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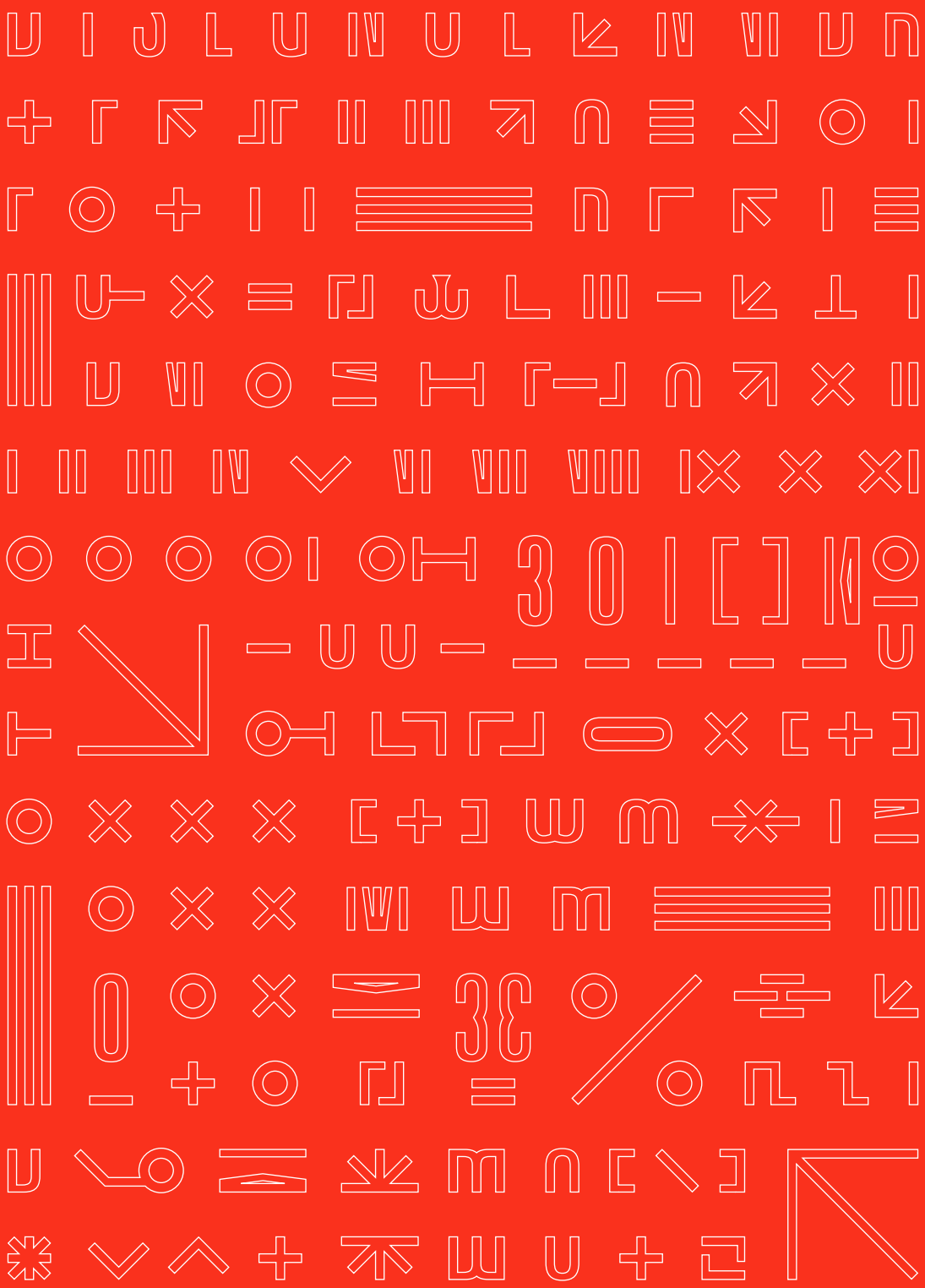
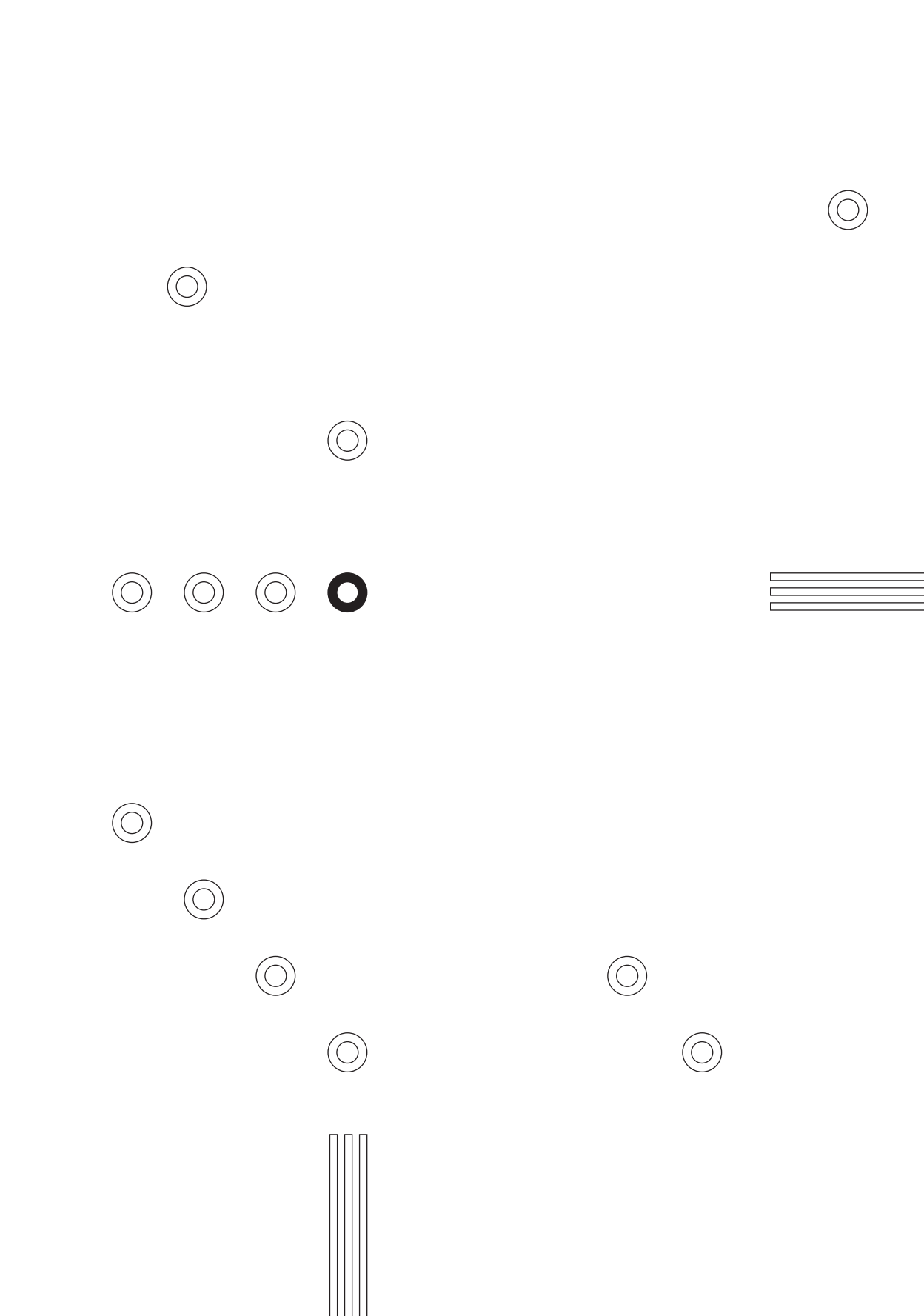
journal of design culture
_S/D: Sign and Design





Disegno

Journal of Design Culture
Double-blind peer-reviewed, open access scholarly journal

Aims and Scope

Disegno publishes original research papers, essays, and reviews on all aspects of design cultures. We understand the notion of design culture as resolutely broad: our aim is to freely discuss the designed environment as mutually intertwined strands of sociocultural products, practices, and discourses. This attitude traverses the disciplinary boundaries between art, design, and visual culture and is therefore open to all themes related to sociocultural creativity and innovation. Our post-disciplinary endeavour welcomes intellectual contributions from all members of different design cultures. Besides providing a lively platform for debating issues of design culture, our specific aim is to consolidate and enhance the emerging field of design culture studies in the Central European academia by providing criticism of fundamental biases and misleading cultural imprinting with respect to the field of design.

All research papers published in Disegno undergo a rigorous double-blind peer review process.
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DISEGNO_VI/02_S/D: SIGN AND DESIGN

Contents

DESIGN, SEMIOTICS, ANTICIPATION

Mihai Nadin

ABSTRACT

From the Why semiotics? question to the specific aspects of the semiotic underpinning of design the journey is one of discovery. Indeed, design is discovery, i.e., it is anticipation-driven. Therefore, nothing qualifies as its foundation. Design as a process does not require secure preliminaries (theories) from which to set out. It does not require a "place to stand," a necessary reference, from which to start the adventure. Design assumptions are by their nature questions guiding anticipatory action. They are circumstances of conflict (the old, the current, the new), which semiotics registers very much like a seismograph. The "earthquake," i.e., the creative design, is not the graph of the Earth shaking, but a new landscape. The interruptive character of design inquiry, i.e., its disruptive nature, is especially significant when subjected to the après-design analytic moment. This is when recursive definitions (of aesthetic nature, semiotic, economic, cultural, political, etc. significance) are used as a metric of design, creating the illusion that they can become some norm. Actually, design creates a context for meaningful interactions. Design's self-motivating nature of inquiry escapes such exercises. The activity called design is constitutive of the new, not the celebration of the past. Therefore, we present not only what has so far been learned from a design informed by semiotics, but also what might better serve designers in the context of the rapid change we experience in our days.

#anticipation, #discovery, #meaning, #narration, #semiotics

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The plan pursued in this paper is simple:
1) Preliminaries—easy-to-follow explanations regarding the WHY? question of semiotics.
2) A formal synthesis of what designers ought to know about the semiotics du jour (current dominant ideas), i.e., the WHAT? question.
3. An attempt at alternative foundational views of semiotics.

1 PRELIMINARIES

1.1 Why do designers need semiotics?

The only reason for revisiting the subject (at the suggestion of *Disegno*—a journal focused on design culture) is the unabated optimism of a design educator (and theoretician) still trying to understand what design is—and why we need it. Especially in a day and age when text-to-image machine learning (under various labels) generates pseudo-design at the level at which, unfortunately, design is practiced today. Of course, design continues to change (otherwise it would die); so does the automated generation of pseudo-design. If artificial intelligence is trained on mediocre design, it will generate the same. But this is also true of design education. In its deepest meaning, design is an activity through which human beings became what they are while creating realities for their various activities.

Design is consubstantial with the sense of the future characteristic of everything that is alive. This understanding is key to framing the relevance of semiotics in design—and it includes design education. Study music if you intend to become a composer or play some instrument (virtuoso level or for pure pleasure). Studying music does not make you more talented, but it gives you what it takes to understand what you do, even if you create new, original forms of music, new realities expressed in sound form. Neither semiotics nor any theory—of design (yes, music is designed!) or of anything else, including complex networks theory, computer science and artificial intelligence, and genetics—will compensate for lack of talent, or for inadequate design skills. If you are dedicated to navigating the ever-more agitated ocean of change in the hope of discovering new continents (or islands, at least), a compass might come in handy; or if you build a house, scaffolding in some form is unavoidable. When we listen to a concert, we don't

hear the scales that the musician trained on day after day, year after year. But without them, there is no music. Learning the basics applies as well to dancers, actors, painters, sculptors, even poets.

There has never been more design than today. And never has more money been spent on junk design. For all that design still contributes to culture, no other field promotes a more unsustainable way of living than design. It promotes a delusional understanding of progress to consumers at the expense of the future. Advertising—making Silicon Valley richer by the minute—is an activity with an effectiveness below two percent. When everyone seems to know what design is, and what qualifies as successful design (i.e., successfully monetised), it is justified to entertain a simple but direct question: Is there some way—such as studying semiotics—to guide designers and the public in matters of design?

In this context, another question pops up: *Why* semiotics? It is easy to find a justification for other disciplines—communication theory, psychology, cognitive science, culture theory, anthropology, etc.—when trying to explain what design is. In the peer review process, I was gently reminded that hermeneutics (Follesdal 1979, as well as Ricoeur 1981, 1986; Heelan 1972; Ihde 1997; Markus 1987, among others) facilitates the experience of interpreting texts for the visual realm. Indeed, with DALL.E2 and Midjourney, words are originators of images coming out of the large "mixer" of training data (the whole web, museum collections, design production, etc.). Accordingly, hermeneutics cannot be disregarded. In the same vein, the actor-network theory—ANT—(Latour 2005) cannot be omitted when providing a broader context. Any productive question should be considered. What should not happen is that we lose sight of the whole: trees are important, but the forest should remain the focus.

For semiotics, the situation is more challenging. As an encompassing theory of signs and sign processes, it does not resolve any design-specific problem. Accordingly, some see semiotics, not unjustifiably, as a useless intellectual overhead: study definitions, compare various kinds of semiotics (e.g., Peirce, de Saussure, Lotman, among others); learn words that have nothing to do with what a designer is expected to do, or that might help those who use design. Seen in this light, it really is useless. This is not unlike its application in medicine: symptoms deserve attention, but healing does not come from the semiotics of disease. Again, in this limited understanding, semiotics can, at best, be consulted after a design is finished, more of an afterthought than a guiding principle or method.

"Why semiotics and not information theory?" pops up as the next justified question. Without probing the subject in depth here (for details, see Nadin 2018, 2019), let's place it in the current context of the obsession with big data.

In our time, everyone wants numbers—which means data—and therefore everyone measures everything. Due to this expectation alone, advertising—this is where Silicon Valley sucks in the billions—wastes not only money, but also resources. Yet we continue to measure, in a culture in which wasting (somebody else's money) is a source of wealth. Semiotics does not offer a metric by which one can at least distinguish between adequate and marginally acceptable design. But it opens a perspective crying for our attention: *meaning!* Data is not information. It becomes information once it is referenced to meaning (Nadin 2018, 2019). Unfortunately, in the hands of incompetent, so-called semioticians, even semiotics itself, in defiance of its own condition, submitted to quantification and the measurement craze. For some, it became a numbers game—such as in the so-called ecological evaluation of user interfaces—instead of a pursuit of meaning.

The failure of semiotics itself to resist opportunism fragmented the field to such an extent that it sacrificed its fundamental condition: being a *meta-discipline*. Indeed, feminist semiotics, legal semiotics, gender semiotics, etc., are caricatures of a discipline meant to describe how our thinking (focused on representations), and our doing (the making of everything, from ideas to government, to revolutions and wars, etc.) come together and make sense. Semiotics is holistic—what counts is the *whole*. Reductionism—dividing semiotics into several parts to be examined in no relation of one to another or to the whole—kills the living nature of sign processes. Those who miss the necessary understanding of the holistic nature of sign processes end up missing the understanding of design as a holistic expression.

Semiotics and design are as inseparable as scales are for making and experiencing music; or as movement exercises for dancing; or as drawings for building a house or a machine. Or better yet, as inseparable as programs from the functioning of the simplest to the most complicated machines. Yes, semiotics integrated in design is the program. We need to understand programming above and beyond the mechanics of writing instructions in convoluted languages that translate our thoughts into what the digital machine can process. In the absence of a program, the old meatgrinder—remember this kitchen tool?—is only a set of various pieces of metal. The hand crank, the screw clamp, the blades, and all it takes to assemble it and make it workable are part of a whole with a precise function: turn a chunk of meat into ground for your burgers or meatballs. The combustion engine can become a car on account of an elaborate design program in which a motor is only part of a whole called *automobile*. The bicycle and the surfboard are nothing but hardware of a sort, unless "programmed" to allow for functions that we call bicycling or surfing. Theories such as those describing the Social Construction of Technological Systems (Bijker, Hughes, and Pinch 1987) imply that designing integrates design-specific contributions

and users as co-designers. Neither bicycles (motor-assisted or not) nor the internet-grounded activities they analyse are co-designed. There is no design interaction to account for, but rather conditioning through design. The myth of collective wisdom extends to customisable products (e.g., user interfaces) that are actually selections from a predefined set. Semiotics and design as a semiotic activity (the art of design) are by necessity the expression of the individual experience integrated in an open-ended process, i.e., *semiosis*.

1.2 What designers need to know

As important as it is to debunk pseudo design theories, let's not forget the initial question: Why semiotics? Does semiotics turn the metal pieces that a meatgrinder is made of? Of course not. Semiotics does not turn the motor into a car, or the two wheels held in a frame with a handlebar into of what we call a bicycle (with or without battery). The programming that design provides is semiotic programming in the language of design. What is programmed, i.e., made possible, is *meaning*.

Semiotics, as the science of sign systems of all kinds (the language of mathematics, the formalism of physics and chemistry, the notation systems of music, of dance, of the World Wide Web, etc.) is the domain of meaning. Logic that guides human thinking is about what's true and what's false regarding mind operations such as inductions, deductions, inferences, calculations. What does it mean to say that "Semiotics is about meaning"? There is the "Know how"—how to grind meat, how to drive a car, how to bike, how to surf—and there is the "Know that," i.e., the science behind all that it takes in terms of knowledge and skill to make new things (Ryle [1949] 2009).

Everything is designed. Sometimes successfully, other times not. Constitutions, governments, highways, posters, songs, user interfaces, websites, fashion, food (not just its presentation), drugs (for medical purposes or for so-called recreational use), babies, education, bank robberies, currency (crypto, anyone?), chat GPT, wars, and peace agreements. For your own enlightenment, name one thing in your life that is not designed. Of course, there are some things that are not subject to design: toothaches and heart attacks are not designed, likewise sneezing, falling in love, and making children. Or stones on a beach. Earthquakes. But as soon as human beings purposefully make things happen, as soon as individuals constitute themselves through their actions (We are what we do!—recall *The Civilization of Illiteracy?* Nadin 1997), they identify themselves, as semiotic animals (*zōon semiotikon*). This is the identity of the designer—the animal that makes a meaningful future happen for some explicit or implicit *purpose*. Aristotle is watching (even those who never heard his name): "The specific difference is that part of the essence which distinguishes the subject from other things of the same genus or kind" (*Categories*, 350 BCE).

Is a bird's nest designed? Is a beaver's ingenious den designed? Asking these questions before advancing the idea that *Homo sapiens* are designing beings will spare us the embarrassing realisation that other creatures also design. Their designs are the expression of the anticipatory nature of life: do what it takes to preserve it (fig. 1).

FIGURE 1. *A bird's nest and a beaver's den—anticipation expression: natural forms that we perceive as design of the living expressed as what we perceive as design. Design is purposeful above and beyond survival. Author's archive.*

If we take note of the fact that quite often design is not the purpose, as is it in human activity, then we realise that there is a distinction between a bird's nest and a skyscraper. Design is purposeful above and beyond survival. This is where thinking enters the picture. And there is one more distinction: design is something that is associated with the sign, in other words the way in which we re-present goals and purposes. Therefore, design is always the unity of syntax (formal aspect of representation), semantics (understanding), and pragmatics (what for?). Design is, within culture, a sui generis educator. In association with art, poetry, film, and media, design promotes values.

Design starts as a semiotic process, and it is best represented by how tools come into being.

For those aware of semiotics, it is easy to realise that the hammer—one of the first tools, a stick with a stone attached to it—is an extension of the hand. Semioticians would call it an iconic representation (fig. 2).

FIGURE 2. *Semiotic evolution of the hammer: from iconic condition to symbolic function. Author's archive.*

In time, this extension of the hand acquired functions that the hand itself could not achieve. Of course, if you have a hammer in your hand, you have more power than someone who doesn't. Tools are empowering. This is how from the iconic level—imitate the arm—people proceeded along the sign process to achieve the symbolic level. The gavel in the hands of a judge signifies many things. But the hammer can also become the hammer that ignites the bullet in a gun (fig. 3).

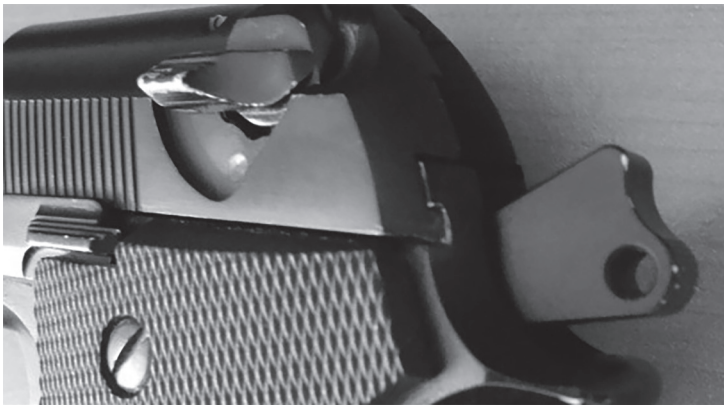

FIGURE 3. *The hammer ignites the propellant in the bullet. Design empowers—and not always in the most desirable manner. A long way from the ur-hammer. And designs evolve! Ever thought about the cell phone as a weapon? Author's archive.*

At this instance between the direct action—hitting the nail on its head—and the indirect action—triggering the process through which an explosion is produced, we notice a chasm. Reflect upon social media—the most pervasive design of our time—and its possible destructive potential. To design is to guide actions through which the possible futures become reality. Designers make possible means and methods for triggering change. Through semiotic means—what else are the infinite numbers of web pages and the associated browser technology for facilitating interactions?—the anticipated future is turned into a new reality.

There is no identifiable need for a theory of design. Bees and birds do not know semiotics; beavers build their abodes ignorant of any theory of design, or of science. While each of the animal or bacteria expression of anticipation is based on that particular organism's need to survive, design is social in nature. It transcends the limits of a beehive—a small community. The social scale of design is testimony to a process that makes design a necessary component of a society. While the word *design* points to an activity focused on the sign, it could also mean not only *from the sign* but also *on account of the sign, concerning the sign, according to the sign*, and even *through the medium of the sign*. The programming aspect—to program meaning—is reflected in the variety of ways in which a design facilitates human interaction. Design has formal aspects (the looks, the materiality), but in the final analysis, it is a pragmatic endeavour: it facilitates meaningful human action, with the emphasis on *meaningful*.

Here is the place to rehash semiotic concepts. Semiotics as a discipline reflects the nature of knowledge acquisition. It was conceived (actually constructed) and developed in order to facilitate activity in the domain of what is meaningful to society and its members.

1.3 From form to *Gestalt* to design

Designers are among those professionals who have shown a first and continued interest in the modern revival of semiotics. In search of a theory for a field of human practice characterised by the lack of a conceptual discipline, designers, especially those formed in the Ulm School tradition (which built upon the Bauhaus), were willing to adopt semiotics as their theory. They expected that semioticians pay attention to critical problems of design and not extend a logocratic model (i.e., based on how language works) where something else—understanding images—seemed necessary.

Maldonado—an impressive author of texts on design theory—undoubtedly deserves credit for being receptive to semiotics and making it part of his own design concept. At the initiative of Theo Crosby (architect, sculptor, writer, designer, founder of the design and architecture firm Pentagram, and editor of *Uppercase* magazine), and with the assistance of some of his students—Guy Bonsiepe should be mentioned here—he published several articles dealing with semiotic concepts and their pertinence to design, see, for example Maldonado (1967). Bonsiepe embraced semiotics to the extent of defining design as interface—sign systems bridging between realities. This happened when Europe, still in love with semiology (based on de Saussure's work on language) discovered Charles S. Peirce. Max Bense, continuing his search for a scientific foundation of aesthetics, arrived at sign theory (1970, 1971). East European designers, facing constraints typical of authoritarian regimes, approached the semiotic problems of codes with new hope for their future work. Working with semiotics, a designer could avoid the trap of ideological discourse. On the American continent, the interest of designers in semiotics was expressed quite late, mainly through students and scholars from Ulm (the famous Hochschule für Gestaltung), or by contamination from other fields—predominantly from literary studies. Americans were intellectually too lazy to get to the core of Peirce's semiotics. This has not changed over time. The quick-fix expectation still dominates. This short historic note is hardly a rigorous account of names and events, but an explanation of work that results from applying semiotics to design, or from looking at design from the semiotic perspective.

A certain turn in my life (i.e., forced emigration) put me in the position of being able to devote many years to the issue. I carried with me what I learned from Hans (János) Mattis-Teutsch, a friend of Moholy-Nagy (with Lajos Kassák they published *Ma*, also the name of a group). Mattis-Teutsch taught design in Brașov (Romania) and was preoccupied with

conceptual aspects of designing works of art (his own sculptures and paintings included, Nadin 1977). From Solomon Marcus—a superb mathematician—I brought semiotics with me, studied in depth, and applied it to art, architecture, theatre. All this informed my teaching of design and semiotics in Germany and the introduction of computational design. Upon my arrival in the USA, I initiated the teaching of semiotics to designers (Rhode Island School of Design 1981–1985, Rochester Institute of Technology, 1984), the development of original courses for practicing designers who wanted to apply semiotics in their work, and the application of semiotic principles to my own design work pertinent to computers and artificial intelligence (Nadin 1986).

Design happens to be a rather unsettled field of human creativity, without critical method (and without methodical criticism), and without the means to construct one for itself. People who worked in typography, printing/printmaking, jewellery design, architecture, textile, heraldry, ceramics, fashion, and other arts started identifying themselves as designers a bit over a century ago. Design is a general concept that covers various aspects of human culture. It describes the underlying quality of objects, actions, and representations which various people make possible in a given culture and within a value framework.

To design means, among other things, to plan, to anticipate according to a devised course of events in view of a goal and under the influence of an environment. Björn Englholm (1984), in an article that deserves the attention of both designers and semioticians, referred to a time "Als man zu Design noch Gestaltung oder Formgebung sagte" (when design was still called *Gestaltung* or form-giving; my translation).The shift in terminology he described is taken a bit too seriously, to the extreme that, under new names, design products "identified as good" offend the eye.

In today's design, ideology is written in upper-case letters. American design or Italian design is no longer concerned with a subject, but with representation. Design degenerates into sign. (Englholm 1984, 6) [my translation.]

Does it? Or is the process different in nature: is matter (subject of work, such as in processing materials) replaced by its representation and subjected to digital processing? The internet, and by extension the web, changed the entire environment. AI and machine learning are even more disruptive. In the grip of the mother of all machines—the Turing machine—design became a necessary intermediary. With more than seventy years of active involvement in design, Bonsiepe could celebrate his prophetic statement that design is by necessity an interface. But is it? Machine Learning took over the UX business precisely because it was no longer a form of design, but rather an appeasement of the machine model.

The "new" designers—technologists of design—now apply complex knowledge, use sophisticated expressive means, and pursue function-

ality, mimicking aesthetic quality in inciting the user to interact with the design, to "complete" it in the process of using it (the pragmatics of product). (Is this what the ideologues of social castration of technology had in mind?) *Jugendstil* designers beautifully concentrated on syntactic aspects. *Bauhaus* started with strong semantic overtones. The so-called product semantics—an attractive product design aimed at maintaining product form as close as possible to what users perceive the product to be—should be mentioned as an example (despite the primitive thinking often embodied in the theory developed). Very few designers concentrate on pragmatic issues, critical in this age of fast-changing contexts in which design is perceived and interpreted. Ray and Charles Eames come to mind; and maybe Florence and Hans Knoll. I claim that, despite their fundamental differences, the Bauhaus and postmodern models share a common focus on the pragmatic level of the sign: Bauhaus in accord with the socialist ideology it embodied; the postmodern along the line of a better understanding of our new human condition in this age of technological renewal and scientific discovery. Design acquired, in the postmodern, qualities reflecting the semiotic awareness of designers. The world is "semiotised." Humans work less and less with real objects, and more and more with their representations. Therefore, designers are forced more to shape representations than to shape realities.

2 ON THE SEMIOTIC NATURE OF DESIGN

The process of designing is quite difficult to describe due to the interdisciplinary nature of design. Design covers such various fields of activity as architecture (from landscape to interior, urban, monumental), visual communication, engineering, and industrial design. It is one of the most pervasive human activities. The "specialised" components (e.g., planning, aesthetic quality, the social and psychological aspects of design and the designed product, communication, science, technology) require an integrative procedure. A self-critical moment, allowing designers as well as users of design to compare new designs with previous work and situate design in the broader context of culture and civilisation is desirable. The design process, in its close relation to design products and their use, implies design intelligence, cultural sensitivity, and a critical attitude—semiotic components of the many other forms of human activity.

Design principles are semiotic by nature. To design means to structure systems of signs in such a way as to make possible the achievement of human goals: communication (as a form of social interaction), engineering (as a form of applied technical rationality), business (as a form of shared efficiency), architecture, art, education, etc. Design comes about in an environment traditionally called *culture*—currently identified as artificial through a rather romantic distinction between natural and artificial—and acts as a bridge between scientific and

humanistic praxis. Along this line of thinking, Herbert Simon stated, "Engineering, medicine, business, architecture, and painting are concerned not with how things are but with how things might be—in short, with design." ([1969] 1996, xii) The object of semiotics is sign systems and their functioning within culture. For a long time, one type of sign—the symbol—was considered representative of all signs in human culture:

For most of us [...] the significant part of the environment consists mostly of strings of artifacts called "symbols" that we receive through eyes and ears in the form of written and spoken language and that we pour out into the environment—as I am now doing—by mouth or hand. (Simon [1969] 1996, 2)

Actually, we perceive signs through all our senses, and we generate signs that address the same.

2.1 Sign horizons

In order to apply semiotics, we have to settle upon one of the many definitions of sign that have been advanced and then use it in relation to design. The definitions fall into two basic categories:

1) Adoption of one kind of sign—usually pertaining to verbal language—as a paradigm, with the understanding that every other sign is structurally equivalent. Artificial intelligence researchers are quite comfortable with this model. The Swiss linguist Ferdinand de Saussure (1857–1913) advanced a definition of the sign as the unity between a *signifier* (the actual sign embodied in some material form such as words, shapes) and the *signified* (what the sign is supposed to mean).

2) Adoption of a logical structure, with the understanding that each type of sign and each sign operation can be described within a panlogical system. The American scientist and logician Charles S. Peirce (1839–1914)—a pioneer of the computer—advanced a definition of the sign as "something that stands to someone for something in some respect or capacity." (Peirce, CP 2.228)

No matter which definition is adopted, the question of semiotic relations governing sign processes necessarily comes up. Remaining within the realm of the sign as a symbol, Simon felt entitled to state:

The laws that govern these strings of symbols, the laws that govern the occasions on which we emit and receive them, the determinants of their content are all consequences of our collective artifice. ([1968] 1996, 2–3)

Both de Saussure and Peirce described the same through the role of the social, a semantic equivalent of "collective artifice." Although Simon is mistaken in limiting the sign to the artifact, he is correct in considering signs as having an air of contingency (natural phenomena having an air of necessity, in his opinion).

The panlogical definition of the sign is more appropriate to design, an activity in which the visual dominates. However, there are numerous instances when the Saussurean definition, (or some of its refined versions for which we are indebted to contributions of the French School of semiology) can be used as an efficient analytical tool. Nevertheless, I shall apply the panlogical definition in this text due to its appropriateness to the subject of design and my intention to present examples of semiotics applied to design.

2.2 Explanatory models

Design activities are not reducible to the model of verbal language (or of any other sign system). On the basis of Peirce's definition given above, this diagrammatic representation (not the only one possible) can serve as an operational model (fig. 4).

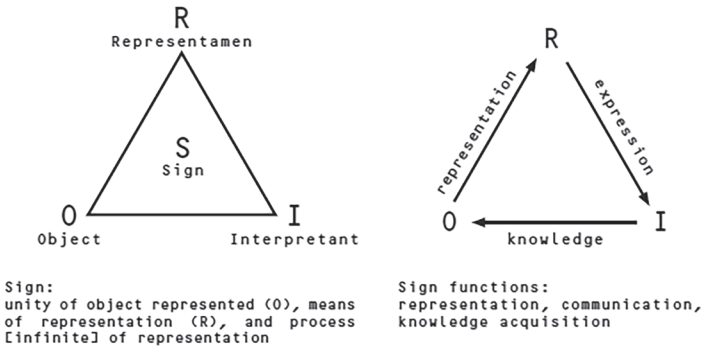

FIGURE 4. *Sign definition and sign functions. Illustration by the author.*

Semiotic levels at which sign processes (semioses) take place, levels that became familiar and important in design, can also be depicted (fig. 5).

Syntax: the relation between signs, how signs are constituted

Semantic: the relation between sign and object, what the signs are conveying

Pragmatic: the relation between signs and the user, what signs are used for (Morris 1938).

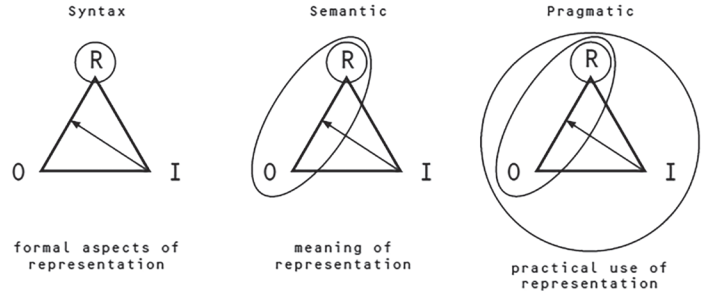

FIGURE 5. *Semiotic levels. Illustration by the author.*

There is little trouble in understanding from this that no sign can be considered independently of its relation(s) to other signs, be these similar (such as words in a given language) or different (words, images, sensory perceptions, etc.). The interdisciplinarity of design is the consequence of the fact that sign processes are heterogenous by their condition. In order to understand how different kinds of signs constitute design, we have to become acquainted with each different kind, as well as with the principles governing human or even machine interpretation of design. Representation of an object, and the consequent interpretation of such a representation can take three different forms (fig. 6).

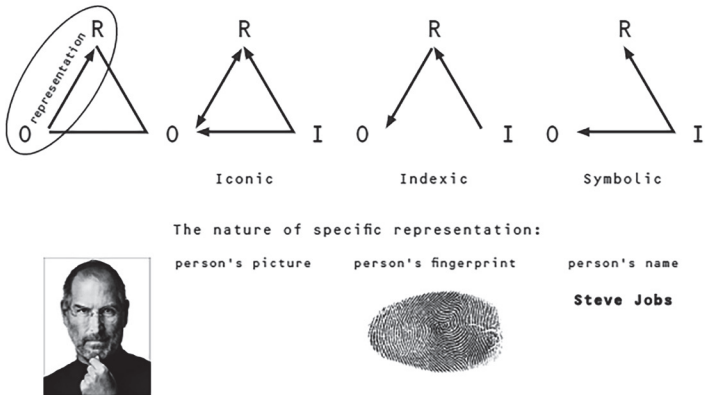

FIGURE 6. *Forms of representation (I used this diagram to explain semiotic representation to Steve Jobs as it applied to work on the semiotics of the LISA computer; Nadin 1984).*

It should by now be clear why Simon's concern with symbols alone (also the concern of the field known as symbolic anthropology, which influenced designers for a long time) proves to be a serious limitation of his explanatory model. However, since symbols are the dominant sign representation in human culture, and since each symbol contains iconic or indexical elements, it is easy to reformulate some of Simon's ideas in order to more adequately make use of the semiotic principles governing the cognitive condition of design. Semiotic interpretation of design requires that we identify the design as the elements constituting it.

2.3 Design as applied semiotics

The main sign operations—substitution, insertion, omission—are actually the rules of design language. They are applied over a repertory that is practically infinite (as opposed to the twenty-six or so letters of western alphabets). Consequently, we do not have an overall design language but sets of design languages. The realisation that there is no medium that suits every application and every user frames the issue of design as applied semiotics in its proper framework. There is no universal method that, once applied, will ensure good or effective

design. The reason is simple: design is interpreted or used by various interpreters; that is, the interpretant—the process represented by all the instances of interpreting a sign—is infinite. For designers to apply semiotics does not mean to design with a treatise of semiotics on the drawing board or under the computer keyboard, but to consider the semiotic implications of whatever they design. What matters is the understanding that designers must know for whom—user within a culture, not commissioner—they design, i.e., to establish a semiotic system with precise, appropriate, and consistent rules.

2.4 Design as interface

People communicate using signs: words of a language, gestures, sounds, images, odours, etc. Such signs can be simple or very complex, homogeneous or heterogeneous, sequential or configurational. An interface is the meeting place between two different entities that are supposed to come in contact, to be brought together, i.e., to communicate. It follows that an interface has the nature of a sign. Simon even introduced "the artifact as interface." ([1968] 1996, 6–7) The concept of interface became fashionable in the "computer age" (as it was called at that time). But it is actually a product of human culture, an artifact environment, and it is in this respect that Simon regarded "the artifact as interface" and "the environment as mold ([1968] 1996, 5–6)."

Interfaces are also a problem of human-to-human relations, especially in the context in which human contact and inter-influence become more and more mediated. Defining the sign as a mediating entity and semiotics as the theory and practice of mediation, I suggest that despite the diversity of signs and sign processes characteristic of design, these all fulfil the basic function of intermediary, go-between, medium between two or several distinct entities brought together through a specialised human activity which we call design. The contingency of each mediation—its likelihood, relative unpredictability, its dependency on and conditioning by other factors—that is, the contingent nature of design, is a reflex of design's dual nature as science (in respect to the scientific principles of design) and as art (in respect to a particular, original way of designing). *The product of design is the reality through which user and designer communicate*. I should repeat that an interface, no matter what kind, specifies the optimal set of signs for the interaction between two entities, be they animate or inanimate. In a limited sense, a user interface specifies the action the user is supposed to take in order to access different parts of a system to the design of the conceptual model that is the basis of that particular system.

Cars, radios, dishwashers, and vending machines, etc. all require an interface in order to be optimally used. Each requires a certain sequence of actions that allows for the pragmatics of using it. What

makes things a bit more complicated in comparison to the most common social forms of interface through the intermediary of natural language (the most complicated semiotic system that we are aware of) is the fact that design interface is part of the designed object. To use an analogy, it would be like receiving with every sentence we hear or read instructions for understanding it, i.e., the code. Design is indeed a work of encoding and providing the key for the "reader." Sometimes design is quite hermetic; at other times it can be direct to the degree of being simplistic, offending our sense of design.

3 ALTERNATIVE FOUNDATIONAL VIEW OF SEMIOTICS

3.1 How does semiotics help the designer?

Semiotics is not an unchanging religion. Like the sciences—mathematics, physics, chemistry, biology, etc.—semiotics changes over time. The wooden planks and metal poles—scaffolding—used in building have been replaced by the aerial lift. Soon, drones will bring the building components to the builders. Semiotics is scaffolding for designers, as it is also scaffolding for the sciences. The relatively primitive view of signs, often based on intuition, was replaced by strict definitions of Peirce's semiotics. But the dynamics of life in our age requires a more dynamic view of semiotics. The alternative suggested reflects this premise.

Semiotics, in order to justify its legitimacy, whether in the design field or in any other human endeavour, has to account for how, from the quantities taken in through the senses, or through measurements of all kinds, we arrive at awareness of the world, i.e., a representation of pragmatic significance. Indeed, meaning is always associated with action (physical, cognitive, emotional, etc.): we want to do something. This is the justification of the effort to know.

The impact semiotics could have on human activity, in particular design, depends on

a. *effectively* associating knowledge acquisition with semiotics (as a meta-discipline);

b. understanding meaning as a particular form of knowledge, complementary to quantitative descriptions of reality.

The immediate consequence of this association: it identifies temporality, a characteristic of semiotic processes, as intrinsic to its definition. Designers rarely realise the time dimension of their activity. In the review of methods and concepts that make up semiotic awareness, it becomes clear that in the absence of a dynamic view of semiotics, its reason for being accepted and practiced vanishes. Designers need to understand that only the union of a past-defined dynamics and that of a future-informed action is of consequence. It is in this sense that a semiotic perspective is complementary to the deterministic view of

change. In what follows, an attempt will be made to redefine semiotics according to what from inside the discipline became an imperative: couching the semiotic in the broader view of pragmatism. Let me "rewrite" Peirce: The purport of semeiotic consists in the open-ended holistic modes of existence, in particular, of rational conduct, which, in any given context, would ensue the acceptance of a semiotic process perspective (Peirce CP 5.438 paraphrased; see Hartshorne 1965).

3.2 Semiotics and anticipation

The bird's nest or the beaver's den is not constructed in reaction to danger, but in anticipation of change (reproduction, protection, etc.). The anticipatory nature of the living vouches for the necessary nature of a semiotic view in ways similar to how the deterministic nature of physical processes (such as the functioning of the universe) explains gravity. With one important difference: gravity, as a phenomenon of physics alone, is the embodiment of determinism. It can be explained through cause-and-effect relations. That is, a past (cause) leads to a current state (effect). Semiotic processes (semioses) testify to the non-deterministic nature of the living. The same sign can mean different things. Yet another paraphrase of Peirce (in reference to CP 5.402): We compare action (through which anticipation is expressed) to the finale of the "symphony of thought" (Peirce's words), or better yet, to holistic cognitive processes. They integrate the sensorial, the cognitive, and the motoric. We do not understand the few bars at the end of a musical movement as the purpose of that particular movement (i.e., effect), but rather as an integral part of the whole. The aesthetic quality of a typeface or of a design cannot be a goal in itself. The meaning of design is constructed in the act of interpretation by those using it—i.e., those interacting with designs. The goal is a concrete manner of meaning emergence. It is a possible future. The bird and the beaver live their choices. Human beings can evaluate their adequacy before making a choice. To evaluate the outcome, to take a critical view of it, is what semiotics affords. The entire interactive domain of human activity today is testimony to this. We can model a possible future before making our design choices.

Based on this idea I wish to define an alternative view. Let me reaffirm the fundamental idea to which almost everyone in the choir of semiotics agrees: Semiotic processes, in whichever domain (mathematics, poetry, design, politics, etc.) are a prerequisite for knowledge acquisition and for sharing it. Knowledge itself stands for something else—whatever that particular knowledge is about: matter, poetry, sex, astronomy, moral values, etc. Knowledge about design is different, of course, from scientific knowledge, but in the absence of it, design is simply not possible. It is the compass we need in our various journeys. For this reason alone, the semiotic description, while not the same as

the knowledge represented, is about awareness of change, not about change itself. Design is by necessity new—rehashing (the current dominant practice) does not qualify as design. The outcome of the new "machines" that transform text-to-image is imitation, but never having the condition of design.

To know is to know for some purpose—including a purpose for its own sake. Think about the famous Rietveld chair, not exactly designed for sitting. Purpose—exactly what distinguishes the living from non-living matter—is related to the awareness that all there is, including the knowing subject, changes. *To know* is by necessity purposeful. This is why knowledge is not in reaction to the past, but in anticipation of the future. This is especially true of design. Anticipation is always expressed in action. Knowledge acquisition, implicit or explicit, is the elementary form of anticipatory action. We know for the future. Based on this knowledge, designers continuously invent the future. Those still dedicated to the slogan "Design is problem solving" *do not* understand what design is.

Anticipation is a realisation in the space of possibilities. Some realisations are right—we avoid so many dangers, most of the time not even aware of them. Some are wrong. Prediction is informed by determinism: same cause, same (or almost same) effect. Anticipation is action informed by non-deterministic processes. Semiotics has nothing to contribute to the determinism of predictive mechanisms. However, semiotics could inform awareness. Consider, as an example, the culture of earthquake awareness in Japan and the learning process—a whole life long—for everyone involved. Designers in Japan internalised this awareness. Faced with the threat of terrorist attacks, Israel developed an effective alert system in which reaction and anticipation complement each other. GPS not only guides us on the road, but also supports a variety of businesses. The i3 car that BMW designed opened the horizon not only for electric cars, but also for autonomous (i.e., self-driving) vehicles.

Inference from the past to present and future, often supported by statistical generalisation, is powerful, but insufficient (and sometimes dangerous—think about Chat GPT disguised as Sydney and threatening humankind!). The future informs the present through the realisation of the meaning of something—disease, creative act, nutrition, exercise, etc.—that stands for a desired goal: maintaining life, encouraging creativity. All cells, of animals, insects, and plants, interact for the purpose of remaining viable parts of a whole defining a living entity. With a few exceptions, design for medical applications failed miserably to deliver what would actually help the healing process. Everything pertaining to a physician's office or hospital became an industrial application lacking human touch. The assumption, accepted by designers, that the human being is a machine undermined their work.

3.3 Design is purposeful

Purpose, the attainment of which semiotics should provide a means for integrating a variety of processes, is not reducible to the "atoms" from which the anticipatory action is made. To achieve a goal—e.g., advertising a product, conceiving a device, sharing a political program, engaging students in a project, denouncing racism, or affirming a new scientific or aesthetic value—involves all it takes to design a marketing campaign or to engage people in new actions. To design a political event, or a new teaching and learning environment involves a multitude of semiotic processes. Obviously, to denounce racism, for example, goes beyond the sign *#BlackLivesMatter* (or the graphic elements involved). Designers failing to understand this operate under the false assumption of substituting rhetoric for action. A new scientific concept, or a new design concept engages semiotic means: a new foundation, new methods for describing it, and testing. Once more, BMW's i3 illustrates the point. A new language of integrated actions is what designers at BMW defined, implemented, and tested. Aesthetic interactions, usually described as innovative (or creative), come to expression semiotically. They integrate look, structure, function, and adaptive capabilities. In the context of the COVID-19 lockdowns, face masks, and social distancing, new forms of expression were amply tested. But none was reducible to a sign or signs, or to their classification. They are of the nature of a semiotic aggregate, a whole unfolding in real time, or in virtual time.

The next step, i.e., to understand the holistic nature of semiotic processes—how they integrate the human and the environment—and their continuity, is not optional. Yes, design is by necessity holistic, integrating all components. As a consequence of the necessary nature of sign processes, understood as means informing action, semioses are integrative in nature. In this view, it does not suffice to identify the iconic nature of the user interface based on the desktop metaphor, or to find a justification for the indexical in identifying individuals by their fingerprints. Actually, it requires the understanding of the possibilities created, not of ways to represent things or phenomena.

Those who see in the sign the equivalent of what the atom is for matter miss the alternatives represented by fluid sign processes within an open-ended, non-decidable process. From all these possible alternatives, I suggest the dynamic view of semiotic events succeeding in time. And I shall present three different examples of ways to understand semiosis as goal-oriented: the model of the flowing stream, and narration and story.

3.4 The flowing stream

A very promising attempt at organising and subsequently evaluating our own semiotic experiences is suggested by the flowing stream, conceived by Gelernter (1991) and further pursued as a computer application by Freeman (1997). The flowing stream is the sequence of every digital

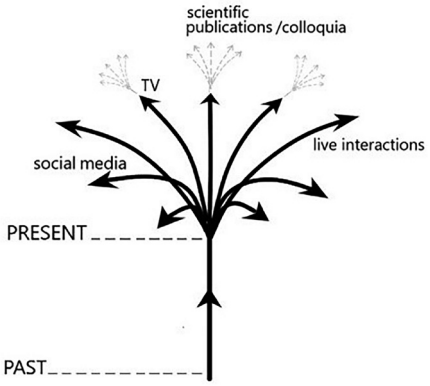

FIGURE 7. *The flowing stream—semiotic processes unfolding. Illustration by the author.*

document—mail, photo, word processed, URL, notes, sounds, etc.—referenced in the order of their receipt (or in the order in which they were generated, using the time stamp of the device used).

However, semiotics is not about data (representing quantities), but about meaning, that is, interpretations; and in this sense it is more of an art—like medicine—than a science. A record of succeeding experiences is the premise for understanding not only what happened, but also of what might happen. Let's use a visual representation: a paraphrase of Gelernter's (2013) sketch on the back of a napkin (fig. 7).

Every semiosis has a past, a present, and a future. Consider calendar entries: events consumed (e.g., visit to the eye doctor, a trip via aeroplane, a concert attended), events taking place (reading a book, listening to music, running), events to come (the next class to teach, a faculty meeting). The purpose of an action (e.g., writing a birthday card, finishing a symphony for its first performance in a concert hall, preparing for graduation, hugging) and its semiotic representation are connected. In the semiotic "forest of trees" from which other "trees" are growing, the past is always a retro-semiosis: an interpretation at $t_{present}$ of whatever happened, or we assume happened, at t_{past}. The interpretation has its own time stamp. It is not a mechanical act, but a living experience. Even the act of interpretation can be further interpreted: Why is t_{past} meaningful at $t_{present}$? Because while succeeding events (narrations) are time-bound and independent of the observer, their interpretations in stories are not. The interpretant process is open-ended. Apply this to Shakespeare's writing, to the paintings of the impressionists (recall Manet's *Le Déjeuner sur l'herbe* and how it morphed into many interpretations, each with its own meaning). Apply it to Newton's physics and to genetics, to political programs and to ideologies. Notice how the meaningful extends from its inception to the present, and how it informs anticipatory action. As an epistemological construct, interpretation earns its legitimacy by making possible the realisation of meaning: how and why a semiotic process is pragmatically significant. *Interpretation takes place from the tail end of the process: the narration in reverse, from end to beginning. Possible extensions are all meaning-pregnant.*

Thus semiosis, as a flowing stream, integrates the subject: The subject sees the red light and stops. Or drives through. The video camera provides a different record, independent of what the subject believes or makes up: "I saw a car speeding in my direction and didn't want to be hit." Their meanings are different: Through the semiosis, the subject extends a hand to the past and a hand to the future: "No, I don't want to be fined for a violation, even if the video camera shows clearly that I did not obey the

rules." Interpretation is always goal-driven, and it depends on the context. The record is independent of context (yet dependent on technology and its built-in assumptions). The "interpretation" in the autonomous vehicle is a data processing stream, without any understanding of what it means to drive close to a child, to an elderly or a handicapped person.

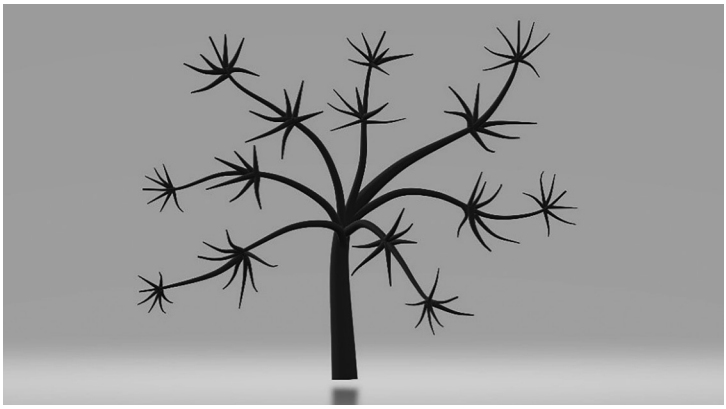

FIGURE 8. *Infinite semiosis along a variety to timelines. Semiosis generates futures as meaning. Illustration by the author.*

Actually, semiosis, i.e., semiotic process involving sequences or configurations of signs, is a diary of someone's semiotic experience. It cannot be reduced to the various signs making them up. A headache can be considered as such—the pain localised in what is called the head—or as symptomatic of something else, part of something else. Or—and this is the place where the flowing stream metaphor of trees developing from trees, etc. comes into play (fig. 8)—it can suggest a context (stress, shock) that leads to the headache. Better yet, the headache stands for something else, not as an "atom" of the state, but rather as a process. It is an open-ended process associated with future states: from taking a pill, resting, undergoing tests, requiring surgery, and so on. The tail—i.e., the time vector from the headache-free past to the present—is minimal. But the time of pain seems unending. Machines are not aware of what pain is; they receive pre-programmed threshold values. To realise this elementary semiotic distinction is a good premise for designing devices that help monitor someone's condition but do not interact with living processes.

Each semiosis, i.e., process of individual involvement in semiotic processes, starts with being born, primeval cry, naming, birth certificate, and continues with vaccination record, social security number, driver's license, official identification card, etc. More and more semiotic identifiers accumulate: first words spoken, individual motoric expression, aptitudes identified, kindergarten, school, college, etc. Notice how the "tree" branches out and new "trees" grow out. Think only of someone's loves, or of the social interactions through which identity—a semiotic aggregate—is ascertained. It takes one rumour (not to say an article in a peer-reviewed journal) to fill the world with semiotic processes ranging

from rational inferences to pathological speculations. This is where the critical function of semiotics is relevant: not in deciding upon truth or falsehood, but in suggesting the meaning of each. If the dynamic systems metaphor (e.g., the flapping of the wings of a faraway butterfly can cause a hurricane) can be modelled through a deterministic process (computers are appropriate for this), the semiotic "butterfly" escapes description. Wars were started on account of semiotic processes that went awry.

Among lesser disasters are "designs" of all kinds that have reached the market: the HydrateSpark (to remind people to drink water); the Kérastase Hair Coach (measures the brush pressure on a person's head); Garageio (for opening the garage door using your smartphone); the "smart" Griffin toaster and "smart" Griffin Mirror, Flipflops. All these and more—many more—because *meaningless* can be monetised within a culture blind to meaning—never mind sustainability. Evidently, semiotics can and should shed light on design aberrations.

The semiotic ecology expands. Cloning belongs to the process: Humans imitate and are imitated; they multiply; their semiotic output (intentional or accidental) increases and becomes part of the vaster encompassing ecology called culture. This is probably what everyone focused on the semiotic nature of culture reported on, without realising the complexity of the process. Indeed, culture is an ever-evolving process of G-complexity (Nadin 2014); that is, it cannot be consistently and completely described. It would be beneficial to take the flowing stream model and apply it to or conceive of activities such as social programs, education, medical care. The anticipatory dimension is evident: the possible future is a semiotic future, of goals representing possible states of reality. The tremors registered on a seismograph are representations of measurements—data used to infer from the past to an upcoming earthquake. The degree to which the laws of physics describing such an occurrence are known is reflected in the accuracy of the probabilistic prediction. The symptoms associated with medical conditions—headache, fever, sweating, etc.—are of a different nature. Their meaning is context dependent. There are no laws describing the state of health from good to bad. The meteorological data suggestive of a hurricane, as well as the musical passion of a four-year-old girl or boy who might become the prodigy of the future, can be considered from a semiotic perspective despite the fact that they refer to fundamentally different forms of change. The flowing of a stream is a suggestive representation, provided that the focus remains on meaning.

3.5 The design narrative and the meaning of change

Narration, and its extension in the story as interpreted narration, is an alternative corresponding to the understanding of semiotic processes as time events. The most intuitive description of a narrative is the following: record of a sequence of events as they succeed in time. Example: how to prepare coffee, one step at a time. The word (from the Latin *narrare*)

means to recount. Therefore, each narrative adds up to knowledge, at least in the sense of documenting successful and less successful activities.

Narrative emerged as a plurality of means of expression for describing human experiences and making sense of them, i.e., understanding their meaning. Some comments about narration could help in realising its semiotic significance. It is evident that parents involve narrative as a means of sharing knowledge with their children. Schank and Abelson (1995) argue that stories—interpreted narrations—about one's experiences, and the experiences of others, are the basic constituents of human memory, knowledge, and social communication. They call for a shift towards a functional view of knowledge. Schank (1995) explains: "Intelligence is really about understanding what has happened" so that those who share in it might "be able to predict when it may happen again." Such knowledge is constructed by indexing narratives of one's own and others' experiences and mapping them to structures already in memory. Atance and O'Neill (2005) write about narration as a goal-oriented representation making it possible to pre-experience an event. In other words, the goal-oriented aspect suggests that anticipation implies awareness of narrations as preliminaries to actions ahead of the time when such actions might become necessary (before storms, earthquakes, volcanic eruptions, fires, etc.). Through narration as a semiotic experience of recording actions, humans acquire the developmental basis for skills such as planning and causal reasoning—which are semiotic in nature. Their object is *what* stands for the real, and this entity can be a narration. Episodic future thinking emerges around the age of four and is related to children's abilities to construct and comprehend verbal accounts of experiences. The neural basis for the role of narrative in the abstraction of daily experience to knowledge (Mar 2004) is a subject of interest not only to those focused on marketing, but also to those discussing the broad issues of sustainability. Narrative comprehension engages a widely distributed network of brain regions, as well as the sensorial and the motoric, and is clearly distinct from basic language comprehension (Nichelli et al. 1995; Ferstl, Rinck, and Von Cramon 2005; Xu et al. 2005).

Narration is different from a progression of statements that describe something (Bruner's definition, 1968). Narration is the unity between an event and its representation (in words, images, sounds, etc.) as a time sequence. Think about the hammer—from extension of the arm to the triggering factor in a gun. Saussure would say "signifier and signified," but this holds true if we do not consider them at a certain moment (synchronic perception, frozen at the time of its capture), but rather in a diachronic sense. The bicycle we ride (including the flood of all types of eBikes) is part of a narration that starts with the wheel. There are narrations extending over a life-long (e.g., our biophysics), even beyond one's "expiration date," and others that can be extracted and further analysed (as we shall see in the example to follow).

It is not surprising that some (Mar 2004) identify the causal structure as a necessary condition for a sequence of events to qualify as narration. The narration called *determinism*—a sequence starting with a cause and ending with an effect—is an example of a selection of cause-and-effect related events, but not a necessary attribute of narration. There are narrations of non-deterministic sequences, defining the living, and for which semiosis is supposed to open access to their meaning. A person gets infected by the SARS-Cov-2 virus; the person is non-symptomatic. Can we infer from this that the person does not contaminate others? This is a possible understanding, i.e., meaning. But everything else—not infective, mildly infective, selective infectivity (e.g., only children, only men, only the elderly)—is possible. This is a semiotic meaning problem, not one of quantities, measurements (called "tests"), or models. This view entails a form of language which includes a context (setting) and a plot: a sequence of events bound by temporal, and implicitly causal, relationships.

Narratives take place in a context—meaning is context dependent. Time, location, and characters are elements of the narrative. In a distinct way, scientific texts are narratives (Bruner 1968). Consider Newton's physics, Einstein's views, quantum mechanics, genetics, etc. Their understanding is unequivocal. There is one and only one interpretation: The law expressed can be tested, but not changed. But when interpretation can expand beyond the law, we are in a different situation. The semiotic process might evaluate the semiotic means used, as well as the authority of the scientist (what Google Scholar provides), or of the institution he or she represents. Past publications, collaborators, affiliations, and funding can be taken into consideration. The current obsession with all kinds of transformers (text processing for machine learning á la Chat GPT) illustrates only what happens in the absence of semiotic competence. Semiotic identifiers are taken out of semiotic processes and transformed into narrations ranging from the coherent to the absurd. The means of expression—e.g., language, diagrams, visualisation tools—are part of the broader semiotic process of evaluation and cannot be reduced to mechanical processes.

Narrative intelligence theory (Mateas and Sengers 1999) states that the temporal structure affects the reader's ability to comprehend the story. Quantum mechanics, with its entanglement model, conflicts with the understanding of Einstein's world of a limited lightspeed. To make sense of it, competence is a necessary premise. To make sense of machine learning productions—imitations of everything used to train them—goes beyond someone's education level. You can have Chat GPT write evaluations for you that seem plausible. But not to understand what is evaluated, or why.

The semiotic perspective concerns the culture into which a semiotic concept evolves, or in which semiotic activity takes place. In other words, how the meaning is conveyed, shared, and informs the life and

activity of those who are part of the culture of their time. The design of the Webb telescope that looks deep into the past corresponds to an expanding semiotic perspective.

If indeed semiotics is about purposeful actions, it is not surprising that interpretations of the narrative—stories—are generated for a goal: establishing norms, conveying knowledge, creating a context for raising a question. In design, the narration of what is needed in order to prepare a cup of coffee becomes the story embodied in the coffee machine. Questioning is the semiotic process of conjuring meaning. The designer builds models as a form of examining and questioning various ideas and means. The narrative is held together by the temporal chain. The story escapes the temporal chain. It often involves virtual times. The epistemic power of the narrative corresponds to its function as a record of events. The epistemic power of the story explains how and why meaning is conjured. In previous writings examining the relation between semiotics and anticipatory expression (Nadin 2013), the following were asserted:

1. Narration is a record of change.

2. A story is an open-ended process of narration interpretation, i.e., meaning assessment.

Watching the universe through a telescope is a way to access the narration of the physics of the universe. The Webb telescope produces the story, which we can watch in real time. Yet a better example: compare the telephone switchboard to the rotary dial phone to the iPhone (fig. 9).

FIGURE 9. *From the manual switchboard (connecting two persons through a wire) to the rotary dial phone that allowed the user to select connections and to the smart phone of our days—connected to the World Wide Web—the design task evolved from providing a context for narration to open the story space to practically everyone. The military is behind the cell phone; thus, it is no surprise that the cell phone became a possible weapon (used, e.g., in mass demonstrations).*

In semiotic terms, the narration, like any sign process, is an aggregate. Bense (1974) introduced the notion of *supersign* to describe such sign aggregates. It can be extremely detailed, or rather abstract. "Queen X dies Tuesday, at this time and this place, surrounded by her daughters." "The King dies five days later, in the middle of the night, while trying to get out of bed." The same sequence can be expressed

as "The Queen died and then the King died" —what happened and in what order. (Forster [1927] 1985, 86) These are representations standing for real events, not the events themselves. The time sequence is representative of a semiotic process, described here through words. But imagine instead of words, images or combinations of words and images, or sounds or whatever can represent something else. The time sequence as a whole is representative for a process selected from a multitude of other events. It is a record—a memory—and as such makes the semiotic process part of the semiosis of life.

The sequence "Queen dies, then King dies" (a simple narration) can easily lead to a story: the Queen dies because the King was unfaithful; the King dies because the Queen poisoned him (or had someone do it), or she cursed him. In E.M. Forster's example, the King died of a broken heart—different semiosis, different meanings. In the story, the narrative data—what and how things happen—are associated with meaning corresponding to the context. Stories are meaning processes triggered by narrations. There are many coffee-making machines. Each offers a different story.

Through stories, the information from the narration—who died, when, where, etc.—is associated with meaning (Nadin 2011) in view of the intentions of the storyteller, or of the scientist who works on a new theory (of gravitation, of relativity, of quantum mechanics). The information regarding the falling apple (or the falling of anything, such as stones, meteorites, individuals, etc.)—the data record, the narration—reveals the meaning of the physical laws, in this particular case, the law of gravity. But it can, as well, associate the narrative to a story different in its condition from the one expressed in the theory of gravity: poetic, dramatic, religious, metaphysical. Imagine a story where the apple does not fall down, but up! Design can make this happen. In each case, a different meaning is conjured. Kings fall from power, leaves float in the wind (slow falling); the fall of Rome marked the beginning of the "Dark Ages"; people who fall on account of lost faith need help to get up and get on with life; fallen angels come to Earth to redeem themselves; and so on. Some meanings are subject to confirmation through experiment; others, being unique, are not. Physical, chemical, and biological entities are observables. Meaning is not. At best, we can construct a record of how meanings change over time, in various cultural contexts. This is actually what semiotic process is. Richard Feynman, recalling the death of his first wife, noticed that the clock stopped at the time recorded on his wife's death certificate. Was there a meaning to be assigned to this? The narration prompted the physicist, a self-declared atheist, to produce a scientific story: elimination of mystery, poetry, religion, etc. He knew that he himself had fixed the clock, and he knew that it might stop if it were moved. It was, after all, a mechanical contraption. Design from yesterday.

But similar narrations—e.g., the clock that stops exactly with the last breath of a dear person, or of some celebrity, or a daughter's dream about the loss of her father—populate culture and foster storytelling in many variations. They should not be misunderstood as observables, but rather as meaning processes, as interpretations. In some cases, the sign processes of the narration serve in knowledge acquisition, in others, in the expression of meaning.

The clock of narration corresponds to the intervals between events in real life. The clock of interpretation corresponds to a living time, of many possible rhythms. The clock of narration and the time of interpretation—the time of the story—are different. The clock of narration corresponds to the rhythm of events in the physical world. The time of interpretation projects into the physical world rhythms characteristic of the change in the living, in particular, rhythms associated with interpretation (stories about the same event can be substantially different). The pain timed on a clock and the subjective time associated with experiencing pain are never the same. When we react to something—a car rushing by while we cross the street—the reaction time affects performance.

When we imagine things in the future, we have the convenience of controlling the rhythm of time. This, too, is a design task. BMW's i3—designed by Richard Kim—embodied in new shapes and new materials things imagined. A victory for design. Indeed, as events unfold in time, the clock, i.e., a gravity-based machine that measures the interval corresponding to the movement of celestial bodies—the clock—serves as a reference. But the time of design is future. Let's imagine that all the machines we call *clock* (no matter what kind, from the pendulum to the wristwatch to the digital clocks of our age) stop. Time does not. Only the measurement—of intervals—is affected. Semiosis corresponds to time perceived, i.e., time experienced, not to time measured. The living is affected by intervals in the environment of existence; but the living also introduces its own rhythms into reality. Saccadic movements, the foundation of sight, have a rhythm different from that of the heartbeat and neuronal connections. Birds in flight or the slow fall of leaves are other examples of particular time scales; the heartbeat of animals is extremely varied. Faster-than-real-time is not only for films, but also for design: the visionary aspect.

Being a record of change, each narration is a representation of the dynamics of reality. Each interpretation of a narration is a story, i.e., the meaning we associate with the information on record. A faster clock, such as the clock of interpretations, is what it takes to evaluate the possible consequences of the phenomena on record in the narration. In other words, the future itself, as we relate it to clocks, is nothing but the outcome of time associated with a faster clock. The semiosis of a possible future based upon which anticipatory action takes place is

independent of the measured time. As a virtual reality, this future does not depend on the rate of change expressed by the clock. We refer to possible futures—plural!—because clocks with various speeds, from very slow to extremely fast, can be constructed. Each such clock allows us to investigate the future *not as a probability*, but as *possibilities* (often negating probability)—where innovation takes place. If the information in the narration is continuously subjected to interpretations from the future, facilitated by the faster time experienced cognitively or sensorially, its meaning becomes *anticipation*. The semiosis underlying reaction is different from that of anticipation. This is yet another reason why a foundation of semiotics that reflects the nature of the living can only be grounded in the anticipatory processes definitory of the living. Consequently, design in the deepest sense of the word is anticipatory.

4. IF WE ARE SERIOUS ABOUT DESIGN

For those who are prepared to give semiotics an opportunity to ascertain itself as a necessary endeavour intended to support purposeful activity, let us end with a comparative view. Nobody disputes the role of mathematics in the progress of society. Even designers realise that many of their tools are mathematical in nature. However, very few, if any, would endorse semiotics as they endorse mathematics (even if they find it difficult). This could change if semiotics were to become as necessary as computer graphics is, or as the mathematics of digital typography is. Confronted with an increasingly worrisome future, society could rediscover the meaning of sustainability through design.

The examples of alternative semiotic approaches suggested here are part of an open-ended toolbox that semioticians are invited to further expand. Indeed, there is not one and only one valid semiotic approach; and there is always the next step—new views, new methods, new understandings. The ideas spelled out here were tested in my class—*Anticipation Informed Design* (Nadin 2022), offered to the students of the Invisible Studio of the Eindhoven Design Academy (2021–2022). It was the last class of my academic career. This article on design, semiotics and anticipation might as well be the last I write on this subject. Let all those passionate about the subject pick up the baton and continue a race that should never end—if we are serious about design!

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