chapter nine

Roots in the Ulm School of Design?

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Origins are hard to prove, and answers to questions concerning them offer at best arguable reconstructions. The following is no exception. Clearly, the semantic turn is not a mere extension of what was taught and deliberated at the Ulm School of Design,* where I studied industrial design from 1956 to 1961. For one reason, the culture of technology at that time did not require it as much as it does now. Ulm happened during Germany's reconstruction after WWII and during the transition from an industrial to a postindustrial society, a transition not recognizable at that time. For another, science, naively cherished in Ulm, has moved away from the then prevailing positivism. Finally and personally, I continued to study communication in the United States, became a professor at the University of Pennsylvania's Annenberg School for Communication, and am now weaving my understanding of human communication back into design, an understanding that developed largely outside and after Ulm. Although my ultimate involvement in communication theory and research can be traced to Ulm, product semantics was formulated only in the 1980s, and its growth into the philosophically grounded and social science informed semantic turn in design is a more recent phenomenon. Let me suggest where credit is due and where claims of origins might have to be qualified.

Surely, the Ulm School of Design was an intellectually unique and enormously creative place. It was also far less monolithic than it might appear from its outside and in retrospect. Its faculty was amazingly young and came from several countries. Numerous designers, architects, cultural critics, and scholars at the cutting edge of their fields passed through Ulm and were given opportunities to present their ideas and often worked with students for a while. Through these guests and a small but current library, new vocabularies entered Ulm's discourse. They were tested and contested, always in conjunction with particular design applications, and affected the curriculum unevenly.

* Hochschule für Gestaltung (HfG) Ulm, Germany, 1953–1968.

9.1 *Bill's functionalism*

Functionalism probably was the most deeply engrained vocabulary at the Ulm School of Design. There, much as in most design circles at the time, Louis Henry Sullivan's dictum *"form follows function"* served as a principle for rational justifications of designs. It asserted the conviction that once the function of an artifact was understood, its form would naturally emerge from that understanding, and conversely, if the form of an artifact had little to do with the function it was meant to serve, its function had not been understood well enough to start with.* We, the faculty and students at the Ulm School, relied heavily on this functionalist logic and tradition. We referred to THE function of cultural artifacts as if it was obvious that all artifacts had to have one or be worthless. There was no critical questioning of what a function was, where a function came from, and who or what defined the function in question. There was also no discussion or awareness of the conservatism that part–whole relationships entailed (Section 8.5). Accepting a function as the goal of a design meant not to question the whole of which it was to be a part, the larger context that the artifact was meant to "serve." For example, while designing tableware, eating practices are not questioned, much as while developing a radio, the whole system of radio transmission and programming is assumed given. Taking the larger whole for granted is, of course, a way to limit a design problem and get it done, but it is also a way to submit to prevailing conceptions that restricted spaces for design. More important, in Ulm, we reasoned with this functionalist dictum as if our vocabulary had nothing to do with merely seeing the world that way. Our discourse, and just that, made functions appear to be objective, amenable to scientific explorations, and the topic of seemingly rational discussions. Owing largely to the influence of Max Bill (1952) — founder, first Rector of the Ulm School, and on its faculty until 1957 — the vocabulary of functionalism became refined and ended up recognizing four functions: technical, material, production, and aesthetic.

1. **The technical function:** All designs were expected to satisfy their mechanical purposes (within a larger whole). Max Bill saw this as the primary function of products. The philosopher and long-time guest professor Max Bense called it the "technical function," one of three semiotic dimensions he believed all objects of design had to satisfy.** Reinhart Butter and I (Krippendorff and Butter, 1993) wrote critically about this functionalism, and the discussion of the logic of functionalism (Section 8.5) explored the implications of this part–whole relationship.

* As elaborated in Sections 1.2 and 1.3 and illustrated in Figure 1.3, miniaturization has made this design principle technologically obsolete or at least not generalizable to electronic artifacts. There simply is no natural form that could be derived from the miniscule circuitry. Often, the body of such artifacts reduces to a human interface or is absorbed in another device, in a computer, for example.

** Bense (1971:79, 81) considers design objects in terms of three semiotic dimensions: form, materiality and function and combines these with Peirce's (1931) triadic distinctions.

Thinking within established categories, obviously, a watch is expected to tell time, a chair is expected to carry the weight of a sitting person, and an automobile is expected to enable people to drive from one place to another.

2. **The material function:** This dimension entailed the obligation to use materials appropriately, in German, "Materialgerechtigkeit." This commitment tied Ulm to the design tradition of craftsmanship, starting with William Morris at the turn of the century. It encouraged designers to make use of materials in ways most fitting to their nature. For example, the Ulm stool in Figure 9.1 was used to sit on two levels, at a table or desk and more informally during discussions, parties, or lectures. It afforded carrying personal belongings, serving as bookshelves in the dormitory, and as a lectern on top of a table. It exhibited not only all the materials it was made of — the three flat pine boards, and the hardwood dowel and edges — but most important, it revealed and was meant to show the craftsmanship in their joints. Showing the (good) craftsmanship of their makers was considered a matter of "honesty" as opposed to "deviously" covering it up by other materials, paint, for example.

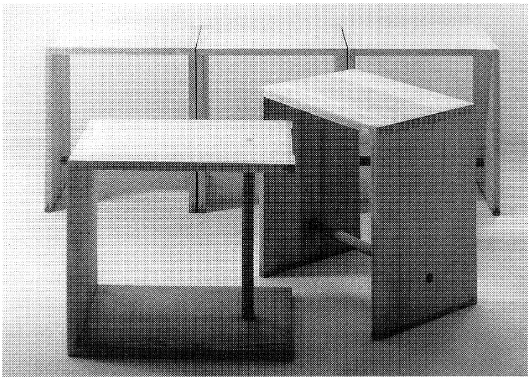


Figure 9.1 The Ulm stool — its form, true to its materials — by Max Bill and Hans Gugelot, 1954.

3. **The production function:** This function entailed the obligation to find forms especially suited to economic mass production, culminating in the demand that products should ideally express or at least not conceal their industrial origins, their means of production. This dimension went beyond the Bauhaus manifestos of the 30s, which sought to commit designers to make their products accessible to everyone, hence, mass producible. But in Ulm, this commitment to an egalitarian vision achieved the status of a function: the forms of artifacts had to accommodate the available means of industrial production. This function was

used to justify rectangular volumes, machined surfaces, repetitive patterns, and combinatorial systems over unique and artistically embellished products, for example, by celebrating the modularity of stereo equipment and prefabricated architecture. Figure 9.2 presents the design of a briefcase whose plastic shells were identical so that they could be produced from the same mold. When the briefcase was closed, the snaps complemented each other in perfect symmetry.

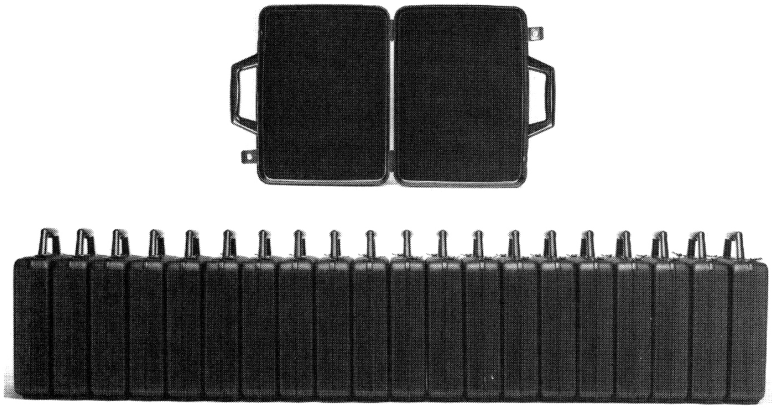
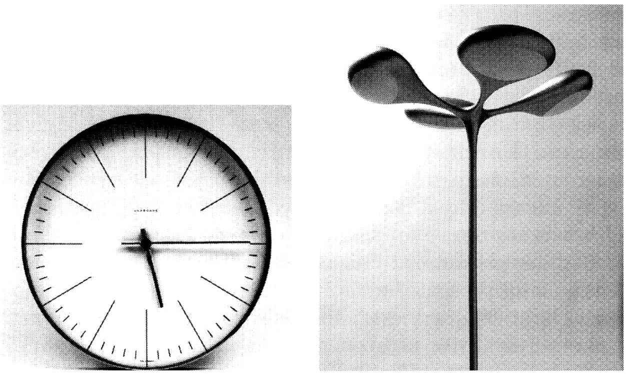


Figure 9.2 Plastic shell briefcase — identical shells in service of their mass production — by Peter Raake and Dieter Raffler for Hanning, Paderborn, 1966.

4. **The aesthetic function:** According to Bill (1952), this function embraced everything that could not be accounted for by technological, material, and production functions. He visualized the domain of aesthetic decisions as a space of all options that the other three functions did not rule out. The concept of an aesthetic function stayed within the functionalist discourse, obviously, but reserved artists a legitimate place in that discourse. In Bill's vision, design was the art to integrate the forms of everyday things into the industrial-cultural context in which they were to function. In Ulm, the aesthetic function came to embrace such virtues as consistency, simplicity, symmetry, clarity, cleanliness, and honesty, none of which were captured by the other three.

It is important to note that Bill defined the aesthetic function in the negative, as a leftover category, as what remained open to choices after the constraints of technical, material, and production functions had been satisfied. Logically, this was a remarkable move because now all qualities of form could become the target of functional explanations, which made his functionalism "complete." By reference to these functions we could exhaustively examine and justify or dismiss any design, including arguing for the infamous gray boxes, even when they presented challenges to manufacturers. To achieve "good form" in Bill's terms meant that all four functions had to be satisfied.

In the absence of theoretical propositions in the domain of aesthetic functions, the prevailing contempt of arbitrariness and intuition, and of forms that failed rational, i.e., functional analysis and justification, Bill drew on mathematical justifications, originally for his nonrepresentational art, called "concrete art." In 1949, he wrote: "The mainspring of all visual arts is geometry, the correlation of elements on a surface or in space. Thus, even as mathematics is one of the essential forms or primary thought .. it is also intrinsically a science of the relationship of object to object, group to group, and movement to movement" (Bill, 1949:86–90). In Ulm, mathematical forms came to be associated with nonarbitrariness, unquestionable purity, and the highest aesthetic quality. Figure 9.3 shows two examples, designed about 10 years apart but manifesting the same spirit. Remarkably, both designs, like most that were developed in Ulm, proposed forms whose aesthetics were hidden behind mathematical justifications, but envisioned no new uses — a manifest consequence of the conservatism inherent in functionalism.



(a) (b)

Figure 9.3 Mathematically justified forms — (a) wall clock by Max Bill for Junghans, 1957; (b) street lighting by Peter Hofmeister, Thomas Mentzel, and Werner Zemp; instructor Walter Zeischegg, 1966.

Bill's wall clock reduces the clock to its conceivably simplest graphical display· its face — today one would say to its (graphical) interface. All of its features are mathematically justified. For example, the length of the hour hand equals the radius of the face. Both hands reach the ends of the divisions of the circle into hours and minutes, exactly. The form of the street lighting derives from minimizing the proportion of surface to volume while as a matter of obvious functional necessity connecting the lights to a pole. To the designer's credit, after nearly 50 years, Bill's wall clock is still on the market and today, the street lighting could easily win design competitions.

Logically, Bill's aesthetic functions, defined by negation, would include product semantics in its domain. However, in celebrating mathematical forms — geometry, symmetry, systematic repetitions, and formal aesthetic principles (Section 8.6, item 2) — which are inherently a-contextual, supposedly determinate, and objective, nonabstract meanings are ruled out. There was no way that the semantic turn could have found a place and grow in Ulm's functionalism.

To be fair, technical functions, to the extent they are commonly understood, could be regarded as common meanings of some kind. For very simple tools, like tableware, bicycles, or umbrellas, there probably is no difference between the functions they are to serve and what they mean to most users. For more complex artifacts, the technical functions that engineers have to work with typically deviate from the meanings that users have of these artifacts. Computers, transportation systems, and the Internet, for example, could not be realized entirely with the understanding that their users have of them. The semantic turn acknowledges diverse stakeholders to have different meanings. The technical functions that engineers are concerned with are important only for a short period in an artifact's life. In use, in language, and in an ecology, artifacts have different meanings, and designers may have to consider all relevant meanings. In Ulm, we acknowledged that products could and indeed should serve several functions, like the Ulm stool shown in Figure 9.1. But all of these functions were thought to be universal, not cultural or social. Universality of meaning is utopian and utopians we were.

Another anecdote might shed light on the difference between how these matters were attended to at Ulm and now. To fulfill an assignment aimed at clarifying how various semantic character traits (Section 4.3) can be made manifest, a student of mine at Philadelphia's University of the Arts, where I teach occasionally, presented a Slinky for its expressing the character traits "flexibility," "lightweightedness," and being "intrinsically motivating" (as opposed to extrinsically or instrumentally motivating — Section 3.5.2). Her photographic image of that Slinky resembled one that was published prominently in Bill's seminal book, *Form,* which defined his notion of "good form" by a collection of aesthetically exemplary designs. Bill's caption of the Slinky celebrated it as an "ingenious" toy whose movements and the sounds it makes are "indescribable" (Bill, 1952:108).* Evidently, this was true then. Now, a vocabulary, measuring scales, and practical procedures have been developed for mapping semantic attributes into the characters of human

* The caption of this photograph reads: "Diese Stahlfeder ist eines der genialsten existierenden Spielzeuge. Seine Bewegung in der Hand und sein Klang können nicht beschrieben werden. Diese Feder wandert, unter anderem, selbständig die Treppe hinunter." — "This spring of steel is one of the most ingenious existing toys. Its movement in one's hand and the sound it makes are indescribable. This spring walks, among others, down a flight of stairs, on its own."

interfaces, the very phenomena that could then be described only in the geometrical terms (Slinky = a perfect spiral) of an "aesthetic function."

Bill deserves credit for recognizing that the human qualities of forms could not be reduced to technical, material, and production functions, which, in the 1960s were increasingly recognized as the cause of failures of strictly functional designs. Functionalist mass products caused not too many problems when they turned out socially unusable or lacking meaning. They could simply disappear from the market. But functionalist buildings often became unlivable horror stories, and functionalist city plans just did not work as intended, often eliciting high human costs. Without human-centered conceptions, without openness to second-order understanding in Ulm, we could not see that talking, working, and justifying designs within these functions boxed us into our own limitations.

9.2 *Bense's information philosophy*

An idea that shaped my interest in semantics is Claude E. Shannon's *Mathematical Theory of Communication* (Shannon and Weaver, 1949), called information theory for short. Max Bense presented a version of it in lectures between 1954 and 1958, and his books on information aesthetics (Bense, 1954, 1956, 1958, 1960), followed by Horst Rittel and finally Abraham Moles. Bense subscribed to the Cartesian distinction between a material-energetic reality and an intelligent "co-reality." From the perspective of information theory, reality, determined by thermodynamic contingencies, was seen as converging toward a state of entropy, a measure of disorder. And coreality, shaped by human intelligence, was seen as increasing the amount of neg-entropy, a measure of order. For Bense, both worlds were conceived of as dynamic and digitized. Reality was subject to natural laws, hence probable; coreality was governed by intelligent choices, creativity, newness, and hence improbable. Aesthetic production therefore was inherently neg-entropic and order creating. With these conceptions, Bense sought to transform aesthetics from a philosophy of appreciating beauty to a philosophy of the artificial, of the cultural production of technological artifacts, works of art, and texts.

In information theory, neg-entropy increases with the improbability of the produced work, with the number of possible works from which it was chosen. Entropy increases with duplications, with the mass production of the same kinds, resulting in an increase of the likelihood of any one of them. By equating the measure of the neg-entropy of a cultural artifact with its aesthetic value, Bense's aesthetics entailed a quantum-dynamic theory of culture: According to this theory, the products of the avant-garde, being radically new, highly improbable, and maximally surprising, turn also out to be most informative aesthetically, but in their extreme also incomprehensible. And as these products become more common, by mass reproduction or increased familiarity, their information value declines to the point of losing any aesthetic appeal. Naturally, students and faculty of the most innovative and advanced school of design at that time wholeheartedly embraced

Bense's aesthetics and intellectual justification as a theory of their own mission in an industrial culture.

Shannon's information theory did not address issues of meaning. This went well with Bill's project of concrete art, an antirepresentational program that can be traced to the Bauhaus, Bill's alma mater. I am convinced that his project is what drew Bense to Ulm. A consequence of Bense's information aesthetics was that students started to count, and experienced how problematic it was. Entropy measures were relatively easy to obtain for the typography of texts, but they could become quite arbitrary when applied to paintings, even of a nonrepresentational kind, and to industrial products.* Counting and computing everything by hand severely limited comparisons of information quantities to very small sample sizes. An avant-garde poem instead of poetry, a printed page instead of newsprint. However, the idea of information as a relative quantity associated with the probability of one artifact, text, or character within a large repertoire of them unwittingly diverted our attention from the aesthetics of single artifacts (works of art or design) to an aesthetics of the distributions of artifacts, to an aesthetics of the dynamics of mass culture. The absence of representational meanings in this theory conveniently bypassed the two-world ontology of semiotics. It led us to talk of information as a measure of textuality — as one would call it now — and nudged us to think of communication in nonrepresentational terms — in my case, of how artifacts could inform potential users of their own use, without standing for something else.

Subsequent to my time in Ulm, I had the fortune of studying with the cybernetician W. Ross Ashby at the University of Illinois. Shannon's theory was part of the tool kit of cyberneticians, and I became more thoroughly acquainted with it. I contributed several papers, including a book (Krippendorff, 1986) on the subject. Looking back to how information theory was handled in Ulm: we, faculty and students at Ulm, had a vastly overextended and mainly discursive understanding of it. The lack of mathematical training to look through its formalism, the absence of computers, and perhaps naively equating counting with being scientific, prevented us from experiencing its limitations and contributing to it. However, Bense managed to stir our attention to our own role in the dynamics of cultural production, in what I would now call a quantum theory of designed artifacts or, more broadly, of technology.

Finally, in his heart, Bense was a taxonomist. In lectures on the philosophy of science, he presented a systematic classification of all the sciences, filling holes with scientific disciplines to be realized, but being quite oblivious to the political gerrymandering of the boundaries among the sciences. After he left Ulm, Bense (1971) elaborated Charles S. Peirce's theory of signs, iterating its distinctions and generating thereby a whole system of ever-finer differentiations. Although the title of this elaboration, *Sign and Design*, promised to

* Garnich (1979) is an example of these efforts. His 1968 dissertation was supervised by Max Bense for a doctoral degree in philosophy at the Technische Hochschule Stuttgart.

be about design, it did little to clarify its practice. Bense was a creative philosopher, a prolific writer, an enormously effective teacher, and probably the most influential intellectual force in the early part of Ulm. However, I am not sure if he would have been willing to make the semantic turn here described. I do not recall him mentioning Giovanni B. Vico, Ludwig Wittgenstein, Mikhail Bakhtin, J.J. Gibson, or Jacob von Uexküll who prepared me for this turn. Accepting the notion that artifacts are social constructions would have meant for him to give up his Cartesian *Philosophy as a Mirror of Nature* (Rorty, 1979). He was too impatient to acknowledge divergent and especially "intellectually inferior" understandings, which is a presupposition for second-order understanding to arise. When I met him at the 1989 International Design Forum, held on the site of the former Ulm School of Design, I had hoped to tell him about the exciting developments of the semantic turn and to ask him whether he could relate to it. Before I could, early in that conference, he stormed out in protest over a speaker's irresponsible philosophizing. He promised to visit me in Philadelphia but passed away before this could happen.

9.3 *Maldonado's semiotics*

In 1956, Tomás Maldonado replaced Max Bill as the rector of the Ulm School. A year later he introduced semiotics into the curriculum. Bense (1956) had already paved the way for its reception in lectures and publications on a theory of signs, largely in the service of his information aesthetics, later focusing on Peirce's distinctions (Bense, 1972). Semiotics was Maldonado's effort to put his "scientific operationalism" into the driver's seat of design, partly in opposition to Bill's vision of a designer as a kind of aesthetic coordinator of cultural artifacts. To the best of my knowledge, Ulm was the first design school that acknowledged the subject. Maldonado was particularly fascinated with the politics of semioticians. In his seminar, he traced the influences that various schools had on each other, who adopted whose definitions, and so forth. During these explorations, he became committed to the work of neo-positivists, particularly Charles W. Morris (1955) and more generally to the Unity of Science movement. Count Alfred Korzybski's (1933) somewhat obscure General Semantics entered Ulm through guest lectures by Warren Robbins, a cultural attaché at the U.S. Embassy in Stuttgart. As his own contribution to semiotics, Maldonado (1961) published the definitions of 94 terms. These definitions were intended as analytical tools and as a way to canonize the semiotic discourse for design. Subsequently, Maldonado's students added rhetorical concepts and applied them descriptively, largely to visual phenomena (Bonsiepe, 1996).*

* Pages 91–103 of this book contain a rewritten article, originally published in the journal of the HfG Ulm: *Ulm*, 14/15/16, 1965.

The absence of empirical investigations *with* these terms — using human subjects to verify the semiotic distinctions — and *of* these terms — critically evaluating how the vocabulary of semiotics aided design — attests to Maldonado's belief in the universalism of semiotics, following the hopes of the already mentioned Unity of Science movement. But universalism leaves no space for alternative constructions of reality. Its propositions are not taken as mere hypotheses but as objective and hence culture-free generalizations of facts (Section 8.1). In condensing the diverse definitions published in the semiotic literature to a single consistent set — without theoretical propositions — Maldonado demonstrated a taxonomic or classificatory conception of science, which is essentially closed to empirical validation.

The neo-positivism of that time prevented semioticians from recognizing that semiotic distinctions — actually all terminological distinctions — are drawn in language and negotiated among people who care about them. Terminological distinctions create differences, constitute the very reality they claim to describe, and call on authorities to keep them in place. Maldonado's semiotics relied on the authority of philosophers such as Rudolph Carnap, I. A. Richards, Charles S. Peirce, John Dewey, mostly, however, on Charles W. Morris, whom he cited most often, but also on his own. After all, he was the rector of the most progressive design school in the world.

Naturally, any taxonomic conception of science invites struggles for being right, and there were many among Ulm's faculty. For example from 1960 to 1961, I was working at Ulm's Institute for Visual Perception, led by Mervyn W. Perrine, an empirical social psychologist from Princeton University. One funded research project concerned color perception. Arguments arose, to the point of threatening the very existence of the Institute, between Otl Aicher, Maldonado, and Perrine. Aicher insisted that empirical findings with subjects should not contradict his own color theory — no longer taught in Ulm after 1958 — because subjects could not possibly know as much about color as he did. As a successful graphic designer, Aicher was confident he knew better. He could not care less about how others perceived colors, which made empirical investigations meaningless for him. At another point, Maldonado was befuddled when subjects ranked visual stimuli in ways inconsistent with each other and quite different from what his ideas led him to expect. To him, this called scientific methods into question.

True, statistical generalizations do not make good design decisions, but done well, empirical studies certainly can shed light on the reality of other people, the very people that would come in contact with designed artifacts. In Ulm's antiempirical climate, vocabularies took the place of unchallengeable truths, and the realities they brought forth were lived intensely, defended against alternative versions, and generalized to if not authoritatively imposed on students, leaving little room for the uncertainties that nourish the testing of empirical hypotheses. Not surprisingly, the Institute for Visual Perception was short-lived. Empirical studies of meaning, on which a semantics for design could have been built, were pioneered elsewhere, by Charles Osgood et al. (1957), for an early example. Osgood's work stimulated studies of meaning outside Ulm and influenced the work of some Ulm graduates but only after they had graduated.*

The inability of semiotics to grant human agency (Section 8.1, item 2) is evident in Maldonado's definitions as well. Their carefully chosen definienda did not envision people as having the choice of seeing something as a sign, sensing something "as it is," or experiencing multiple versions of the same reality (Section 2.3.2). Peirce's (1931) notion of "semiosis," the process of something becoming a sign for someone, which could have opened a space to enter human agency, came to be defined with reference to Morris (1938) as the "process in which something is a sign to an organism. The object of semiotic investigations" (Maldonado, 1961). Morris was a behaviorist and Peirce's pragmatist conception did not translate well into Morris' and Maldonado's definitions. They offered no possibility of conceiving of semiotic theory as a byproduct of the language used to state it, as the result of the dialogues, social interactions, and the interfaces in which it is realized and could differ by contexts of use, culture, or intention. The idea that acts of defining, publishing, and using the semiotic vocabulary could create the very phenomena that semioticians claimed to study, that semiotics relied on the semiosis of its own reality, did not occur to anyone at that time.

The positivist prohibition against self-reference (Whitehead and Russell, 1910/1958), the absence of recursive accounts and the universalism in Maldonado's semiotics precluded second-order understanding — designers' understanding of stakeholders' understanding — which is a key to human-centered design (Section 2.5). It also prevented conceptualizing the kind of interactivity, now built into human–computer interfaces, which are guided meanings and in turn create new meanings without prescription by a grand semiotic theory. The hermeneutics of reading text could have introduced such notions even before the advent of computers. But it had no currency in Ulm.

Fundamental to Maldonado's semiotics was its two-world ontology of a world of signs and symbols and a world of material objects (Section 8.1, item 1). An anecdote of how this played out in practice may make the point. When I wanted to write my graduate thesis, later titled *On the Sign- and Symbol-Character of Objects* (Krippendorff, 1961c), it was only natural to think of working with Tomás Maldonado. Predictably — but only in retrospect — he told me that signs refer to objects, but objects cannot be signs of something else; and that the whole idea of objects having meanings therefore was a categorical mistake. For him, meaning was a semiotic reference relationship and this settled what one could legitimately say about the objects of design. With this conception of meaning, graphics, photography, and texts became natural candidates for semiotic analysis — but the objects of industrial design were not. It was this positivist ontology of semiotics that created a blind spot

* Zillmann (1964), for example, wrote as the director of the research component of a Zurich advertising agency and now teaches in the United States.

for its proponents and put a theory in charge of explorations at the expense of everyday experiences. I had to write my thesis with Horst Rittel instead.

9.4 Chernyshevsky's political economy of aesthetics

As I was writing this chapter I recalled a perhaps more personal influence. It was in Ulm that I first read the work on aesthetics by the nineteenth century Russian materialist philosopher Nikolai Chernyshevsky (1855/1953). Radically departing from universalist claims, Chernyshevsky saw aesthetics as a ruling class' self-serving theory of beauty. He asked, for example, why fair skinned women with rose-colored cheeks are considered more beautiful than women with tanned and wrinkled faces. His answer was plain. Women of the ruling class did not have to work in fields and could instead attend to their attractiveness in appearance, dress, and conversation. He deconstructed — as one would say now — the prevailing aesthetics, especially its claims to universality, showing that an aesthetics was an elite's instrument of domination, setting its own values above those of others. In his thesis, beauty was — in today's terms — a socially constructed phenomenon and hence a politically variable concept. Aesthetics is not true or false, as theories in the natural sciences are supposed to be, but it is constituted in particular social practices. It is kept stable through the tacit enforcement of powerful institutions, including the network of artists, critics, collectors, and connoisseurs who benefit from working within that dominant theory of beauty. Chernyshevsky's ideas foreshadowed those of Roland Barthes, Jean Baudrillard, Michel Foucault, and especially Antonio Gramsci (1971), whose theory of hegemony covers similar grounds, now shaping the understanding of postindustrial culture.

Bringing Chernyshevsky into the twentieth century, it became obvious to me that art required name recognition (brands) and arguments (advertisements) at least as much as providing sensory experiences (works of art). Although creating art was banned from the curriculum at the Ulm School, several students and some faculty painted on the side. There were places in the city of Ulm where art could be exhibited and discussed. But the determining factor for whether something was worth showing largely seemed to depend on how it was justified and by whom. Those able to wrap their art into compelling narratives succeeded more readily than those who merely exhibited their work. Max Bill, for one, was a well-known Swiss painter, sculptor, and architect before he cofounded Ulm and became the first rector of the school. He, and an international group of artists and poets, in manifestos, exhibitions, and readings, had developed a vocabulary, including a theory of what art "really" is, to distinguish their "concrete art" from everything else. Using this vocabulary with the implicit backing of the loose community of concrete artists generated discussion and granted recognition. Those who did not have compelling narratives were less fortunate. For example, Friedrich Vordemberge-Gildewart, an early faculty member at the Ulm School with an impressive record in painting and typography, did not go for the dominant discourse, and felt marginalized.* Bill and Bense were close as long as Bense used Bill's works in his writings. When he had an argument with Bill and used Vordemberge's paintings, there were tensions. Unlike Bill's interest in justifying individual products of culture, Bense was interested in distributions of artifacts in society. Neither realized that aesthetic perception is acquired in language and, hence, is social or political in nature.** Explaining aesthetic perception as physiological correlates of the objective properties of art objects — as attempted by Bill's reliance on ideally mathematical forms (geometry, proportions, rhythm, or grammar), and much later Gros' (1984) concept of a formal-aesthetic function (in terms of the classical principles of gestalt perception) (Section 8.7 item 2) — merely supported the aesthetics of the dominant cultural elite. Chernyshevsky might have taken Bense's information aesthetic to task as well by asking who is being served by the cultural production of improbable objects.

The sociology of Ulm's aesthetics and functionalist rhetoric cannot be understood without situating it in the period of its use. When the idea of a design school surfaced, a few years after WWII, Germany was in ruins. Inge Aicher-Scholl, whose siblings were killed in 1943 for protesting Nazism, wanted to create a memorial in their name. Some hoped to revive the Bauhaus, whose teaching was tragically interrupted by its forced closing in 1933. Bill, who had been at the Bauhaus, saw unprecedented opportunities for a new kind of design school that would contribute to the industrial culture of a new democratic Germany. From its beginning in 1953, the Ulm School of Design presented to the public an impressive array of consumer products with radically new appearances and proposals for larger projects. The clarity of its designs, its astonishing productivity in many spheres — industrial consumer products, visual communication, industrialized architecture, journalism, and film — fueled the emerging consumer industry in Germany, Braun AG, for example, and gained international acclaim.

Ulm's success was due largely to its highly effective rhetoric, a vocabulary for explaining its designs. We, students and faculty, were easily drawn into the functionalism just described by what it accomplished rhetorically. We challenged each other's designs, learned to justify every detail, and what succeeded was defensible indeed and typically also outstanding. We spiked our arguments with concepts from novel disciplines, ergonomics, semiotics, cybernetics, scientific methodology, and information aesthetics, to name but a few. We chose easily defeatable adversaries — advocates of American styling and commercialism, traditional arts and crafts–oriented designers, and the mindless producers of kitsch — and easily "won" debates by "proving" their products "indefensible," their methods "unscientific," their ideas "obsolete," or overlooking essential functions. We played a successful

* Friedrich Vordemberge-Gildewart, personal communications on several occasions. Even Lindinger's (1987/1990) Ulm retrospective had not that much to say about him.

** The social psychology of perception revealed the social background of subjects as a major factor in their perception of things. To explore this was one of my motivations for joining the Institute for Visual Perception at the HfG Ulm.

language game on top of visible design innovations. We saw ourselves as challenging an old aesthetics but — entering Chernyshevsky — we did not recognize that what Ulm provided served the needs of a generation of younger and progressive consumers to set itself apart from the generation that lived through WWII and subscribed to values considered out of date. With the marketing of successful designs from Ulm, industries naturally adopted and unwittingly promoted Ulm's justifications and thus entered Ulm's vocabulary of product forms into that intergenerational struggle.

Moreover, Ulm's alleged culture-neutral celebration of technology played right into the needs of postwar industry — not just in Germany — to expand its markets internationally. The explicit denial of pursuing a particular aesthetics, celebrating arguments in the name of science and technology had the effect of rendering cultures that held on to their own traditions or resisted the supposedly culture-neutral functionalism of the industrialized West as "backward" or "underdeveloped." We also did not see any contradiction between battling for a new aesthetics and the universalism we claimed for what we were arguing. Chernyshevsky's notion of what aesthetics does could have easily undermined these claims, but only a few of us read his work.*

Regrettably, the successes of Ulm's aesthetics also deafened us to different voices. We knew the users of industrial products only through texts on ergonomics, gestalt psychological principles of perception, typographical rules, and color theories, some developed in the Bauhaus — not by listening to or surveying the concerns of users, social classes, or other cultures. The Ulm School contributed many original investigations. But they were compelling demonstrations, like the Ames demonstrations of visual perception, not empirical inquiries into how others conceptualized their own worlds. We took for granted that consumers had to be educated in the new industrial culture and assumed their acceptance of our ideas to be merely a question of time. We hardly doubted our own convictions. This contrasts sharply with the semantic turn in design, which starts with the recognition that people (designers, consumers, and other stakeholders) may not think alike and create their own meanings for the innumerable ways of interfacing with technology. The disinterest in potentially different but equally valid conceptions prevented us from embracing Chernyshevsky's social relativism and from considering that artifacts are also the medium of social or cultural struggles.

9.5 *Rittel's methodology*

In Ulm, all design procedures and product forms were questioned and had to be justified or, failing this, be dismissed as arbitrary and inferior. We practiced quite unconsciously what Chapter 4 poses as a theorem of the semantic turn — that "the fate of artifacts is decided in language." The

* Dolf Zillmann, for one.

vocabulary for such deliberations was enriched by a curriculum that, by comparison to other design schools, was academically demanding and included several design related disciplines, notably physiology of perception, ergonomics, social psychology, sociology, economics, political science, cultural anthropology, semiotics, information and communication theory, but also traditional topics from physics to the cultural history of art. They were all made relevant to design, and the intellectual framework intended to assure their integration was the philosophy of science, originally taught by Bense. Bense was an abstract thinker and his presence enhanced the intellectual quality of the deliberations and added to Ulm's academic aspirations, but it did not challenge design as practiced in Ulm.

In 1958, Horst Rittel, a mathematician by training, replaced Bense. His first assignment was to lecture on information and communication theory, which everyone at that time thought to be the key to the future. I recall his first lecture in which he presented the technical details of Shannon's theory that Bense had glossed over. Being far younger, more practical, and quick to adapt to the needs of Ulm's curriculum, in the course of Rittel's tenure at the school, the philosophy of science he was asked to teach became increasingly relevant to design. It turned into a systematic exploration of the heuristics that designers were using. Rittel's mathematical training gave him access to models, theories, and conceptual frameworks that ordinary designers had barely heard of. He immensely enjoyed making abstract ideas relevant, and the echo he found among students brought the design discourse to a different level. He introduced methods of operations research, mathematical decision theory, game theory, systems analysis, and planning techniques, and thus enriched the repertoire of design supporting methods. Again, the Ulm School of Design was probably the first and may still be the only design school in the world in whose curriculum such topics flourished.

Whereas Bill's designer was to find a new aesthetic unity between contemporary culture and forms of mass produced artifacts without catering to commercialism or relying on sentimental kitsch, Maldonado's designer was to be equipped with the instruments of science in order to coordinate decision making from the centers of industry. Under the influence of Rittel, the conception shifted to a designer who would be able to handle heuristic planning and design methods, and work as equals in product or strategy development teams.

Bruce Archer, a guest professor and pioneer of design methods in the United Kingdom, also played a major role in introducing systematic, that is, step-by-step, design methods into the curriculum of industrial designers, later adopted by Butter (1989) into product semantical considerations. Other faculty, notably the macro-sociologist Hanno Kesting, also supported Rittel's teaching. Some of the more senior faculty, Otl Aicher, for example, felt threatened by talk about these design methods. And although his opposition was born largely out of ignorance — he abstained from lectures of his colleagues and did not participate in applying and testing these new ideas — the reason for this rejection may have been due to his interest in graphics, which while innovative, concerned simple and obvious problems for the solution of which good intuition sufficed. Initially, Maldonado may have seen in Rittel someone who contributed to his scientific vision for the school. But Rittel was not a taxonomist who categorized the world or a positivist in search of evidence in support of a theory. He was a pragmatist, full of compelling ideas. Rittel's design methods projected and in turn prepared us for a more complex world, opened the possibilities of empirical research, encouraged examinations of the assumptions made when deciding with uncertain information, raised the awareness that our designs would have to resist possible counterdesigns (game theory), and realized that in complex systems in which almost everything is connected to everything else, designs can have rather unanticipated consequences. Most students soon recognized that the future of design was in being able to solve complex design issues with defensible methods. Designing photogenic products was no longer seen as an aim of design education. Some students shifted attention from architecture to urban planning, from feature writing to organizing advertising campaigns, and from conceptualizing single products to systems. Many current writers on design methodology (e.g., Cross, 1984) acknowledge Ulm's contribution to design methodology. A science for design, as proposed in Chapter 7 bears the influence of Rittel and Archer as well.

As Rittel's heuristic methods started to enter and guide the design decisions of students, it was inevitable that the language of students shifted from justifying the functionality of photogenic products to justifying the design methods that led to them. The arguments that were correlated with this shift proved far more compelling than functionalist and semiotic ones had been. This gave rise to tensions between the visible and invisible Ulm, as some now see it. Faculty who ran increasingly profitable design studios, working for industrial clients inside the school, left teaching largely to those who did not have such studios. They could not see virtue in the shift in design thinking, created a false schism between science and design, and used it as a smokescreen to hide their economic interest. Some historians (e.g., Betts, 1998) have fallen victim to this rhetoric, blaming scientification as the major factor of Ulm's eventual demise. This was not so, however, as Rene Spitz (2002) revealed in his fascinating political history of Ulm.

Rittel's planning methods, developed further after he left Ulm for the architecture department at the University of California at Berkeley, must be sketched here because they took off from what he learned and taught in Ulm. In Berkley, Rittel moved beyond design methods to formulating a theory of strategic argumentation under condition of conflicting objectives (Cross, 1984:135–144, 317–328). Starting from the obvious that planning always concerns future conditions and requires commitments (by stakeholders) from which facts (art, artifacts, and social facts) arise, Rittel's approach came to embrace a dialogical notion of language (Section 4.1). He conceived of designs as plans (I prefer proposals to indicate that they must always address stakeholders), as networks of defensible claims, together with their appropriate warrants, against counterclaims and diverging interests in the presence of which they would have to succeed. In terms of the trajectory of artificiality (Section 1.2), Rittel started to develop a multilogic for projects. He anticipated stakeholder theories but did not concern himself with meanings, I suppose largely because he became involved in large public projects and complex architectural designs that are often driven by a handful of economic players and political interest groups. Already mentioned was his formulation of so-called wicked problems (Section 1.4.2), which defy rational considerations by being definable only from their possible solutions. This is quite consistent with the semantic turn's emphasis on visions of desirable futures as opposed to traditional problem solving à la Simon (1969/2001). I am convinced that had Rittel become concerned with artifacts of mass culture and information systems, which are driven by voluntary use, market considerations, and multiuser and multicultural participation, and are of political significance, some of his planning methods, posthumously published in Rittel (1992), would have led him to a semantic turn as well.

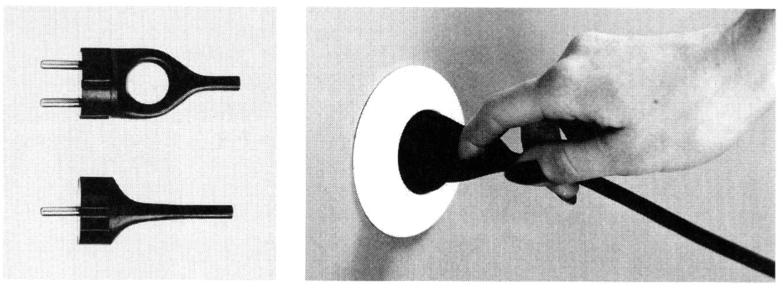
While in Ulm, Rittel supervised my graduate thesis on the procedural meanings of designed objects (Krippendorff, 1961), the precursor to product semantics. It mapped planning theory into everyday interactions between users and their artifacts.

9.6 Barriers to considerations of meaning and some exceptions

Clearly, meaning had no currency in Ulm. The preference to reveal a product's technical function, its materiality, and its method of production — using the kind of forms, that we thought were easy to manufacture but actually were only easy to draw· straight lines, right angles, geometrical forms, unobtrusive gray colors — and the equation of aesthetics with culture-free mathematical forms left few opportunities for considerations of different users' conceptions and meanings. Under the aegis of functionalism, artifacts could not be conceived to mean different things in different contexts and for different users without being considered wrong. The only contexts we considered were far removed from ordinary people's discourses about artifacts: modern society, technological trends, and visual culture, on the one hand, and physiological or ergonomic and perhaps social textbook generalizations of users, on the other.

If it is true that meanings are central to any design intended for human understanding and use, axiomatically (Section 2.2), then it stands to reason that designers always had to cope with them in some form or another. I maintain that this was so, indeed, even in Ulm. Functionalism in effect provided one kind of meaning. Without adequate vocabularies, other kinds were either left to habits or intuition, or hidden behind the façade of a dominant rational consensus. Bill's notion of an aesthetic function, followed by Maldonado's semiotic scientism, exemplified efforts to capture territories lost to formal reasoning but not quite getting there for lack of second-order understanding. In Ulm, meanings got lost between the cracks of its dominant justifications. Following are six examples whose semantics were not recognized at that time nor entered Ulm's retrospective (Lindinger, 1987/1990).

1. The first example is Aribert Vahlenbreder's electric plug, shown in Figure 9.4. This is one design that is semantically obvious to everyone who has handled electric plugs before. There is no need to ponder and figure out what it is for. The hole of this plug is just the right size to invite putting a finger through and pulling it out.* It is also flat and can be handled conventionally as well, by holding it between the thumb and the index finger, for plugging it into a socket. The absence of screws and its plastic material gives a sense of being safe from electric currents. Its use is self-evident despite its unfamiliar form, which is a semantic ideal. When Vahlenbreder presented his design, it was unfavorably compared with the design efforts of his costudents who had produced more elaborate (but now mostly forgotten) models. His was considered too simple. He had used available parts, and it was completed the night before presentation. His design was recognized, published, never produced, but recently reinvented in Japan. Interestingly, it is only one of two out of almost 60 products that the Ulm retrospective presents as being handled, "in use." All other products are shown in peopleless photographs. Even the model of a car, photographed for contrast on a street with several contemporary models, is shown on a city street without a soul present. From these photographs alone, readers cannot escape the impression that Ulm celebrated the forms of artifacts over their use, an impression that has been independently examined and



(a) (b)

Figure 9.4 Electric plug in soft PVC — self-evident handling — by Aribert Vahlenbreder, 1959.

* Note that European safety plugs are far harder to insert and pull out than those conforming to U.S. standards.

verified (Wachsmann, 1991). Vahlenbreder's use-determined design was an exception. In the retrospective, the caption for this design mentions the material it was to be made of but nothing about accomplishing obviousness in meaning.

2. The second example is Reinhold Weiss's laundry iron, Figure 9.5. Ulm's retrospective praises the uncommon and ergonomically justified position of the handle. But it fails to note Weiss' considerable effort to (semantically) distinguish the part that users could handle safely and the part he wanted to discourage users from touching. He accomplished this by introducing a discontinuity (Section 3.4.5) in the form of several seemingly heat-insulating ribs, visually highlighting the difference between the two parts. As a witness to the process of this graduate project, I can attest to his unacknowledged concerns. There was no accepted language to describe the meanings of these lamellar discontinuities.

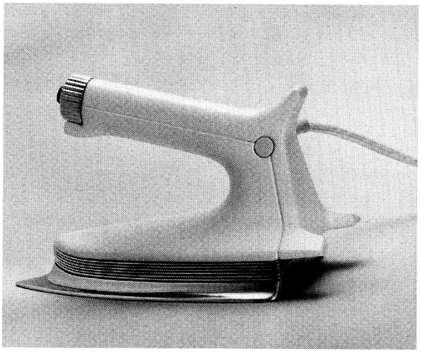


Figure 9.5 Clothes iron — distinguishing hot and handleable areas — by Reinhold Weiss, 1959.

3. Design students in Ulm selected their own projects. Instructors did not pose particular themes and all criteria were open to discussion. In designing a caliper, Figure 9.6, my intention was less aesthetic than to render this unfamiliar instrument easy to control. I examined the handling of numerous familiar tools that required a squeezing action: pliers, scissors, can openers, pincers, for example, even sponges, and ended with how people held stopwatches. Stopwatches and calipers shared a dial for numbers to be read with the expectation of being accurate, the more the better. I used two colors to distinguish the part that one was supposed to grasp and the arms with the exchangeable precision tips that should ideally remain untouched to obtain reliable measurements. I also explored ways to express the precision of this

instrument through the fine divisions on its dial. The design received attention in publications and exhibitions, but nobody saw or cared to mention what its form was to accomplish and whether it did.

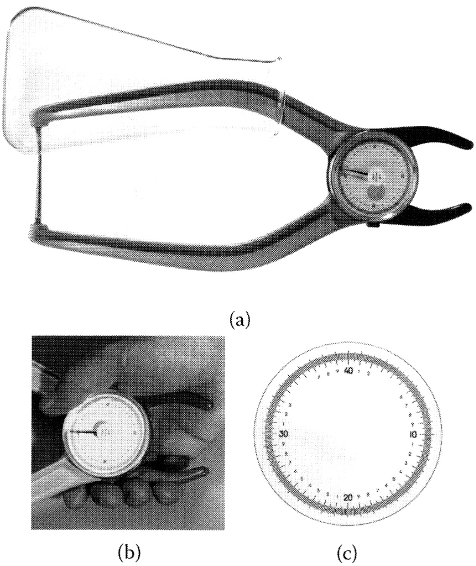


Figure 9.6 Precision caliper — making its handling familiar and recognizable — by Klaus Krippendorff, 1958. (a) Caliper in use; (b) its handleability; (c) its precision.

I also recall an example that was disastrous semantically: my design of the head of a drafting machine. It had a bright yellow squeezable handle, or knob, whose mechanism eliminated the need for several push buttons and levers. Its technology resulted in a patent. But, against the background of its white circular scales, the yellow knob led many to describe the instrument as a fried egg. Clearly, something went wrong here. Holding on to a squishy egg yolk was certainly not appealing. Many had such associations. How could one avoid these meanings? Color theory was too abstract to embrace meanings and was, in any case, no longer taught in Ulm. Semantic criteria for color choices were simply unheard of.

4. The fourth example is Reinhart Butter's precision balance, Figure 9.7 Butter followed the general preference in Ulm for straight and simple appearances. He remembers deciding on the color of the two release knobs for the scale. Common sense would suggest a dark color to camouflage accumulating dirt from handling. However, he chose white to motivate cleanliness, instead, which was more in line with the fragile

character of a precision balance. He adds that there was no vocabulary to discuss meanings, no discussion of semantic issues, and certainly no method to systematically consider them. What made his balance a precision balance was left to intuition or subjective impressions. Only in retrospect can one see how the meaning of precision, now described as a character trait (Section 4.3), was achieved.

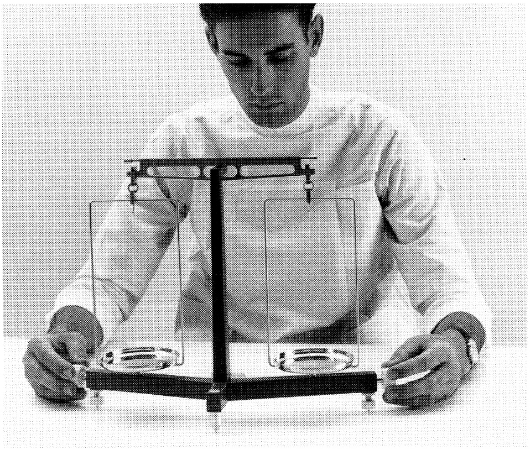


Figure 9.7 Precision balance — implicit semantic concerns — by Reinhart Butter, 1959.

5. As a fifth example consider Hans Gugelot's 1956 Radio-Phono-Kombination SK4 for Braun AG, Figure 9.8. It shows a longish white metal box, topped by a transparent Plexiglas cover through which one can see its turntable and radio controls. Unlike traditional radios, SK4 was also attractive from all sides, did not have to be placed against a wall, and commanded attention in a living room. SK4 was an instant conversation piece, a moderate market success, but became something like a public icon of Ulm design. Interestingly, Gugelot's explanations for this revolutionary design are not mentioned in Ulm's retrospective (Lindinger, 1989/1990:75–77), and I do not recall ever hearing any, except for the insistence on its being functional, clean, and simple. Interestingly, its technical sounding name "SK4" did not appeal to buyers, and so it acquired an unintended but with hindsight meaningful nickname. The see-through cover reminded the public of the glass coffin of Snow White in the Grimm Brothers' fairy tale by that name, and so it came to be known as "Snow White's coffin." Its unexpected naming demonstrates that industrial products are not merely used as intended by their designers or producers, they also enter language (Chapter 4) where they come to live a life of their own and may become

infused with all kinds of meanings, stories, and myths that in turn shape its perception. Luckily, "Snow White's coffin" was affectionate and positive. Names can also ruin a product.

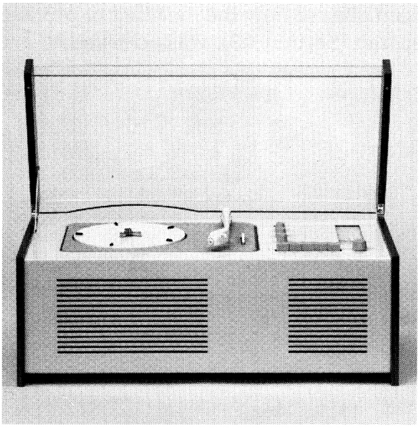


Figure 9.8 Radio–record player combination SK4 for Braun AG — "Snow White's coffin" — by Hans Gugelot, 1956.

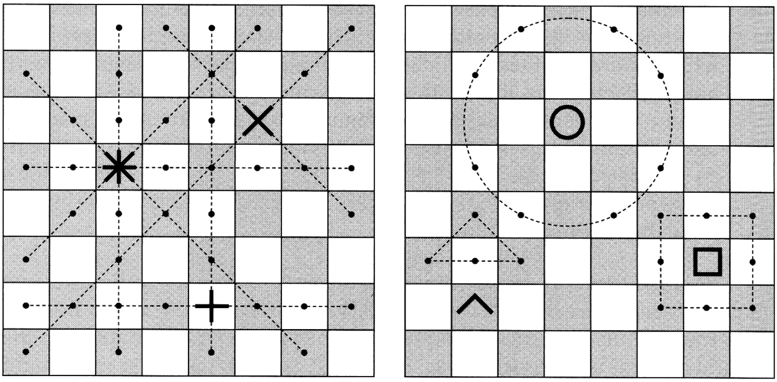
Most important, where SK4 entered the ecology of hi-fi equipment, it replaced the ideal type of wooden or plastic radio boxes with their distinct front: cloth-covered loudspeaker, station and volume controls, and a hidden turntable, if any. It had the ecological meaning of weakening the then popular radio stereotype and opened the possibility of subsequent designs.

The sound quality of SK4 was clearly below the performance expectations, even of its times. But buyers willingly sacrificed technical quality for meaning. The exciting and bold universalism that Ulm stood for became a convenient means for younger users to distinguish themselves from the "provincialism" of the declining prewar culture of their parents. "Snow White's coffin" became a conversation piece with totally unexpected sociopolitical meanings. It still is a conversation piece but now in different contexts: design museums, connoisseurs and collectors of design, and published histories of design, this book included. It acquired its meanings in the latter contexts as technological culture moves on. Today, we can see the semantics of this radio–turntable combination more clearly. "Snow White's coffin" had made no functional contribution by which Ulm wanted to be judged. In the absence of an adequate language to address semantic considerations, meanings were left to fortuitous circumstances.

6. The final example is a set of chess pieces that I developed in 1960. To appreciate the visual nature of the game, I started to play chess daily while writing my thesis, which, not coincidentally, concerned itself with how artifacts could inform their use (Krippendorff, 1961a, c). Chess is a game that requires players to recognize strategic patterns of possibilities and constraints. It consists of moves and countermoves that threaten or protect pieces from being lost; each aims at improving one's strategic position relative to the other player, ultimately cornering the prize: the opponent's king.

Chess is alleged to have originated in seventh century India as a war game. It took 300 years to travel via Persia and the Arab world to Europe. As it traveled, its nomenclature and the forms of its pieces adapted to the cultural contexts of their new users. In seventh century India, war was fought with elephants, horses, chariots, and foot soldiers, and the earliest known accounts of chess use these terms. In Persia, the game revolved around a shah and his faithful counselor and messenger. In the Arab world, the name shah stayed but the counselor became a vizier. When chess entered Europe, the names of its pieces came to represent the then prevailing feudal hierarchy. In English, the shah was translated into the king, literally, but the vizier became the queen, elephants became bishops, representing the church, horsemen became knights, chariots became rooks (castles or towers), and foot soldiers became pawns. In Europe, the abstract shapes of Arabic chess pieces became more or less elaborate representations that followed their names, not the roles they played in the game. This says much about how language acculturates artifacts in use.

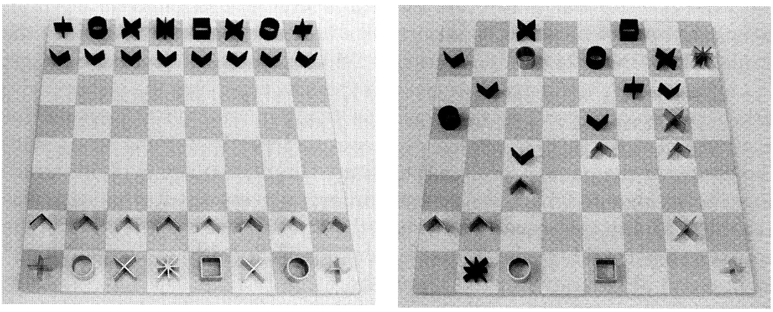
I did not like war, and found the feudal structure encoded in the traditional European chess pieces unfortunate and unnecessary to playing the game. I knew the 1924 Bauhaus chess set, which preserved its feudal heritage, but expressed its hierarchy by cubes and spheres, except for the bishop, who was represented by a cross. I was also familiar with other designs, for example Man Ray's 1927 set whose pieces had nearly nothing to do with the nature of the game. Consistent with my simultaneously evolving graduate thesis, I wanted my chess pieces to inform players about what each was capable of doing, and reveal the threats they could pose to each other in the course of a game. I hoped that making their operational roles "self-evident," as one would say now, would allow the game to be learned more easily, render the strategic options that a particular configuration of pieces entail more readily transparent, and improve strategic thinking. In my analysis, chess has three directional pieces that can move any number of squares in any one of several directions, threatening everything in their possible paths. It also has three pieces whose movements are circumscribed. Two of them control fields that surround them and one can move only in one direction, forward. It made sense to adopt two simple and obvious rules: the directional pieces should visualize the direction of their mobility and control, and the circumscribed pieces their ranges, the limits of their mobility and control.



Directional pieces: Queen = Rook + Bishop   Circumscribed pieces: Pawn, Knight, and King

Figure 9.9 Correlations of chess pieces with what they control.

This correlation may be seen in Figure 9.9. All pieces were of equal height, naturally. The Bauhaus' bishop resembled mine, suggesting that its albeit differently motivated semantics could make sense here as well. In the beginning of a game, the row of pawns visualizes the protective shield they collectively provide for the pieces behind them. During a game, when pawns typically appear in "birds' flight formation," they continue to visualize their defensive roles, as may be seen in Figure 9.10. The queen, combining the capabilities of the bishop and the rook, combines them visually as well.



(a)   (b)

Figure 9.10 Chess pieces — visualizing possible movements — by Klaus Krippendorff, 1960. (a) Starting configuration; (b) intermediate configuration.

The pieces were to be cut from profiles of extruded nonmagnetic metal, chromed and blackened respectively. To center the figures on the squares of the chessboard and prevent literally turning the more mobile bishops into clumsy rooks or vice versa, a system of four positive and four negative magnets were to be inserted into the board, which would ensure the correct directionality of the pieces during a game. Carving these shapes into wooden cubes or using inlays on one face of squares was envisioned but not realized.* To use the set immediately, a compromise was made, replacing the + of the rook with a ⊥, which depicts the fields it controls at the beginning of the game.

Much after I had finished the set, I realized that designing these chess-pieces had been my way of working out at least part of the thesis that I was writing at the same time.

The six examples just discussed are not representative of Ulm's many contributions to design. They were selected as semantically interesting exceptions, pertaining only to product design and representing but a brief period of Ulm's short but productive history. They are also relatively small artifacts, hand tools, appliances, and furniture, which are hardly representative of the kind of design problems the semantic turn is facing now. Computer interfaces did not exist. Multiuser systems did not play the role they do today. Large projects that required work in multidisciplinary teams were talked about but not really tackled. Ecology had not been recognized as something to worry about. And the lack of self-reflective use of language made it difficult to consider our own discourse as a possible way of redesigning design.

In concluding this chapter, I am suggesting that the approach to design that Ulm had taken, while reaching far into the future, was essentially blind to systematic considerations of meaning. These examples of designs slipped through the cracks of its functionalism. Maldonado's semiotics saw meanings only through the lens of an unproductive theory of signs, as representations. Nevertheless, Ulm's discourse certainly informed my own path, even where I disagreed. It is not surprising that from Ulm, many former students were led to considerations of meaning, each for their own reasons. Richard Fischer (1984), one coauthor of the theory of product language (Section 8.7), expressed his dissatisfaction with functionalism already as a student in Ulm and subsequently found his way out of its box. Jochen Gros (1987), the other coauthor of this theory, studied with Martin Krampen who had studied with Maldonado. Krampen (1979, 1989) wrote on the meaning of urban architecture and did much to develop behavioral methods to experiment with representational meanings. During his short interest in semantics, Dolf Zillmann (1984) developed novel measuring scales. Gui Bonsiepe (1996), keeping the legacy of Maldonado alive, recently acknowledged human–computer interfaces as a new ontology of design. Shutaro Mukai (1979, 1986, 1991, 2003) explored the nature of language, Japanese characters in particular, advocating a concrete poetics, and teaching industrial design with this in mind. Reinhart Butter encouraged me for years to continue working on the meaning of meaning in design, which he recalled from our overlapping tenure in

* These shapes may gain currency in contemporary computer chess, which is played on a flat screen. The contemporary two-dimensional depiction of the classical chess pieces has no correlation with what they are able to control.

Ulm. He practiced product semantics long before it had a name, and this book is full of examples of his Ohio State University student's work. Hans-Jürgen Lannoch (Lannoch and Lannoch, 1989) became an early contributor to product semantics. Sudhakar Badkarni coorganized the first product semantics conference, in 1987 in Bombay, India, titled Arthaya, which is an ancient Hindu word for meaning. Bernhard Bürdek (1991/2004, 1997) contributed to HfG Offenbach's theory of product language and began to address issues of computer interface design. For all of these diverse contributors, and probably others as well, experiences in Ulm were the common thread. Ulm enabled its former students to boldly pursue paths not envisioned at that time.

Despite Ulm's blind spots for meanings, the semantic turn does not oppose Ulm's values. It could be considered a radical reformulation of the Ulm School's moral mission, now moving design into what was then an unarticulated domain of human-centeredness: The design of meaningful human interfaces with technology. Some of Ulm's esteemed virtues reappear in the well-known qualities of human communication: clarity, economy, expressivity, and informativeness, but now conceptualized in interactive and culture sensitive terms. While the semantic turn creates new options for design, it does not endorse arbitrariness, meaninglessness, or dishonesty either. By playing on the now dated design principle "form follows function," the semantic turn offers designers a new covenant:

Interfaces follow recognizable meanings.

The semantic turn acknowledges design as a fundamental human right, the right to construct one's own world, interact with fellow beings in theirs, and make contributions to the ecology of humanly accessible artifacts. It is a matter of ethics to acknowledge multiple stakeholders in design, but it is a matter of survival for the design profession to make design discourse — the language that creates possibilities and proposes collaboratively realizable futures — methodologically sound, easy to use, and accessible to everyone who cares to exercise their right to design. With this in mind, this book starts a new foundation for design.