-cultural histories, elaborate existing archetypes, and all are loaded with social meanings that place them in the symbolic context of their use.

It follows that the traditional distinction between syntax, semantics and pragmatics is not particularly relevant here either. According to C. Morris in *Signs, Language, and Behavior* (New York: Prentice Hall, 1946), the relationships among signs belong to the domain of syntax; the relationships between signs and their referents constitute the semantic domain; how both effect a user defines the domain of pragmatics; and all three are subsumed in semiotics, the general theory of sign processes. Designers who subscribe to these traditional distinctions are easily led to think in linguistic metaphors which suggest in turn that the symbolic qualities of their products should refer to something other than themselves. Such designers tend to rely on signs whose meanings are well-established in other contexts, whether they prefer extensive explanatory graphics printed on boxes whose proportions and surfaces say little about themselves otherwise; whether they add

**Could Design Be a Form of Communication?**

Aware of the psychological and social uses of objects, the designer could be cast in the role of a communicator whose messages to the user concern the symbolic qualities of products. Just as a journalist creates informative messages from a vocabulary of terms, so could a designer be thought of as having a repertoire of forms at his disposal with which he creates arrangements that can be understood as a whole in their essential parts and that are usable by a receiver because of this communicated understanding. In this issue, Jochen Gros cogently argues for the development of such a product language. But, unlike the journalist who reports on events he or she observes, the designer creates forms that report about themselves, including about their possible uses, their cultural heritage and, only sometimes, about the designer's experiences and style. While a journalist is often judged by whether he gets a mes-

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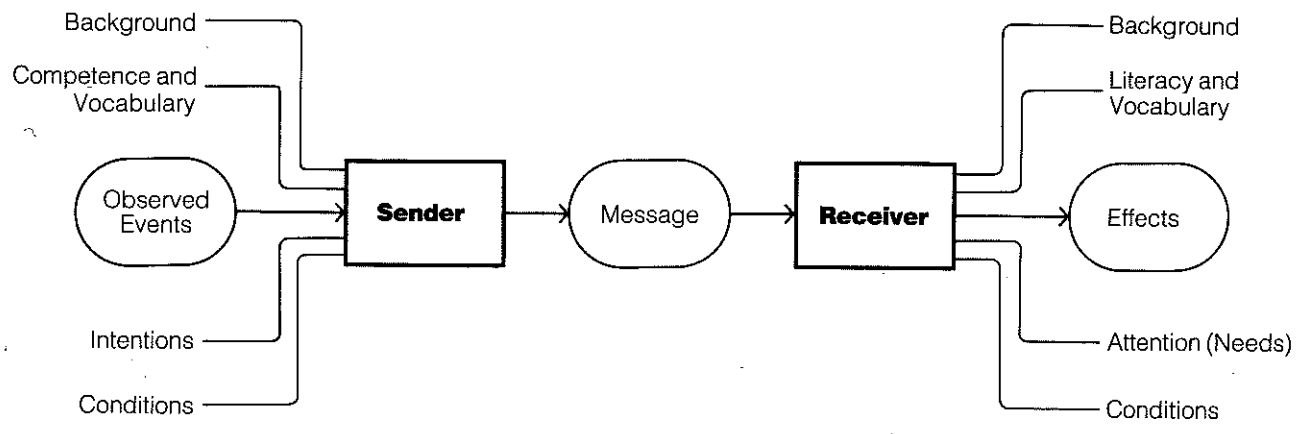


Figure 2:  
Communication process

chrome and decor as symbols that may give the impression of value; or whether they see forms as convenient wrappers to hide what the product is or could become for a user.

Product semantics cannot prevent such unfortunate applications. As the study of the symbolic qualities of forms in the psychological and social context of their use, it recognizes that man-made forms can embody, as an indistinguishable symbolic unity, both signs and referents relative to a community of users. It transcends the traditional distinctions. It does not suggest the designer's reliance on linguistic or graphic props borrowed from elsewhere. To make its aim clear, product semantics must not only demonstrate successful applications but also develop its own distinctions and thereby transcend the traditional and misleading distinctions.

sage across as intended, the designer, more so than the journalist, can only hope to contribute to the way users create meanings and develop mental models commensurate with their needs to use the designers' products. In this issue, John Reinfrank briefly discusses this as 'mapping.'

Another way the designer differs from the journalist is the extent of his or her control over the process of communication. Notwithstanding the institutional and technical limitations of print, radio and television, for example, the channels at a journalist's disposal transmit huge amounts and highly timely information. In comparison, the channels available to designers are slow, subjected to numerous technical and marketing constraints, polluted by unwarranted preferences held by intermediaries and corrupted by the visual-tactile illiteracies of the gate-keepers in charge of the process of production and marketing.

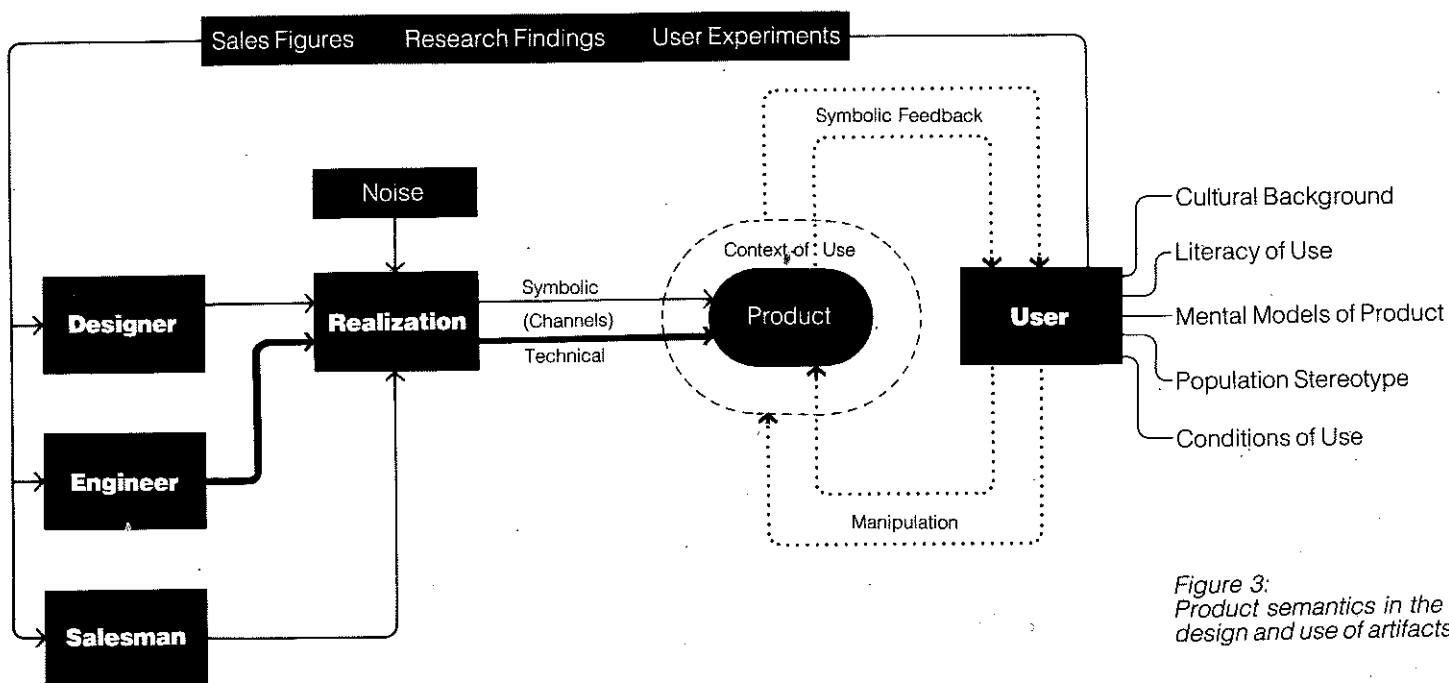
**All man-made forms have socio-cultural histories, elaborate existing archetypes, and are loaded with social meanings that place them in the symbolic context of their use.**

The knowledge product semantics provides about how objects work within the context of their use cannot entirely be expressed in terms of linear communication between a designer and a user. The crucial difference lies in the individuality of the users' interpretations which evolve in the circular process of their involvement with the designers' products. Journalistic reports may be registered, and their information may be consumed, but objects become meaningful by interacting with them as users and by making them part of the users' life. Figure 3 depicts a designer whose circumstances realistically restrict him to be a mere contributing communicator, albeit a very important one.

even so, designers cannot be ignorant of the meanings they acquire in this use.

• **A product's form, shape and texture.**

These reveal nothing other than what an object is, how it is to be used, by whom, in what context and to what ends. Although the use of graphics may have similar aims—consider the lettering, "(I am an) IBM 360 Information Processor" on a mainframe computer whose shell could house a lot of other things as well—a product's form, shape and texture is in the true sense indiginous to that product, and (unlike graphic elements) they cannot be understood without the object being that object for a user. The symbolic meanings of forms, shapes and texture are the most characteristic concern of product semantics.



**The most elementary kind of infelicity has the effect of rendering different products indistinguishable or unidentifiable by a user. Such infelicities are disastrous mistakes when they occur in emergency equipment.**

**Channels Influencing Product Use**

The meanings relevant to product design may be communicated through four symbolic channels.

- **Information displays**, such as screens, loud speakers and moveable signboards. The information such displays provide is correlated with phenomena extrinsic to the object's form and, hence, outside the domain of product semantics. The designer's concern is limited to the interface between such displays and the user.
- **Graphic elements or two-dimensional markers**, including labels, color codes and written instructions that are unalterably attached to the object's surface. These markers tend to have meanings not indiginous to the object that bears them as a medium of communication. Linguistic signs, for example, have their own semantic domain and can be studied outside the domain of product semantics;

- **Indications of a product's internal states**. These show the particular operating conditions an object happens to be in while in use. These indications may make use of three-dimensional forms, such as the position of a dial or of the on-off switch for the power supply, or of graphic elements, such as the moving pointer of a dial. Flight instruments in a cockpit exemplify indications. Simple or complex, they can neither be unalterably fixed, like a product's form or the graphic elements attached to its components, nor can they be correlated with extraneous variables, the way television images correlate with what is filmed at a station. Indications of a product's internal states give the user some idea of how that object might work internally without having to take it apart. Designers have the option to reveal more or less of this information or use a logic that aids understanding, but they must provide enough

of that information in a form conducive to manipulate an object successfully. Product semantics is very much concerned with the logic of the information provided about the make-up and internal functioning of products.

These four channels of communication may be redundant in that the information they provide to the user overlaps. Redundancy often aids understanding. But these channels may also produce conflicts by giving contradictory messages to a user, or they may fail to provide enough information, causing misapplications or operational errors to occur. Product semantics heavily relies on the principles of communication characteristic of these channels, and we will point to some typical mistakes designers may make in using them here.

### Four Semantic Infelicities in Design

For a semantics of forms, the creation of paradoxes, conflicts or parallels is often more instructive about how products work symbolically than unquestionable success. In fact, and probably intended as a challenge to existing concepts, Umberto Eco once defined semiotics as the discipline concerned with everything that can be used to lie (*A Theory of Semiotics*, Bloomington, IN: University Press, 1976). The nonverbal analogues of lying range from the Dadaist's creation of impossible-to-use objects, on one extreme, to the unintentional symbolic incongruities, misunderstandings, misapplications, mistakes—in the sense of taking something amiss—or infelicities on the other. We shall list four kinds of semantic infelicities in the design of forms in relationship to the context in which a product may be placed.

The first and most elementary kind of infelicity has the effect of rendering different products indistinguishable or unidentifiable by a user. Such infelicities are disastrous mistakes when they occur in emergency equipment—fire extinguishers, escape doors, emergency buttons—that must be located and identified as such under stress. Infelicities in identification can also be costly when extensive public campaigns or training programs are required to differentiate one product from another or to make a particular product recognizable for what it intends to be or do.

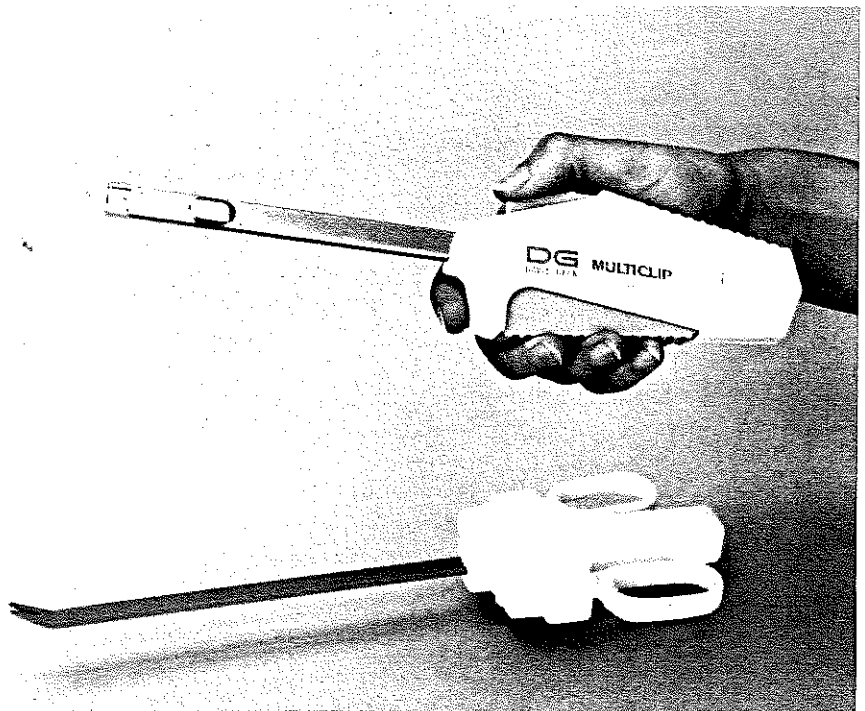
A second kind of infelicity results in the users' inability to manipulate a product in desired ways. Here semantics is especially concerned with:

- A.** The visual or tactile differentiation of a product's component parts, involving the manipulation of some and discouraging contact with others (dangerous).
- B.** The spacial arrangement of components, movements and controls that must be logical, not for the designer but in terms of the user's mental model of the object he wishes to use. (In the example on the

cover of this issue, the most logical position of the power switch might be between the power supply and the shielded work area);

**C.** The indication of the object's internal states in places easy to read and of a kind necessary for or supportive of its successful manipulation. In providing such indications, designers may want to go with and not against existing population stereotypes, such as reading from left to right and turning a knob clockwise to increase volume and brightness. Several papers in this issue refer to the use of such stereotypes, and Example 1 illustrates the self-evident use of a surgical tool in which visual and tactile clues guide the user to handling it correctly under conditions that do not allow time for explanation or experimentation.

### Exploring the Symbolic Qualities of Form



The third kind of infelicity prevents a user from exploring the nature of a product either to improve its operation or to find new applications without outside help. Computer architecture, for example, is notoriously nontransparent. But suitable teaching programs can be made part of a computer's software package, allowing users to expand their computational literacy far beyond what they began with. To overcome this infelicity, designers can use forms that stimulate curiosity and encourage harmless play, or can use forms that are somewhat ambiguous or novel and require of users that they invent their own meanings and cognitive representations suitable to handle the object effectively. Example 2 shows a new product with few formal resemblances to draw interpretations from. The semantics of this form invite exploration and use with a minimum of instruction and is intended to prevent only the worst misapplications.

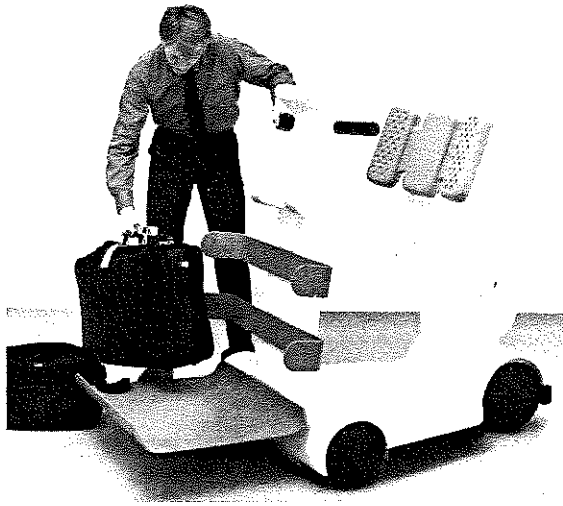
*Example 1: Especially innovative products rely on semantic clues to help communicate their proper use and thus minimize the need for instructions.*

*Example 2:*

*Semantic considerations provide, or at least contribute to, a product's overall self-evidence. (Student project at mock-up stage)*

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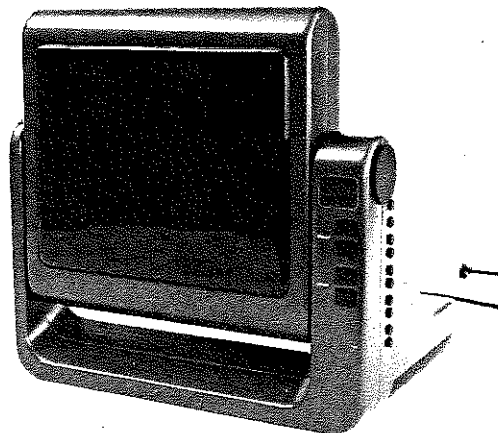
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A fourth kind of infelicity results from a product's inability to fit the symbolic environments in which users must operate them. We know how much the interpretation of objects depends on the symbolic qualities of the other objects that surround or interact with them. In advertising one is particularly aware of the favorable associations proximities can create, such as by letting a famous television star explain a car. But there are limits. A 20-year-old tape recorder no longer satisfies the expressive needs of today's teenagers, regardless of its sound quality. It simply won't fit the social, high-tech and high-touch environment which defines their identity and, in this issue, Uri Friedlander and Michael McCoy further illustrate the importance of symbolic environments for product design. In contrast to the outdated tape recorder, Example 3 shows an effort to develop a television receiver that is unique in form, less constrained in use by contextual definitions and thereby

*Example 3:*

*Often the conscious use of semantics can enhance the character of products by overcoming established formal conventions. (Experimental student project)*

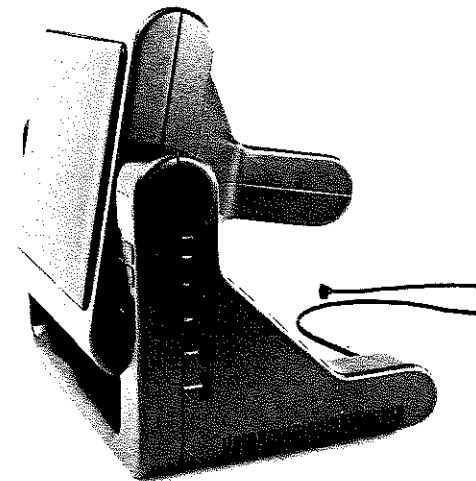


more free to move into novel symbolic contexts.

The four kinds of infelicities discussed here are neither exhaustive nor exclusive. Rather, they illustrate where designers can make mistakes in the symbolic domain and where product semantics can provide insight into why they come about. They designate different failures in the circular dependency depicted in Figure 3 and pertain to different levels in that dependency. The first level—product identification—requires the user to merely look at an object from different perspectives and interpret relevant clues to judge what kind of object it is. The second level—self-evident operation—additionally requires the user to handle an object, to move it about or alter its controls and obtain feedback from those actions. It also requires that the user experience operational success or failure. The third level—explorability of forms—invites the user to play with the object, acquire a working knowledge of it and perhaps invent novel applications. And the fourth level—coherence with the symbolic context—concerns a user who interprets an object in conjunction with others and who may describe the whole arrangement in terms of personal style, individual expression, social attributes and aesthetic value. Product semantics deals with all these levels, promising to make designers aware of the symbolic processes underlying them.

**Highlights of This Issue**

The papers in this issue suggest several approaches to product semantics. Borrowing from linguistics, Jochen Gros points out the need for designers to see themselves as communicators, quite similar to Figure 2, and use a nonverbal product language as the vehicle for communication. From this perspective, to become competent communicators, designers must develop literacy in that language, a literacy that is all the more necessary as technological progress, and



miniaturization of electrical components in particular, renders the search for meaning in objects increasingly important, both for the designer and the user.

Uri Friedlander takes a somewhat larger perspective, suggesting historical reasons for today's concern with product semantics. Early functionalism, he observes, supported capitalist mass production. The crisis in functionalism detected, if not created, at the Ulm School, with its scientific, classless design approach, arises from the conflict between consumer needs and industrial interests. In the current wave of abundance and high technology, people no longer seek to balance form and function. Rather, they aim to surround themselves with objects that best express their political ideology, Friedlander maintains. More so than before, designers now need to "keep the user's psychological, social and emotional needs in mind," and this expanded horizon largely concerns the social reality, which is almost entirely symbolic in nature.

Agreeing with Friedlander's concern for people's opportunities to express themselves, Michael McCoy particularly argues for the need to differentiate between background systems and foreground objects. He describes and illustrates how foreground objects can evolve from semantic and metaphoric analysis so that they display, if not celebrate, visually strong formal elements whose symbolic qualities are unambiguously clear to users.

Hans-Juergen Lannoch sees the root of product semantics in the application of verbal language to the process of realizing three-dimensional forms. In essence, his approach requires that he translate into concrete form words and expressions elicited in association with the concept of an object. Calling the process semantic transfer, Lannoch demonstrates its results with two pieces of electronic equipment whose surfaces are more important than their internal make up.

Discussing a pilot study currently under further exploration, George Burden classifies objects of design in a three-dimensional grid defined in terms of form, graphics and color. He then searches in this space for distributions of objects with similar semantic properties, suggesting further applications.

In another paper, Stefan Lengyel and Attila Bruckner report on research into product semantics, applying an advertising technique for measuring eye movements to three-dimensional objects. This research sheds light on where potential users expect to find controls and indicators, how users decode a form, which aspects are noted and which ignored. Their work offers yet another method through which designers can substantiate ideas in product semantics that could improve user-product interaction.

Closing the issue is an article by John Rheinfrank who explores two contrasting kinds of user-product interaction: The 'Black Box,' whose internal functions are obscured and made mysterious to the user; and the 'Glass Box,' whose function is transparent to the user as needed for mutually meaningful interaction. He then provides an overview of several concepts important to product semantics which his firm, Richardson/Smith, has derived from trend line analysis. Some, such as 'environment,' 'self-evidence' in use and 'mapping' of interactions into mental models, have already been mentioned. While they do not yet have the status of design principles, they point to important conceptual developments.

### **The State of the Art**

Product semantics is still in its infancy. Many designers are dissatisfied with previous approaches and have become aware of the importance of the symbolic role of products. But enhanced awareness is only the first stage of and a prerequisite for the emergence of product semantics. A second stage is the development of concepts and a suitable language in which to talk about the symbolic qualities of products, the user-product interfaces, the construction of cognitive models, the transmission of meanings through the channels at a designer's disposal, the infelicities that may occur and so on. The papers in this issue give evidence of movement in this direction. While work is progressing, results are admittedly rudimentary, scarce in number and isolated from other approaches. Many new ideas will have to be generated, tested and weeded out before we can speak of having a suitable language. In a third stage, empirical investigations are particularly essential to validate the propositions in this language. Those few research efforts that have demonstrably yielded fruits are rarely unquestionably valid and generalizable to support teaching and communication among designers at this time. What we need is a collection of generally applicable research methods that will not restrict us by saying what is right and what is wrong, but that will show us where the range of practical options is.

Product semantics is not a new style. It is not a ticket to intrude into the privacy of the individual users. Nor is it a new functionalism turned psychological. It is a serious study of the meanings that emerge in human interaction with objects. Its application enriches our imagination and aims to prevent the range of failures we have become aware of only recently. This issue of *Innovation* demonstrates our state of knowledge and points out the direction we wish to move toward.

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