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Product Semantics: A Triangulation and Four Design Theories

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Product Semantics
A Triangulation and Four Design Theories

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PRODUCT SEMANTICS;
A TRIANGULATION AND FOUR DESIGN THEORIES.

by Klaus Krippendorff

I will start out by saying a few words on product semantics generally, what it is for those involved and what we hope to accomplish with it. Specifically, I want to triangulate product semantics in its empirical domain, in its philosophy and in its methodology before commenting briefly on the theories the title promises.

I am compelled to proceed that way because, I believe, all designers are naturally attracted to anything new but many of them end up merely flipping through magazine pages for pretty pictures and largely ignore what is being said about their why. Pictures undoubtedly have their fascination, but they can also be misleading. For example, when the word "product semantics" came into use in 1984, coincidentally the year of George Orwell's famous novel. Some saw in it a more acceptable word for the discredited "styling." Some welcomed it as a license, after years of austerity, for a more playful use of product forms, permitting visual metaphors, similies and allegories heretofore banned. Some considered it an invitation to apply graphics and ornamentation to the surfaces of otherwise anonymous (traditionally grey, beige or black) boxes, regardless of what they contained. Others, particularly in the business world, embraced it as a way of adding a new kind of value to a product that promised to increase sales or improve the manipulation of consumer satisfaction, rendering product semantics as a kind of visual "double speak." I can assure you, these are mere epiphenomena of our intentions.

To me, such interpretations of product semantics demonstrate the unfortunate tendency of old minds to adopt new words but otherwise cling to established practices. To dress provocative ideas into old clothes is a way of neutralizing their challenges. I am sure this conference will not be falling into such a trap for its symposia and workshops are conceived to carefully examine and practice what is new, to communicate an appreciation of the problems posed, and to invite participants to share in the new perspective product semantics offers for design.

But after this brief digression let me talk about the empirical domain of product semantics.

Empirical Domain

Since popular misconceptions of product semantics seem so much tied to the treatment of surfaces, the creation of semiotic envelops for products, the application of graphics, etc., let me take the bull by its horns and try to answer the--as it turns out not so simple--question "What is a surface that we may know it, what could it mean?"

Naive semioticians contend that objects are established <u>by their physics</u> and what we see of them is a reflection of light on their surfaces.

Figure 1

In contrast, signs and symbols are thought to be established <u>by conventions</u>, what they mean is what they refer to or what they stand for other than themselves. I happen not to believe in this dualistic world construction and my interest in language owes more to the later Wittgenstein and Austin than to these semioticians. But a better reason for rejecting referential or representational notions of meanings in design is that they inevitably lead to various pathologies. For

Surface

Reflection of Light
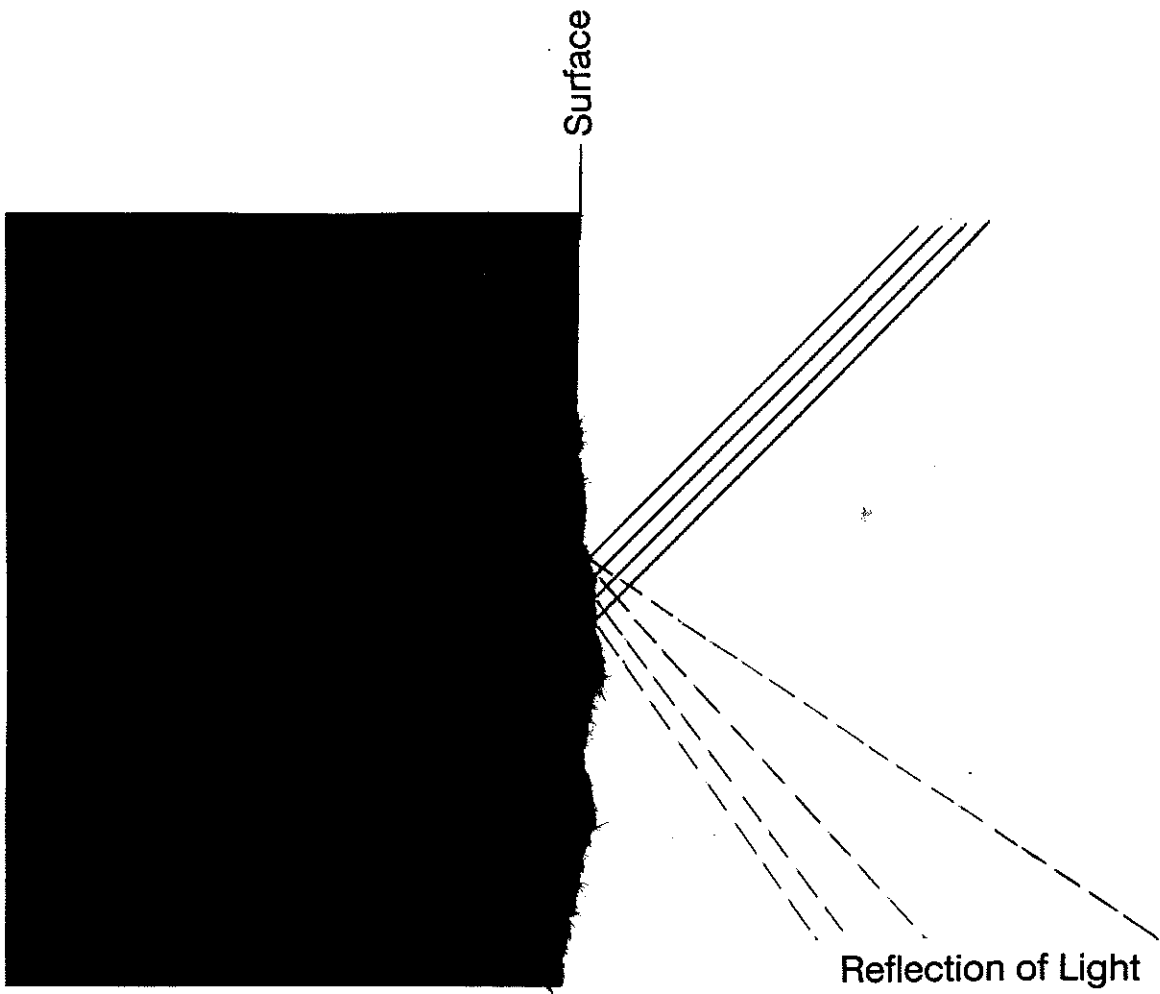
Empirical Domain of an Objectivist Semiotics

Figure 1

example, if symbols are conceived of as standing for something other than themselves, designing symbolic qualities of technical devices would have to divert users' attention to other things, to something possibly more desirable than what it actually is. A telephone in the form of a duck decoy is an extreme example, the addition of fake controls to a boombox is a more common one. The referential notion of meaning invites producers to make consumers believe to have bought something they did not and helps creating a make-believe world of fake facades. So, my first recommendation is to discard representational meanings altogether.

But back to the question of what a surface is, how meaning relates to it. Consider walking on a beach. We feel the sand between our toes and several inches beneath our feet and soon come to see properties we could not see before we stepped on--or shouldn't we say in--that beach: the softness, the warmth, the sound it makes walking. What may have first appeared to be a reflection from the yellow spectrum of the sunlight has now become meaningful and alive. Consider looking into (not onto) someone's face. Even without knowing much about the network of blood vessels, muscles and glandular functions operating beneath it, we soon learn to see smiles, frowns, tears and emotional expressions as reflections of what we believe goes on in someones' mind. Consider sitting in front of a new computer. As we play with it, perhaps motivated by mere curiosity, we see changes emerging on its screen. We begin to understand the connection between our actions and what we see and, if this exploration is sufficiently engaging, we become increasingly able to make all the things happen we want to see and thus develop a deeper understanding of how our computer cooperates with us. Just as we are hardly pleased to see a human face without a skin, for

ordinary computer users, understanding does not involve wires, chips, arithmetic units and electronic rays that activate images on the screen, but it does not stop at its visual boundary either. <u>Understanding something penetrates deep into its interior</u>, makes what can be seen meaningful, transparent, lively, if not a friend, and does this all in the user's own categories of cognition and language, not by its designers intentions.

Indeed, we never see the light that hits our retina much less a surface but what that means to us. The form of an artifact, its reflecting surfaces, may be what a camera responds to, but for us as human users, it always already is interpreted by having a name, by having a recognizable history of use, by being composed of other things or by being able to support a practice of living. If the meaning of an object is not clear for us, we may feel invited to explore or play with it until it is, until we have acquired a practical understanding. Thus, the meaning of something does not lie on its surface. It emerges in use, with practice, the practice of living with our environment and in particular contexts whenever we cognitively connect our actions and perceptions in an experiential circle of use. <u>The meanings thus constructed support our practice of living by penetrating a surface as deep as our understanding goes and by involving as much of our cognition as participates in interaction with it.</u>

Figure 2

While all design could be regarded as an intervention in our practices of living, I am suggesting that <u>product semantics be concerned with human interfaces</u>, i.e. with that layer of cognition in which we experience how we interact with our environment, that layer of cognition
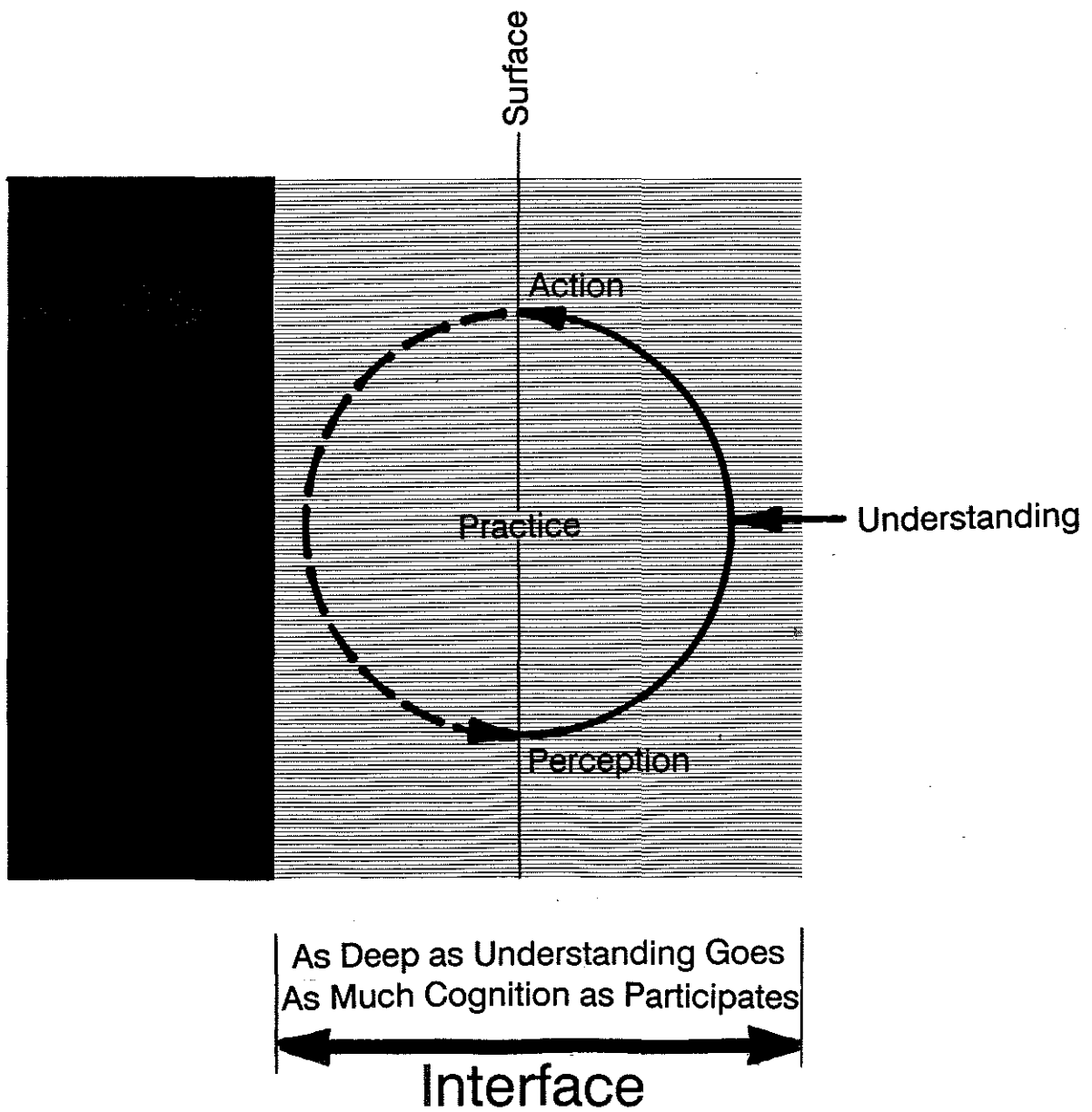
Empirical Domain of Product Semantics

Figure 2

which renders things understandable, meaningful, transparent, alive and useable or that layer of cognition which centers us in our own experiential world. Product semantics resides where human cognition and machine logic fuses into practice.

Let me go further and argue that <u>understanding and practice are inseparable twins</u> and the <u>understanding of something always is the key to its practical use</u>. For example, we might never again run through the sand on a beach after we have been cut by glass hidden beneath its surface (in fact we might then be seeing glass everywhere even though there may not be any). We might be confused and not know how to talk to a person whose face is uninterpretable or exhibits weird expressions. Experiencing our own lack of understanding someone else's face might make us extremely uncomfortable and want us to leave a conversation. Faced with a computer with its near inexhaustible variety of possible uses, we always understand something to begin with. But then, we tend to press only the keys we can interpret, apply only programs we know something about or rely on routines that are familiar to us. The vast majority of the remaining possibilities might challenge a few hackers but mostly stays in the dark of incomprehension. Anything must be recognized for what it is and at least somewhat understood before it can enter a practice and, since there may be many different understandings, anything may be used in as many different ways as it can afford. To speak of "the function" of a product ignores the primacy of understanding and practice in favour of a strange objectivism.

I am finally suggesting that <u>product semantics seek to understand users' understanding of their practices of interfacing with designed</u>

things and provide strategies for designing products that can either afford or supportively intervene in that understanding.

In other words, product semantics should be concerned not with the forms, surfaces and visual or tactile boundaries of artifacts (the things that can be photographed and shown in design exhibits), but with the understanding that penetrates them. Product semantics should be concerned not with material objects as such, but with how they participate in human affairs, how they support understanding and practice. Product semantics should optimize not performance, as measured by outside criteria, but meaningfulness, motivation and the centeredness of humans in their own world and by their own criteria.

Underlying Philosophy

With the understanding of meaningful practices of living at its core, product semantics joins several disciplines in the sciences and in the humanities in a major paradigm shift toward moving human cognition into the center of their attention. In the philosophy of science, the old preoccupation with ontology, the discipline concerned with what exists independent of its observation, is giving way to epistemology, the discipline concerned with how we know (not how we know what), and hermeneutics, the discipline of interpretation. The early behaviorism in the social sciences with its preference for causal explanations, its stimulus-response theories and its disdain for concepts of mind is increasingly superseded by a new cognitivism, an effort to understand how thinking and behaving are woven into communications and into the fabric of society. Cybernetics too is undergoing a major transformation from what is now called first-order cybernetics, the cybernetics of

observed systems, to second-order cybernetics, the cybernetics of observation.

To me, ergonomics, the discipline concerned with optimizing systems performance by applying objectively measurable criteria to the people involved, exemplifies the old paradigm. It reduces the human participants to machine-like operators but, because they always develop their own understanding and cannot be motivated entirely from the outside, ergonomists find human operators flawed with so many unreliabilities and defects that they must spend much of their effort to limit what their "errors" could do to the system as a whole. This approach is demeaning of human capabilities and perhaps symtomatic of old attitudes in design.

In contrast, product semantics starts from the other end, from how people understand their own practice and why they engage in what they do. Product semantics recognizes that <u>people surround themselves with things they are familiar with, are able to handle flawlessly and can arrange so as to feel comfortable among them</u>. For examples, we drive expensive cars though cheaper ones would transport us as well. We are willing to live in disfunctional furniture as long as we like it. We even buy computers we don't really need but enjoy playing with. Such motivations are not rational and determinable by objective criteria but symbolic and derived from within individual understanding.

Product semantics presumes that <u>people do best where they see the possibility of developing their own competencies</u>. We don't like to be trained to do a job others judge us by, but we are eager to learn by doing something exciting, acquiring knowledge while exploring, rearranging or even designing our own environment in our own terms

(guess why designers are so self-motivated!). By designing devices of specialized functionality for use by others, designers have usurped much of the excitement users could themselves enjoy in everyday life. The rise of intelligent machines enables product semantics to give much of this excitement back to individual users.

Product semantics presumes <u>people never are unreliable by choice</u> but by being forced to use things that are designed in ignorance of how they understand or are accustomed to use them. Moreover, we don't like having to expend an enormous amount of energy to adapt to the requirements of badly designed machines for the ultimate reward it promises, we want a machine to be easily identifiable for what it is, understandable in its operation and possibly adaptive to our own way of doing things. <u>Errors in use largely arise out of a mismatch of what a machine can actually do and what it symbolizes to a user to be capable of doing</u>. Product semantics seeks to reduce this mismatch by suggesting self-evident and understandable interfaces. It is thus no longer our problem to logically derive a physical form from an analysis of what something should do but to design something that makes sense to users, that affords (accommodates) a possibly large range of cognitive models users bring to its sight. Hence the slogan:

<u>Design is making sense of things.</u>

To appreciate the contrast created by this paradigm shift, consider the following, perhaps a bit overdrawn, comparisons between the old and a new philosophy in design, spearheaded by product semantics as I see it.

Figure 3

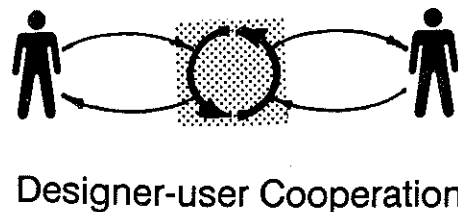| Old Paradigm	New Paradigm
Design is making forms to follow required functions	Design is enabling users to make sense of things
Emphasis is on efficiency and simplicity of operation-- improves of material conditions for users	Emphasis is on self-evidence in identification and understandability of use-- enables users to center themselves in a symbolically meaningful world
(End) products are designed to embody specific functions	(Unfolding) interfaces are designed to afford the cognitive models users have or are desirous to develop and practice
Training and instruction is separate from product use and typically precedes it	Interfaces are self-instructing and user competence is expected to emerge in practical use
Users are rewarded by conforming to objectively measurable performance criteria	Interaction is self-motivating, an engaging play in which users judge themselves by their own criteria
Errors are human and a problem user's must learn to avoid	Errors reflect incomprehensibility and discouraging designs. Machines should be configurable or adapt to available cognitions
Machines are seen as constraining users to apply them as intended	Machines are seen as enabling users to create possibly unintended but meaningful practices
Designers are authorities on how things should look and be used	Designers cooperate with users in intervening into individual practices of living

Designer as Authority   Designer-user Cooperation

Philosophy Underlying Product Semantics

Figure 3
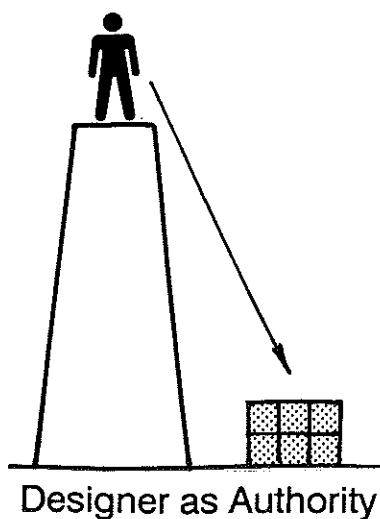
Methodology

As intervention into the practices of living, design must (1) start with some appreciation of existing practices, (2) be able to anticipate the consequences of introducing improved or new artifacts, and (3) have a systematic (professionally acceptable) way of realizing or embodying designers' intentions. These tasks define three classes of methods that are quite common to all design activities but need to be developed for product semantics to succeed in its mission.

The first is descriptive, is an effort to find out what exists and calls for research into people's understanding of things, the cognitive compentencies in use and brought to bear on anything new, the symbolic qualities of familiar objects easily recognized in everyday life. The most useful approaches to such research questions are found in ethnography, discourse analysis and perception experiments. Ethnographic methods are particularly suited to describe in appropriate details existing uses of things, cultural habits and practices and their distributions in a population. Participant observation, video recording and to a limited extend interviewing provide typical sources of ethnographic data.

(Linguistic) discourse analysis probably is indispensable in gaining an understanding of why and how people do what they do. The verbal accounts users can provide about their own practices, whether in the form of protocols or verbal instructions given to others, often constitute the only window into people's world constructions and the cognitive models they employ to handle concrete situations. Perception experiments can reveal how forms, configurations or movements are mapped into language or acted upon in concert with culturally

established practices, thus going to the heart of the symbolic qualities of things. The largely overused semantic differential scales are a case in point. (The perception experiments here referred to should not be confused with those conducted with psycho-physiological intentions in mind. These often seek to exclude or generalize beyond the cultural and situational influences on perceptions which are product semantics' main concern.)

Figure 4

The second class of methods is <u>anticipatory or interventive</u> and seeks to extrapolate from known understanding of things the changes in understanding and practices a new design might introduce. People learn all the time and meanings rarely stay the same. It would be in the spirit of product semantics not to aim at a catalogue of available symbols or at a product language with a finite vocabulary but to develop instead a <u>dynamic theory</u> of how symbols interact and change in meaning, how motivation can sustain the <u>growth in users' understanding</u> toward yet unanticipated practices, how whole user communities can come into being around <u>emerging interface conventions</u>.

Anticipation requires extrapolation from existing knowledge and the theory here needed must be rooted in <u>cognition, learning, social interaction,</u> including the <u>symbolic involvement of institutions</u> (of production, communication and consumption). In work with RichardsonSmith, we have used cognitive theories of how metaphors, metonymies and cognitive prototypes work to anticipate the unfolding of user cognition. Learning theories also are available but rarely cast to shed light on how users might explore the complex affordances of a computer, for example. These anticipatory methods assure that proposed

Ethnographic Methods

Descriptive Accounts

Discourse Analysis

Perception Experiments
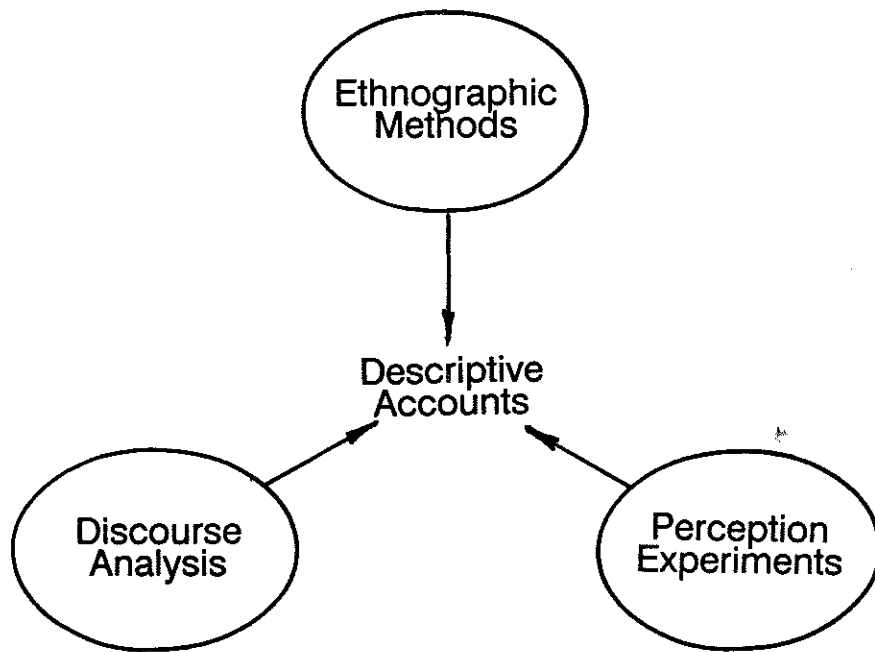
Components of Descriptive Methods

Figure 4

affordances embrace not just the users' cognitive models currently available but also those that will unfold with practice. In the domain of product semantics, anticipatory methods are recursive methods that change their own premise (the conditions that gave rise to the intervention in the first place) and are, I believe, unknown in engineering (the design of a bridge does not influence its underlying mechanics, physics or chemistry whereas the design of an interface inevitably changes the cognition it initially supports).
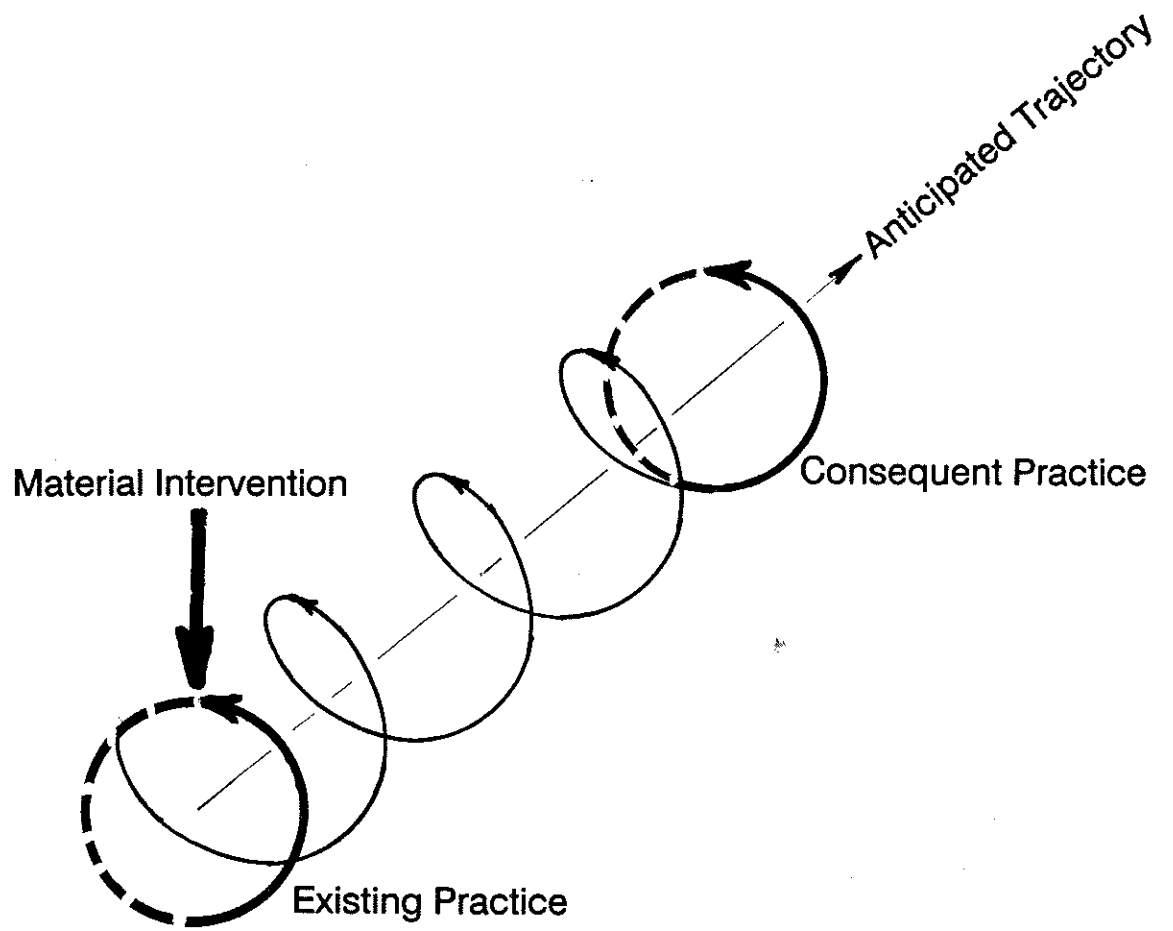
Figure 5

The third class of methods is creative and intended to support informed design decisions, for example, on how semantic attributes come to be embodied in an artifact, how the ethnographies of particular practices are converted into the affordances of a product, how verbal descriptions of an ideal type become translated into easily recognizable forms. With such more or less systematic techniques for realizing designers' intentions must come methods of testing the results for whether they do indeed solve the problem of understanding posed to begin with.--Since this conference includes several papers on such methods I will conclude my triangulation of product semantics and come to appropriate theories.

Figure 6

Design Theories for Product Semantics

At this early stage of development, design theories for product semantics merely can provide conceptual systems capable of highlighting important areas of exploration, directing the acquisition of suitable knowledge, and guiding appropriate design decisions whose consequences

Material Intervention

Anticipated Trajectory

Consequent Practice

Existing Practice

Anticipatory or Interventive Methods

Figure 5

Budget

Selection
Combination
Integration
Communication
Evaluation
Feedback

Message

Material
Intervention

everyday practice
of living
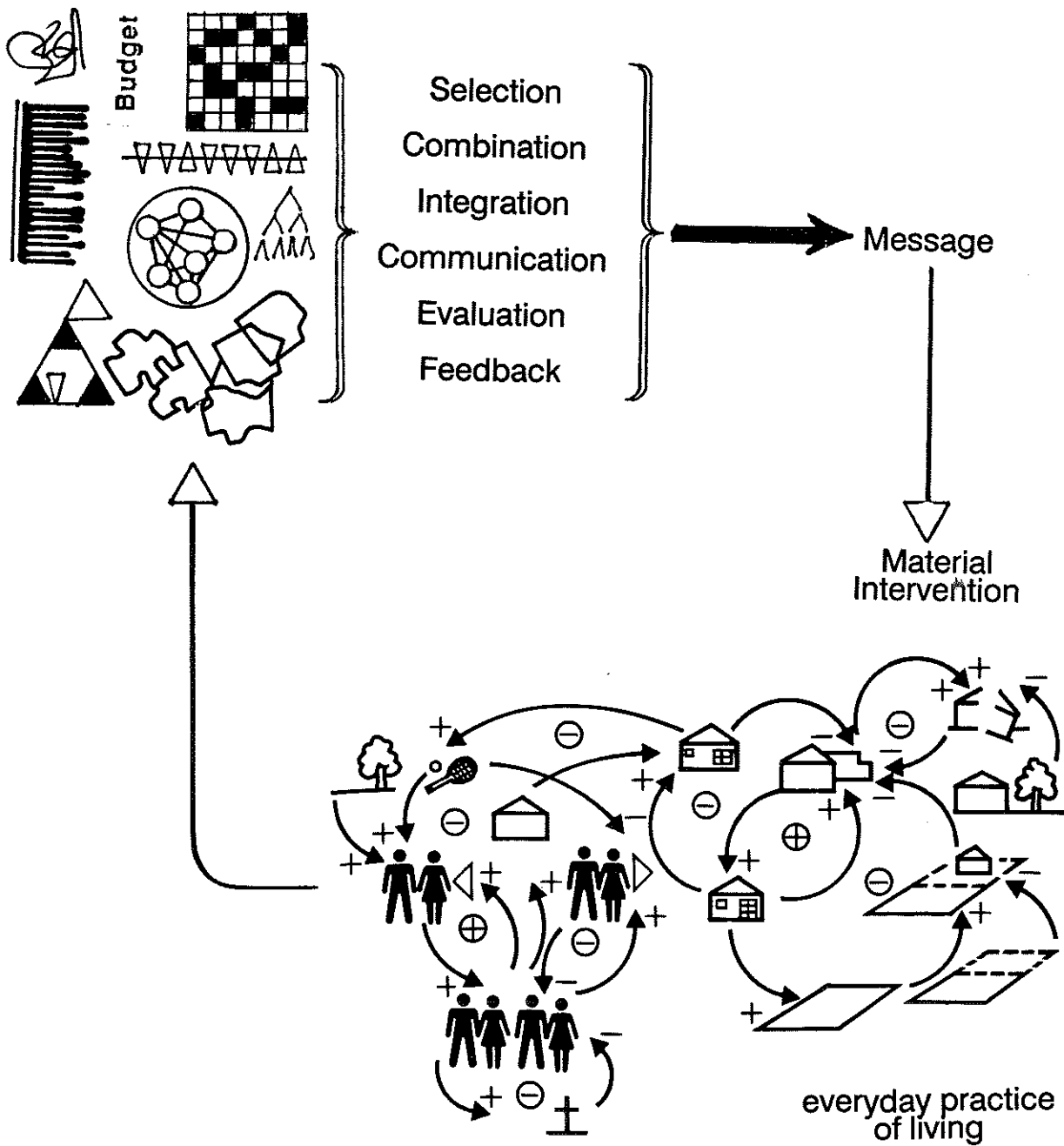
Location of Creative Methods

Figure 6

should turn back on and elaborate the very conceptual system that gave rise to it. I am proposing an embedded set of four such theories: focusing respectively on use, language, genesis, and ecology of mind. But before I outline them, I wish to clarify their common root in understanding different practices of interfacing with designed objects.
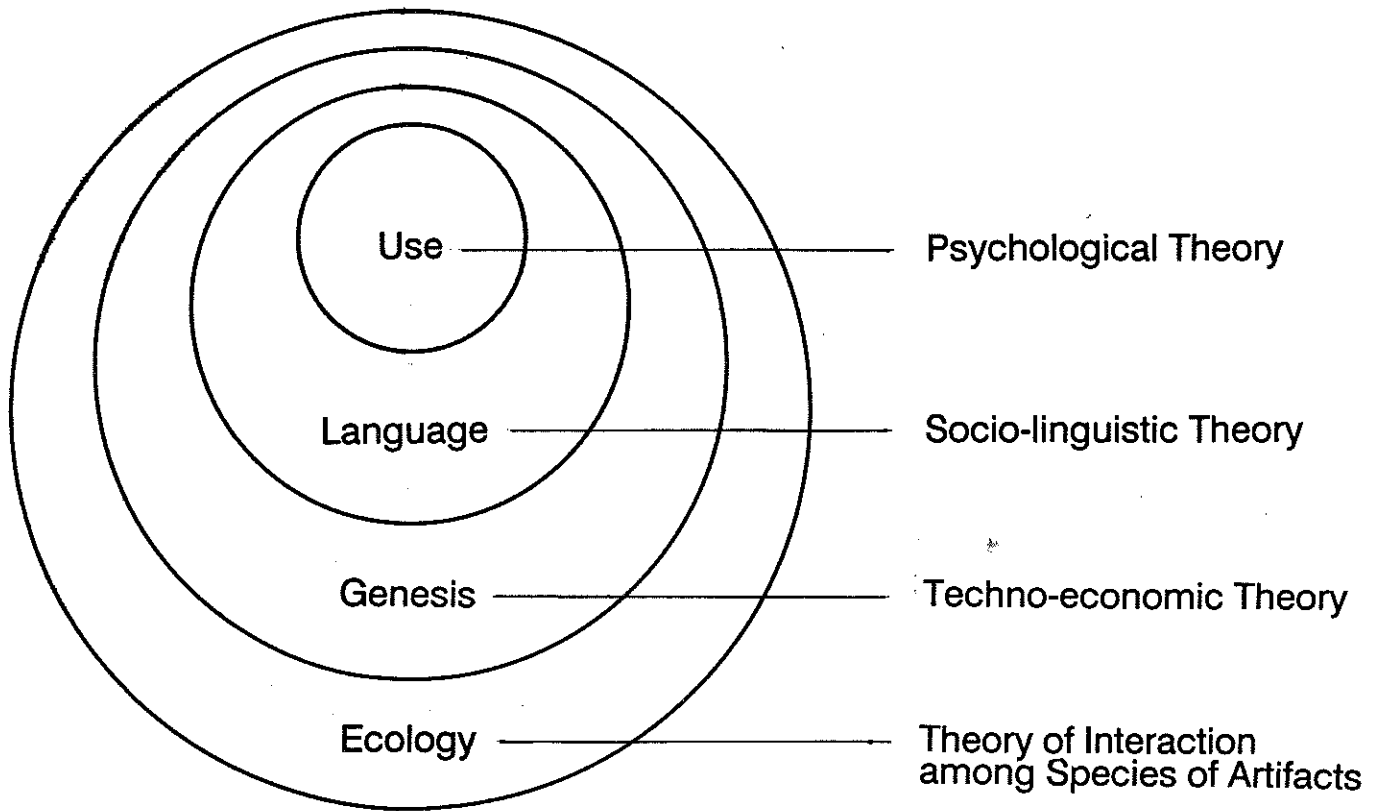
Figure 7

Understanding generally involves connecting experiences of different modalities to each other like walking on sand and seeing it or smelling something and knowing where one is. Understanding things involves relating them to their context of use, to their practice, including to other things we are aware of. Artifacts take part in and well designed artifacts support circular enabling patterns involving our actions on them, our perceptions of them and what we intend to accomplish through them.

It is important to distinguish meaning and sense as two distinct manifestations of experiencing things. We say that something makes sense when we understand the role it plays in a particular context, when we have a satisfactory explanation of what it does. In contrast, the meaning of an object is the sum total of all the contexts for which someone is capable of imagining some sense for it. In short something means (or enables someone to see or anticipate) its possible contexts of use. Thus, by analogy, meaning is to sense as potentiality is to realization, as competence is to performance, as language is to speech. We acquire the meaning of something by generalizing to a range of contexts the variety of senses we could make of it in particular settings.

Use	Psychological Theory
Language	Socio-linguistic Theory
Genesis	Techno-economic Theory
Ecology	Theory of Interaction among Species of Artifacts

Contexts of Artifacts and Design Theories

Figure 7

Meanings always are someone's cognitive constructions and the artifacts that are thought to have them may not live up to them. We call the range of cognitive models or practices that something indeed can sustain its <u>affordances</u>. One could say that meanings are affordances as perceived by someone before they have been checked out in practice. So, a chair means sitting (among other meanings). If a comfortably looking chair is hard to sit on, it does not afford the kind of sitting it meant. If an icon on a computer screen suggests that clicking the mouse on it would "flip the screen" to the next "page" but does not invoke this change when tried, we say meanings and affordances mismatch. <u>Product semantics aims at the design of things whose affordances cover at least the range of meanings they convey to users</u> and all theories in product semantics could be said to concern relationships on two levels of understanding things, between meaning and affordances and between making sense and interface practice.

As I said, in the old paradigm, errors largely were considered user errors and explanations for them were sought in the physiology of human performance, operator unreliabilities, incompetencies or lack of training and instructions. In the new paradigm <u>errors are considered as arising largely from an inability to make sense, from a mismatch of meanings and affordances</u>. Thus, the attribution of blame for such errors shifts from users to the designers who largely are responsible for the interfaces in which these errors arise.

One should distinguish errors that instruct users on how something can be made to do what a user attempted and errors that lead to breakdowns of particular practices. Product semantics makes controlled use of the first kind of errors by encouraging exploration without fear

of making irreconcilable mistakes, affording learning and self instruction. <u>Instructive errors enable artifacts to work themselves into existing practices or generate new understandings</u>. The second kind of errors leads users to a dead end, where help is needed but not provided. From the point of view of product semantics, complex user manuals for how to cope with breakdowns are not particularly user-friendly. They do not promote self-directed learning "on the fly." Even occasional <u>breakdowns of practices disable artifacts to survive the contexts in which they mean to work</u>.

Thus, the four theories for product semantics I have been proposing basically specify <u>four essential contexts in which artifacts should not break down and need to survive</u> existing practices. Understanding, the relationship between meaning and sense, affordances and circular enabling pattern of practice are common to all four contexts. Let me show how they look in each.

The Context of Use

Originally, product semantics was limited to solve problems of use and focussed attention to "the Psychology of Everyday Things" (Donald A. Norman 1988). These are problems of making something immediately recognizable for what it is, often called self-evidence, problems of configuring something so that it can be handled with well understood practices, so called semantic accomodation, and problems of natural acquisition of competence in use, also called self-instruction. Think about the problem of recognizing a fire extinguisher when needed and making its use clear, even under stress. Think about the frequent problem of arranging the switches of a four-burner stove so that it is obvious which operates which. Think about the problem of designing a

single-lever control element for a shower that prevents users from being accidentally burned. Think about the problem of visually representing multi-dimensional data on a computer screen so that they may be understood and manipulated with such familiar concepts as files, piles of documents, landscapes, desktops, tools, etc.

A frequent failure to accommodate even rather simple user's conceptions is the design of hardware on ordinary double glass panel doors, largely used on modern office buildings in the U.S. With hinges skillfully hidden, one cannot make out in which direction they open. With the same handles used on both sides of a glass panel, users are given no indication whether to pull or push the door open. Moreover, with one of the doors occasionally locked, seeking to enter a building ends up requiring up to four embarrassing trials before accomplishing this most ordinary task. Two rather general solutions offer themselves in such situations. One is by employing physical constraints, also called forcing functions, that restrict the user to only those options the device affords, like providing no handles to pull where a door needs pushing. The other is by using indicators that inform users about the options available, like a visual indication of whether a door is or is not locked.

To recognize what something is, to distinguish one artifact from another, research has shown that people approach objects with certain ideal- (also unfortunately called proto-) types in mind. We seem to judge first what we see in terms of its typicality (i.e., the degree to which something is similar to known ideal types, and seek then to explain how it differs from the most similar type. When someone describes something as looking "like a telephone" then reference is made

to the ideal-type "telephone". When this person adds "... but with more buttons," the difference between what is seen and that ideal type becomes explained. In this typology of types, a still more basic kind is C.G. Jung's archetype which is thought to be housed deep in the collective unconscious, not realizable in any one object (even though some artists seek to approximate archetypes in their work), but unconsciously entering the perception and evaluation of most things.

As far as the design of meanings is concerned, we found it helpful to distinguish between deepstructures and actual manifestations of meanings. Just as there are many different ways of expressing a thought so there are many different ways of making a deepstructure manifest in something. Keeping in mind that the meanings of artifacts equals the range of imagined contexts of use, a deepstructure or "gist" is generalized from these contexts, skeletal and primary, whereas its manifestation is concrete, detailed and secondary to users. For most people, a book is first or foremost something to read irrespective of its size, binding, cover, typeface and content, which are necessary characteristics of any book. Manifestations may convey irrelevant or accidental meanings that can distract from the intended practice. The fact that a book can also be used to profit from sales, to support the short leg of a table, to exhibit one's interest in a certain topic, to conceal a document or money is accidental.

To account for the understanding that underlies actual interface practices, users' cognitive models have become central concepts in product semantics. Out of different experiences with using things, people tend to develop a kind of operational logic for why things work the way they appear and how they can be controlled or manipulated

towards desired practices. These models can usually be constructed from the verbal explanations users give of their own behavior, protocols, transcripts of exchanges, etc. Construction of such models provides designers with a reference in terms of which the affordances of a product and the meanings it has to different user groups may be assessed.

Interfacing with something requires that cognitive models complement the behavior they "model" in a circular enabling pattern of action, perception and evaluation (see Figure 2). This requires timely and informationally adequate feedback about whether an action is accepted by a machine, what its internal states are and which options are available for future actions. A soundless keyboard for computers seems a great idea but because users then can no longer know whether a command is entered, this causes uncertainty and invites errors. Switches whose direction tell users whether the power is on or off provide feedback that pushbuttons may not. Moreover and closer to the effects, feedback on whether, for example, a motor actually is running may be more important for taking a next step than the knowledge of whether a switch is on or off. The best interface designs immediately show what the system is doing but only as much as is relevant for the cognitive models in use. The absence of feedback can leave a user uncertain and guessing and irrelevant feedback may be confusing.

To design something for non-habitual use, i.e., for users who expand their understanding to new practices, requires an appreciation of the dynamics of cognition. Two approaches have been found productive of such understanding. One is based on the fact that people differ in the way they explore their worlds, the errors they are willing to risk when

trying out a new practice, the amount of feedback information they feel is needed before acting, etc. Some users require logical transparency, others are willing to muddle through, still others need other persons to explain what they need to know. Designs should support all of these strategies of exploration without causing a total breakdown of practices. The other approach is based on a <u>conception of mind that recognizes metaphors and metonomies to be central processes</u> by which people extend their understanding to unfamiliar objects and practices. Metaphors are processes by which patterns from a familiar domain, are used to organize something in another and unfamiliar domain, metonomies are processes of generalizing from familiar parts to the organization of unfamiliar wholes. Metaphors and metonomies can often be embodied visually and then support users' understanding without or with only few trials and errors.

Human cognition never is fixed (contrary to how we tend to conceptualize the structure of machines). The continuous expansion of practices of interfacing to new and perhaps better things drives not only ordinary users but also designers who, to be honest to themselves, ought to design products whose meanings do afford the very cognitive dynamics they themselves cherish.

The final concept I wish to mention in conjunction with use is motivation, that what sustains the practice of interfacing with designed things. We distinguish between <u>internal motivation</u>, which may be derived from play, from feelings of belonging, balance and coherence, or from acquired aesthetic sensibilities , and <u>external motivation</u>, which is derived from the anticipation of goal achievement. Some motivation is necessary for an artifact to enter a context and be used there. But

this motivation is not limited to instrumentality which functionalists do assume.

Although the context of use indeed has been of primary concern for many designers, there are still three more contexts in which artifacts need to survive in practice.

The Context of Language

Designers usually underestimate the extent to which the meanings of objects arise with language use and crucially depend on non-users. There almost always are bystanders, judges, clients, reference groups or whole institutions who participate in the individual use of things by communicating about them. These "third parties" actively influence if not determine what something is, how it is to be used, who may use it and what value is placed on its possession. Moreover, the structure of the linguistic expressions used in this process has much to do with how the designed environment is being organized and intevened with. One can say that objects are constituted in language, participate in interpersonal relationships through language, become built into social realities by language and therefore must prove themselves viable in human communication, often before they enter a particular practice.

I might add that language is not only descriptive or referential as traditional semioticians assume, instructive or persuasive as rhetoricians insist, but can also be constitutive of social reality as Austin began to see. A priests' statement "I pronounce you hereby married" has no truth value by correspondence but makes the man a husband and the woman a wife. Khomeini's mere declaration of The Satanic Verses as a blasphemy makes it so and causes numerous rather real violent acts. Attributes that are publically associated with

particular classes of products whether through advertising, rumors or hands-on experiences enter individual perceptions and actions in profound ways. For example, products that can easily be made fun of are rarely sold and there are numerous examples where jokes drove a product out of the marketplace. When bargaining over their price, artifacts become exchange objects. When placed in a museum and reproduced in an exhibition catalogue, products become celebrated art objects and as a gift, products can bring people together, etc. Things that are named the same are easily confused in practice. All of these examples rely on a constitutive use of language (which is one of the cornerstones of an emerging cybernetic epistemology). Since language defines and helps weaving artifacts into social practices, artifacts must not only be physically useful but also <u>survive the socio-linguistic context</u> as well.

The need for artifacts to survive in language use starts already at the design phase. Designers receive their assignments in linguistic forms--ranging from vague notions of client's desires to formal contracts, including the design specifications to be met. Designers argue among themselves, make presentations to clients and are well aware that the models and proposals they develop have to withstand the judgement of critics and overcome numerous barriers to realization all of which are largely subjected to arguments. Things that cannot be described can hardly be designed, are impossible to produce industrially, are unlikely to be used and are therefore largely non-existent. Design activities are to no small measures communication activities, aimed at a consensus among all those concerned on what a product should be for or mean to potential users. An understanding of

the language used in design processes therefore is indispensable for understanding of the reality it constitutes.

There are innumerable examples of how the structure of spoken language is implicated in how we conceptualize, design, see and manipulate things. For example, the linear subject-verb-object constructions in English probably are responsible for thinking in terms of instrumental action-actor-target sequences, functions and the like. They also account for designing computer interfaces in terms of (visual) objects and actions to move, transform, create or dispose of (file or erase from memory), for the use of signs for what controls are for, and for giving how-to-instructions to users. Such linguistic constructions give evidence for the existence of deepstructures for understanding artifacts not just for designers but for users as well.

For another example, consider adjective-noun constructions. Adjectival forms serve as natural models for perceiving products as possessing certain semantic qualities, attributes, characters, meanings that classify or order them accordingly. Reinhart Butter's method of translating a set of semantic attributes into the visual manifestations of a product is based on these constructions, as is Charles Odgood's semantic differential that has been used to evaluate the success of such translations. The Lannochs' proposal for a method of semantic transfer similarly starts with adjectives along qualitative dimensions of what they call a semantical space and proceeds to locate a product within that space. It is important to note that most of the adjectival constructions and several dimensions of Lannoch's semantical space makes reference to a user, a speaker, relative to whom experiences,

orientations, comparisons, affordances, etc. are expressed which makes this notion of space fundamentally different from geometry.

At the users end, language is implicated in negotiating the emotional, social and political meanings of products and the practices afforded by them. For example, virtually all objects someone acquires or choses to surround him or herself with can become expressive of that someone's <u>individual identity</u>. The brand of car driven, the artwork collected, the style of dressing or furniture arrangements, all participate more prominently in interpersonal communication than in physical use. Products can become conventional symbols of social differentiation, integration or status and enter conversations in this capacity, thus giving material support for social relationship that are largely created and maintained through language.

A linguistic theory for product semantics must therefore capture those interactions through which distinctions, definitions, social identifications and differentiations of meanings are negotiated, through which products become incorporated in the larger system of artifacts and through which objects participate in human communication. Without the ability of being expressed in language, the meanings of designed objects cannot be shared and ignoring the role of language in designing things may produce functional, but socially useless devices.

The Context of Genesis

For designers, objects have other meanings as well. These result generally from their role in the continuous material reproduction of culture and specifically from guiding artifacts through the web of processes of production, dissemination, consumption, use, and retirement.

The context of genesis essentially consists of a complex process, a process characterizable in terms of communication, that connects designers, producers, bankers, engineers, advertisers, retailors, sales persons, buyers, consumers or users, market researchers, recyclers, etc., into a huge circular network which brings about the transformation of material culture. Within such a production-consumption network objects may be seen as temporarily frozen patterns, gestalts, forms or messages that invite participantion and suggests appropriate responses transforming them into another medium or passing them on to others. When such a succession of transformations comes back to where it started, applies to its own transforms, learning can take place within the network. Indeed, designers never do create industrial products but models, renderings and presentations or communications that must make sense to clients so that they can do something with them. Drawings must be specific enough to guide production engineers to design appropriate tools and product managers to design appropriate marketing research and implementation strategies. For bankers, production plans must make sense financially. For sales persons, products must communicate their potential for profit as incentives for selling them and for users, products must communicate their affordances as incentives for fitting them into their practice of living, etc.

The word "successful" derives from "succession" and to be successful in the context of genesis, <u>a product idea</u> and any pattern that derives from it <u>must be able to pave its own way through the network of production and consumption</u>. This implies that it must be meaningful to everyone involved and at every stage of the genetic process clearly express where it comes from, what can be done with it

how and why, and where it might go next. In this context, design processes result in communications that resemble addressed messages which inform a great number of receivers of opportunities and incentives and include a recursively embedded sequence of similar messages addressed to successive receivers, ultimately leading to where designers want their message to go before something comes back. The process is a process of communication but not between one sender and one receiver through an established channel. Messages here create their own channels as they are passed along.

Designers rarely do entirely ignore the semantics involved in genesis. All have at least some idea of where they want to go with what they do. But, designing products with an eye on prestigious design awards or important publications on the one extreme or assuming the role of frustrated advocates of a certain formal style against industrial interests on the other, does not reveal much depth in understanding the semantics that drives the complex network of production and consumption.

Often the understanding of the semantics involved is only partial, for example, when designers leave their ideas unexplained to the seeming arbitrary interpretation by clients and then become frustrated about what becomes of them. Often the understanding of the semantics involved serves some interest more so than others, for example, the design of corporate styles that convey to users the source of a product with the hope of creating commitments to buy a whole family of products from the same source (having little to do with actual use). Often the understanding of the semantics involved does not govern the whole process, for example, witness the plight of ecologically minded designers to support the development of products that are either

biodegradable, low in entropy or contain instructions on how to recycle them after retirement. The lack of knowledge on how to direct such processes reveals industrial blind spots in the production and consumption cycle. Only <u>when the designers' messages either pass through or generate complete circular chains are designers able to make adequate sense of their own activities</u>. (This is of course true for all the participants in a network of production and consumption for a circle has neither beginning nor end). A design theory for product semantics in the context of genesis therefore describes the network of production and consumption as a communication process that attributes to all participants, including designers, the possibility of understanding, creating and taking responsibility for their own contributions to material culture.

The Ecological Context

The fourth and last design theory for product semantics I have been proposing pertains to the meanings of objects in an ecological framework. Design theory in this context is again structurally different from the previous ones. Let me explain.

In biology, ecology is concerned with the interaction of large populations of species of animals, plants, minerals within their respective environments. It seeks to understand the dynamics arising from species feeding on each other, like the population of foxes feeding on the population of rabbits and achieve dynamic equilibrium conditions. It tries to understand how species move into niches, replace others already there and defend their "territories" against possible intruders. Ecology also studies a variety of relationships that emerge in such interaction, for example cooperation, competition, parasitism,

symbiosis. I have been following Kenneth Bouldings suggestion to extend the biological notion of ecology to species of artifacts such as cars, bricks, appliances, microchips, telephones, furniture, copy machines and watches, all of which are designed and mass produced, and road systems, cities, constitutions and social organizations which are artifacts as well but may be said to have a natural history of their own.

Thus conceived, ecology should not be confused with a conservative attitude toward nature. Keeping pollution of our environment to a minimum, preserving the habitats of endangered species, recycling what was heretofore discarded as waste are important concerns in the domain of a design theory for genesis. Theory in ecology elucidates what happens to large populations of species in interaction.

Let me mention a few issues that ecological theories for product semantics need to embrace.

Firstly, designers who may have the design of a particular product in mind might ask themselves why should they be concerned with how different population of species of artifacts interact, why should they be taking a global perspective when local action seems to be called for? The answer to such legitimate questions is that no one can really prevent several species of artifacts from getting involved in a variety of relationships that constitute whole systems and confine their particular members (including designers) as well. For example, artifacts compete in the sense that an increase in numbers of one kind decreases the numbers of another. This was the case between horses and automobiles until horses found a niche which cars cannot penetrate. Competition is still ongoing between typewriters and computers, between film and video cameras for home use, etc. The use of quills for writing

has virtually died out. Quills now exist in the context of museums where they are no longer used the way they were. We can also observe symbiosis among artifacts, for example, between computers, software, mathematics, telephone networks, etc. which bring their numbers in positive correlation, support each other's viability and form larger cultural complexes that can engage in competitive, cooperative, parasitical and dominance relationships with others as wholes.

Styles, functional complementarities and combinational compatibilities also can become major attractors that bring artifacts together. For example, such rather different objects like forks, plates, glasses, napkins have developed family resemblances and are kept together in most households just as rather different art objects from a particular culture, period or style are likely to find themselves exhibited (or used) in the same locale. Even if their concern is just another product, designers always contribute to ecological interactions of this kind by varying a form, creating similarities and differences, carrying technology from one domain to another, materially supporting a modern practice over a traditional one, etc. Yes, designers must act locally but the ability to assume responsibilities for such actions requires taking larger perspectives. <u>An ecology with artifacts is the most global perspective and entails the most important responsibilities a designer can assume.</u>

Secondly, while an ecology always is self-organizing, allowing no single species to be in charge of all others (not to be confused with the possibility of dominance relationships) and in fact making it impossible for any one participant to understand the whole, there is a crucial difference between an ecology with and an ecology without

artifacts.   In biology, organisms fend for themselves and a pre-technological ecology comes about because there is such a great variety of them, including humans, that do this so well. Artifacts, on the other hand, are man-made, participate in the ecology in important ways but never without a multitude of human brains putting them in place and keeping them in motion. The difference between an ecology with and one without artifacts is meaning, which seems to me the most important organizing principle of ecological interaction between objects. When I said the horse had been pushed into a niche where cars can't enter, and remembering that meaning equals the set of contexts in which something makes sense, I also could have said that the horse acquired unique meanings no longer shared by cars (and other forms of transportation). The radio has not just changed in numbers relative to television sets but as a consequence of this competition acquired special meanings unknown 50 years ago. In an ecology, the meanings of whole classes of artifacts are constituted relative to all other artifacts they compete, cooperate or interact with. It is our collective conception of what they all have to do with each other that makes us making them interact. In this context, we thus go beyond use, language, production and consumption and become concerned with what forms dynamic systems of symbolic entities. Underlying this is the fact that we always make sense of our practice with things but, as we generalize these experiences to the meanings of things and apply these meanings as guides for our practice of living with things, we inevitably organize the ecology that surrounds us. Thus meanings, the symbolic qualities we attribute to objects relative to each other are the key to understanding the ecology of our own cognitively constructed world.

Thirdly, designers are not only part of an ecology with artifacts
(just as all, including humans organisms, participate ecologically),
since meanings provide the fundamental organizing principle of
artifacts' ecological participation, the designers' understanding of
artifacts becomes part of the very ecology it brings about. Whereas
design theories for the context of use, language and genesis could be
formulated from a position outside their respective empirical domains by
uninvolved observers, so to speak, an ecological design theory is part
of the very ecology it describes, must be constructed inside its own
domain and while design, as an intervention in the practice of living,
is being practiced. This self-reference constitutionally involves the
designers' own understanding, including of themselves. Design theories
in the context of ecology can therefore be said to be theories of
designers' mind and practice.

Figure 8

But back to the role of meanings in an ecology. Some cultural
anthropologists have long seen the artifacts we create as the medium
through which cultural identities are preserved and communicated to
subsequent generations. Others have gone so far as to equate culture
with the artifacts a society uses. It is the idea of product semantics
that has forced us to become more specific in this regard and to
identify the cognitive processes that enable designers to create things
that are meaningful to others, things that people can use, talk about
and assemble into lager complexes, things that enable design practice to
be distributed and become part of everyday life (not monopolized by a
select few), things that center individuals in an individually
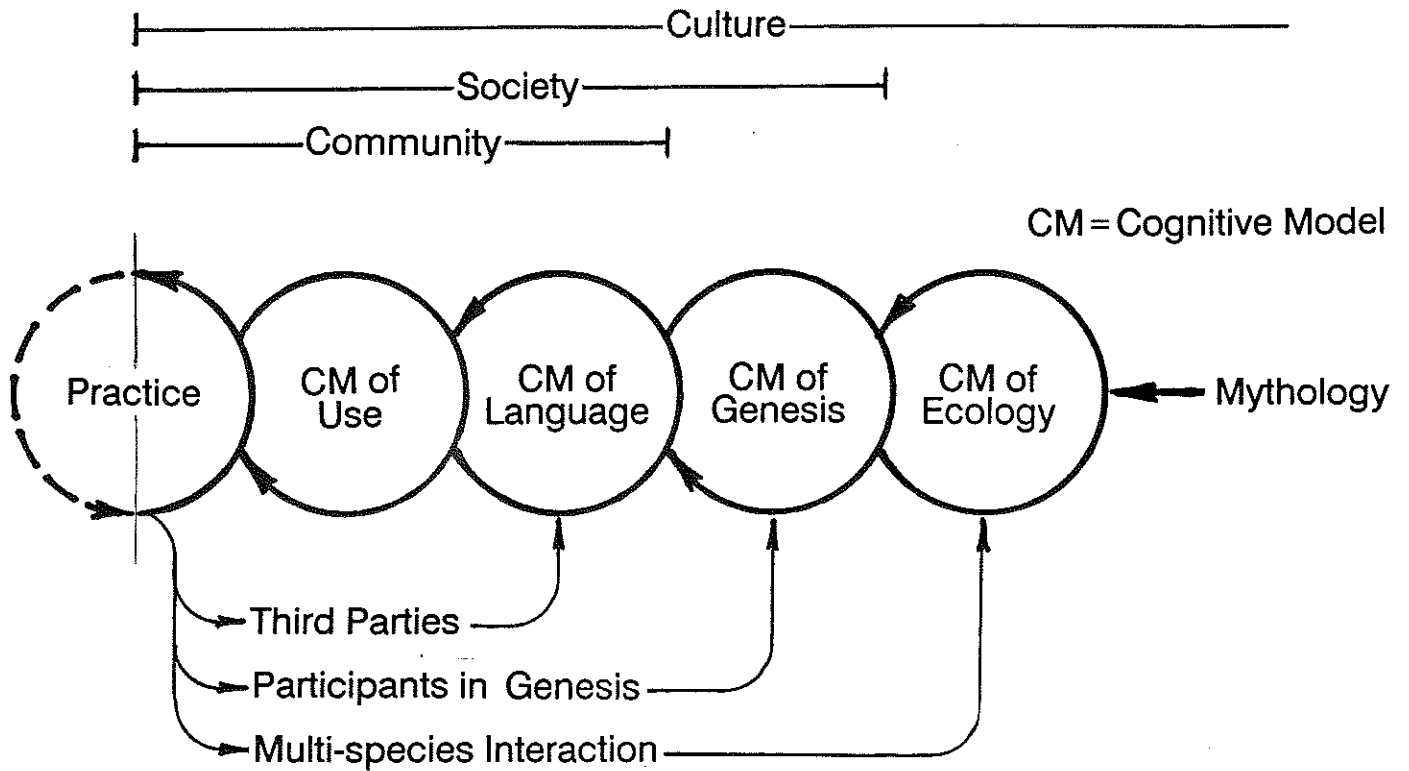
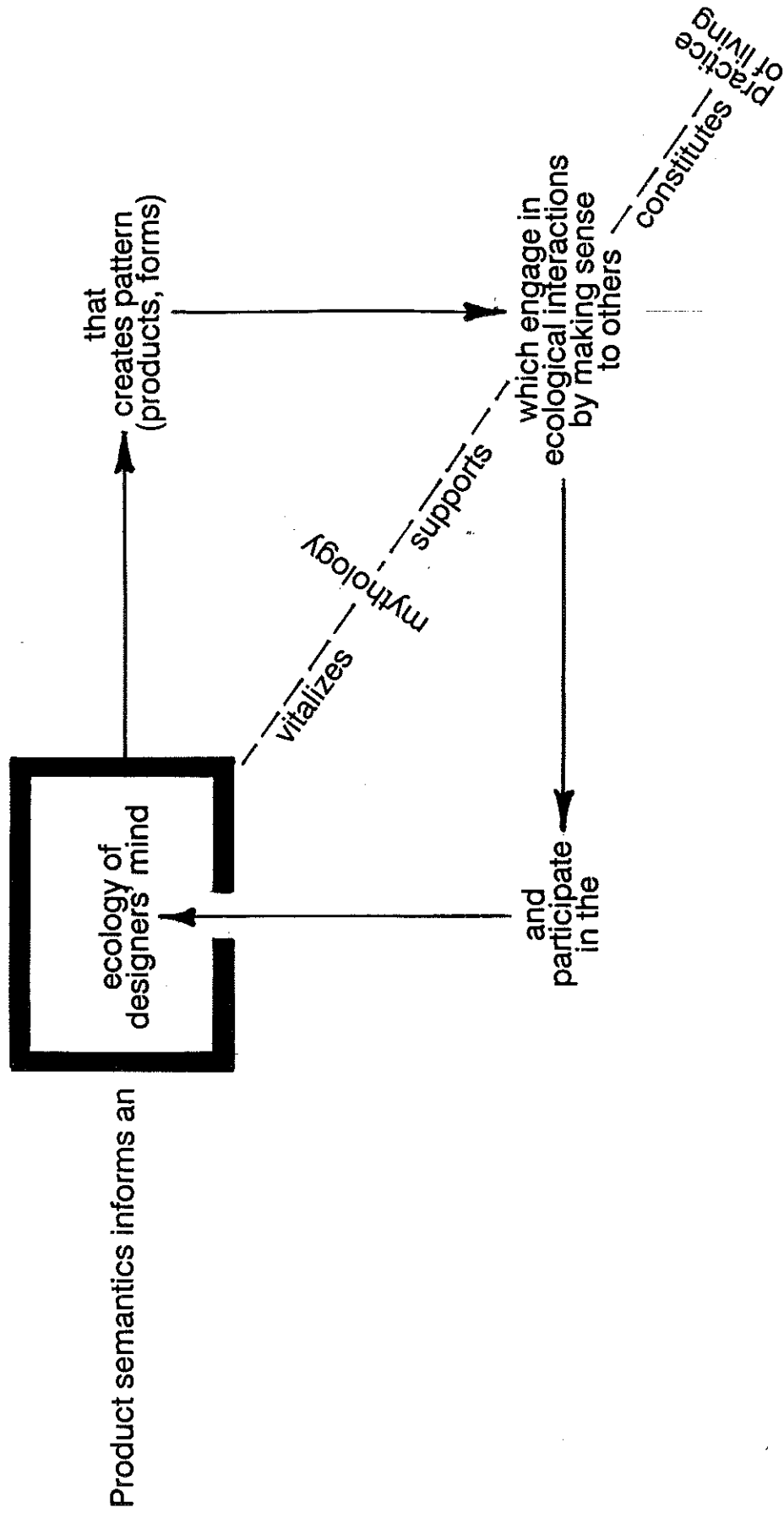Processes in an Ecology of Designers' Mind

Figure 8

meaningful but constantly evolving world. The design theories of product semantics I have sketched so far are manifestations of different levels of an ecology of designers' mind.

Mythology probably is the most important and unconsciously embracing governing structure in an ecology with artifacts. C.G. Jung pointed this out long ago but applied his insight to psychoanalysis only. A culture can hardly be conceived without myths either and the vitality of its continuous reproduction, the ecology of its meanings, derives directly from them. In some cultures mythology is embodied in ritual performances and communicated through stories of supernatural beings and Gods who interact with each other, and perform deeds of immense power. Such stories often serve as examples of how humans interact with each other and through the artifacts of their own creation. In the industrialized West, mythology has become more suppressed, unconscious and implicit in superstitious beliefs, in routine cultural practices, in literature and entertainment but it occasionally surfaces rather concretely whether in starwars (the movie and the defense system), in the idea of intelligent machines (in science fiction and in the design of computers and robots) and in the need to feel one with others (whether by telephone connections or by participation in the mass media). Mythologies give coherence to large cultural ecologies, complexes that no single individual can understand much less design in its detail, assign all participating things meaningful roles and direct them to interact in ways that have developed over centuries of human social existence. Design strategies that go against ancient that ecological wisdom are likely to fail.

In his analysis of Gandhi's use of various objects, S.Balaram has pointed out, that artifacts symbolically mediate between the deep-rooted, often unconscious and relatively stable mythological heritage of a culture and the relatively fast changing socio-economical contexts of everyday life. With the support by powerful mythologies, artifacts can gain considerable ecological strength and introduce meaning and centeredness into everyones life. Whether through designers' ignorance or preference, for example, for a functionalism that cannot cope with meanings at all or for a semiotics of reference that create pathologies in design, the lack of support by existing mythologies can produce an inhuman technology that destroys the larger message that culture is.

Figure 9

Only when designers are able to see themselves as part of the larger system of meanings, an ecology that guides the creation and use of artifacts, changes the material world including their own understanding of it, can designers assume responsibilities for their own ecological interventions, which ultimately are interventions into their own practices of living. On the level of ecology, product semantics seeks to establish the kind of symbolic resonance between the mythological heritage of a culture (or whatever the modern equivalent may be called) and the material support through which practices of living become meaningful and keep human users of artifacts centered and alive. Whoever realizes such connections also centers and vitalizes his or her own ecology of mind. Such aims of product semantics provide a wholely new outlook in design.

Product semantics informs an

that
creates pattern
(products, forms)

which engage in
ecological interactions
by making sense
to others

constitutes

practice
of living

and
participate
in the

ecology of
designers' mind

vitalizes

mythology

supports

Environment of an Ecology of Designers' Mind

Figure 9