

Martin Siefkes

The Semantics of Artefacts. How We Give Meaning to the Things We Produce and Use*

Abstract

Broadly defined, every result of a human action is an artefact. In a narrower sense, the term is used for material things resulting from human actions; in this sense, all artefacts together form the realm of material culture. Although meanings play an important role in our daily interaction with artefacts, they have never been treated in a comprehensive and systematic fashion. In design theory, cultural semiotics, anthropology, and archaeology, different approaches to the semantics of artefacts have been taken. The article draws on these findings to build a generalized approach to artefact semantics that concentrates on the processes in which artefacts are connected with meanings (cf. section 3).

In section 0 seven principles of semantization are proposed: semantization through (1) frame connection, (2) style, (3) iconicity, (4) individual experiences, (5) cultural allusions, (6) connection to social groups, (7) specific contexts. These principles explain semantization as causal process depending on certain conditions. In section 4.2, a notation system for representing processes of semantization is proposed that combines logical and semiotic notation. For each of the seven principles of semantization, the proposed notation and one example are given.

* The text of this article is licensed under the Creative Commons Attribution-ShareAlike 3.0 License (license text available under <http://creativecommons.org/licenses/by-sa/3.0>); for the pictures, different licensing conditions apply. The author acknowledges the support of the Alexander von Humboldt Foundation with a Feodor Lynen Research Fellowship.

1. Artefacts – more than just man-made things

Whether at home, at work or in many leisure situations: as inhabitants of the modern world, we are surrounded by a great number of different artefacts most of our lives. Every year, many new kinds of artefacts are invented, and higher levels of sophistication and technical development are reached. Obviously, artefacts play a central role in all cultures existing today; therefore, *material culture* is an important category of culture theory. For a long time, however, accounts of culture tended to reduce artefacts to their functional and aesthetic dimensions, concentrating on mental representations (e.g. thoughts, ideas, images) and codes (e.g. language, gesture, conventions) as the units driving cultural development.¹

Today, the view of artefacts as passive results of human activity, produced only to fulfil a certain (practical or aesthetic) function, is no longer tenable. In the last years, different theories of artefacts have been proposed (cf. MARGOLIS/LAURENCE 2007), covering questions like perception, classification, and cognitive functions of artefacts, as well as artefact use of animals and their role in the phylogenetic development of humans. One important aspect of artefacts, however, has received little attention: artefacts are invested with different kinds of *meaning* in daily-life situations as well as when used in cultural representations; their cultural role is complex and ties in with mental representations and social structures in a number of ways. Our understanding of culture will be incomplete as long as we don't understand the mechanisms guiding the semantization of artefacts, i.e., the processes in which artefacts are invested with meanings. Diverse principles of semantization can be postulated (cf. section 4.1), but they are still only partly understood and not sufficiently empirically verified.

Though our cultures are permeated by meanings, in the study of culture vastly more attention was paid to those that come in form of signs explicitly produced as such (e.g. pictorial representations, spontaneous gestures), as well as to conventionalized sign systems (e.g. languages, icons, or traffic signs). Most artefacts, however, are *prima facie* not signs, but things constructed to fulfil a function. It is not trivial to ask how meanings are attributed to artefacts, thus making them signs. The complexity of the problem might be the reason why the manifold and diverse meanings we associate with artefacts in daily life have not received sufficient attention.

Semiotics, the study of signs and sign processes in nature and culture,² which dates back to Aristoteles, reached its first apex in the late Middle

¹ For example meme theory (BLACKMORE 1999; DAWKINS 1976) and other evolutionary theories of culture (e.g. BOYD/RICHERSON 1985; SPERBER 1996); the focus on mental processes is also discernible in many approaches presented in NÜNNING/NÜNNING 2003.

² For a comprehensive handbook encompassing all aspects of semiotics, including its theory, methodology and the areas it is applied to, cf. POSNER/ROBERING/SEBEOK 1997–2004 [partly German]. A shorter handbook concentrating on key terms and theories is NÖTH 2000 [German]. A practical, but simplified online introduction can be found at <http://www.aber.ac.uk/media/Documents/S4B/semiotic.html> [accessed December 6, 2011].

Ages and Renaissance; after a period of decline, it was rediscovered at the turn of the 20th century by Ferdinand de Saussure and Charles S. Peirce (cf. ARISTOTELES 1994, Ch. 1; PEIRCE 2000; POINSOT 2008; SAUSSURE 1916). Today, many types of signification processes have been studied in great detail, but the focus of most investigations was on sign systems, whether culturally evolved (e.g. language, gesture, conventions) or artificially constructed (e.g. traffic signs or morse code), and on uncoded context-dependent sign processes carried out by sign users in specific situations. Processes of semantization of artefacts have rarely received serious consideration; if they were noticed at all, they were regarded either as codes (= systems of conventional signs) or as entirely context-dependent signs. In this study, it is proposed to describe them in another way: as *culturally shared principles of meaning attribution* without a completely fixed outcome, which are intersubjectively shared and not spontaneously created by sign users, at the same time allowing for a degree of freedom and context-dependency in their application (as opposed to codes).

2. Artefacts

2.1 Definition

Definitions of artefacts vary to a certain degree. They have in common that artefacts are defined as resulting from human activity,³ but often further conditions are included in the definition, or presupposed in the use of ›artefact‹. The etymology of the term is not very helpful (lat. *arte factum* = ›something produced with skill‹), leaving us free to decide on the most useful definition.

In some definitions of the term, only intentional results of human actions seem to be included, whereas unintentional results are excluded.⁴ With such definitions, category inclusion is not always simple to decide. Actions usually have a whole range of results (from primary aims to results that are never considered), including some that are consciously taken into account and could have been avoided, but are not primary aims of the action. Drawing the line between intentional and unintentional results is therefore difficult.

³ Surprisingly often, articles on artefacts don't bother to give a precise definition. For example, the introduction to MARGOLIS/LAURENCE 2007: ix, a volume on artefact theories, states: »[W]e live in a world that is, to an unprecedented extent, populated by our own creations. We are literally surrounded by artefacts of all shapes and sizes«, but continues to give examples encompassing only material artefacts, neglecting the fact that texts, ideas, codes, and conventions are also human creations. It is implied that artefacts are material objects, but it is never clearly stated, and some articles in the volume use the term in a much broader sense (e.g. as opposed to ›natural kinds«; GRANDY 2007).

⁴ Collins World English Dictionary gives two general uses for ›artifact‹ (apart from a more specific use in medicine): »1. something made or given shape by man, such as a tool or a work of art, esp. an object of archaeological interest; 2. anything man-made, such as a spurious experimental result«. The first definition implies the exclusion of unintentional results of human actions, whereas the second definition explicitly includes them.
<http://dictionary.reference.com/browse/artefact> [accessed December 29, 2011]

In cultural semiotics, a precise definition was given by Roland Posner, who defines artefacts as »intentional or unintentional consequences of human actions« (POSNER 2003: 50f.). We adopt this as our working definition of ›artifact‹.

It should be noted that cultural semiotics defines ›texts‹ as the subcategory of artefacts that have a function and are coded signs in a specific culture (POSNER 2003: 51), whereas in ordinary language, the category ›artifact‹ is often restricted to material products of human actions with a certain permanence: a picture on canvas might be called ›artifact‹, but not a picture projected on a wall. The semiotic definition of ›artifact‹, on the other hand, does not demand permanence: it includes transient artefacts (e.g. the sound someone produces when walking on a hard surface), events (e.g. concerts, festivities) and texts (e.g. verbal utterances). On second glance, the term ›material culture‹ can still be sustained, since even these artefacts and texts have a material, if short-lived, existence (e.g. in the form of air waves, material phenomena which can be felt with our senses and measured with instruments). This distinguishes them from representations (= concepts, ideas, etc.) and codes (= sign systems), which do not exist primarily in material form (they can be documented in books or other media, but this is not necessary for their existence) and are therefore defined as ›mental culture‹ (cf. POSNER 2003: 53).

In this article, we draw our examples from the realm of permanent artefacts, excluding texts (in the wide semiotic sense), pictures, sounds, projections, light patterns, etc. It is plausible that the principles of semantization proposed here (cf. section 4) hold for the whole range of artefacts, but a sufficient range of examples for less typical cases would have to be considered to be sure. For example, texts (in the semiotic sense of coded sign tokens) pose additional problems because they possess coded meanings that often evoke further, less obvious meanings (connotations). The principles of semantization proposed here probably also hold for texts, but their results can be difficult to delimitate from coded meanings and connotations.

2.2 Delimitation of ›Meanings‹ from other Aspects of Artefacts

In design studies, artefacts and buildings have been extensively studied, but usually in regard to two aspects:

- (a) material and formal aspects of their design;
- (b) the relation of their design to their function.⁵ It was a central doctrine of modernism that form and material should be adequate to function. In recent decades, it has also been proposed that artefacts should indicate their function through their design (cf. MULLER 2001: 287ff.). In

⁵ Artefacts do not necessarily have a function; permanent artefacts that have a function are called *tools* (POSNER 2003: 51; cf. section 0). Thus, the function-related properties described here, as well as the first principle of semantization (cf. section 0, (1)), do not apply to all artefacts.

this case, artefacts become sign vehicles whose sign content is their function.

However, there are many other ways for artefacts to act as signs. Some of these are context-dependent and therefore do not lead to ›meanings‹ (which are by definition conventional). If a chair is standing at the side of a street, without a relocation vehicle in sight, an onlooker might take it as an *index* for ›impending bulky waste collection‹. This context-dependent meaning can be strengthened or weakened (i) by further context factors (e.g. it would be strengthened if rain was pouring down, and weakened when the street was cordoned off for an impending bike race), (ii) by properties of the chair (e.g. it would be strengthened when the chair was a dilapidated upholstered chair, and weakened when it was an expensive-looking outdoor chair).

A chair can also, in some contexts, be an invitation for sitting down. When someone applying for a show is called into the room and sees a chair standing in his path, in the apex of a half-circle of chairs already occupied by other people, he might reasonably suppose that the chair is placed there for him to sit down, in front of the jury: it is used as a *signal* for him to sit down on it.

Thus, artefacts can in certain contexts become different kinds of signs (e.g. indices and signals). In this article, however, such context-dependent attribution of sign contents to artefacts will be discounted. Rather, the article will concentrate on partly or wholly context-independent ways for artefacts to gain sign contents. Such sign contents will be called ›meanings‹, and the process in which artefacts gain meanings will be called ›semantization‹.⁶

2.3 Material Culture

In discourses about media and cultural representations, ›reality‹ and ›virtuality‹ are usually defined as opposite terms: ›reality‹ is associated with materiality, whereas ›virtuality‹ is deemed to encompass representations and simulations. This terminological opposition mirrors a perceived division of the human-made aspects of our world (usually called ›culture‹) in a material realm (›material culture‹) and an immaterial realm (›mental culture‹) (cf. POSNER 2003: 50ff.).

Semiotics has developed a description of the realm of ›mental culture‹ as constituted by signs and representations. About the realm of ›material culture‹, less has been said. It is supposed to consist of artefacts that fulfil certain functions. From a semiotic perspective, it has been pointed out that this function can be expressed by the artefact (e.g. through an adequate de-

⁶ It has become customary in semiotics that ›meaning‹ (for the content side of a sign) and ›semantics‹ (for the content-side of a code/sign system) refer to conventionalized sign contents. In this article, the criterion of conventionalization will be applied loosely; thus, if a sign content is firmly connected with an artefact, even in the mind of just one individual, it will be called ›meaning‹ and the process in which it is created ›semantization‹. If, for example, a chair evokes in someone's mind, independently of context, the association with a certain family member and/or experience, these will be called ›meanings‹, even if no one else connects them with the chair.

sign): in this case, artefacts become sign vehicles whose sign content is their function. Apart from their functional aspects, artefacts often figure as sign matter⁷ (e.g. pictures, buildings, books) in semiotic theories.

This limited role of material culture as the realm of things that form the basis for our daily life and for the realm of thoughts, ideas, and representations (mental culture) is no longer tenable. In this article, the existence of principles of culturally shared meaning attribution that will be called ›principles of semantization‹ is proposed (cf. section 1). The assumption of these principles changes the perspective on material culture, which can no longer be seen as a passive repository of things affording the existence of technology, science, art and other aspects of mental culture. Rather, material culture takes an active part in creating the complex web of interacting meanings and influences we call ›culture‹: it is not only influenced by society and mental culture, but influences them just as strongly. Thus, the principles of semantization belong to the processes in which we create our cultural environment through thinking and imagination.

3. Artefacts in Cognition and Culture

3.1 Daily Interaction with Artefacts

As we have seen, artefacts are often reduced to their functions and their aesthetic aspects. Thus, a CD player might be discussed as to its function (e.g. in consumer reviews on the Internet) or as to its aesthetic value (e.g. by a design journal or in marketing campaigns). But in our daily life, artefacts play a role that is more complex and encompasses more aspects.

Artefacts make our daily life possible. The conceptualization of artefacts is acquired early in life, and seems to play a role in the development of our whole conceptual system, probably because they surround us from early childhood; indeed, for modern children, artefacts probably are the most important part of their environment, apart from other humans. This early and basic role has consequences for our perception of artefacts. Jean Mandler writes:

Early concepts of animals and a variety of artefacts form the foundation on which the adult conceptual system of objects rests, and this foundation and the outlines of the system built upon it remain in place throughout life. Because the conceptual system begins to be laid down so early, the first and most deeply rooted conceptions about what is essential to animalness or to inanimate objecthood are constrained by what the preverbal infant mind can conceive. The fundamental notions that organize the developing conceptual system tend to be perceptually based, involving characteristics such as ›moves by itself‹ and ›moves only when contacted by another object‹, or ›doesn't move‹. (MANDLER 2007: 191)

⁷ Sign matter‹ is the material layer of a message, that which is physically the output of the sending process and the input of the receiving process; e.g. paper carrying writing or sound waves carrying spoken language (cf. POSNER 1980: 688; 1997: 239).

According to this account, it is not implausible that we think of the things in our life as our ›inanimate environment«. Present-day human beings are surrounded by artefacts from the first months of their lives, getting used to them as part of their environment and living conditions. We are more or less helpless without artefacts, because a large part of all our practical knowledge (›know-how«) in solving problems and interacting with our environment involves them. But our relationship to artefacts is by no means limited to a strictly function-oriented use. This is true even if we define ›function« in a relatively wide sense and consider ›aesthetic pleasure« as function of aesthetic artefacts, ›communication« (or other sign processes) as function of texts,⁸ and ›celebration« or ›entertainment« as function of rituals, shows and events. We arrive at a distinction between two ways of interacting with artefacts:

(1) As a first interaction type we can delimit the *function-based interaction with artefacts*, which can also be described as ›teleological interaction«, because in it artefacts are used for specific goals (including aesthetic pleasure or entertainment). It should be noted that this type of interaction is connected with different kinds of sign processes:

- The function of an artefact is in most cases conventionally connected with it (e.g. for a motorcycle the function ›road travel for one or two persons«), but its function can also be indicated in the design (a motorcycle indicates its function through its wheels, lights, seats, handle bar, etc.). Furthermore, aspects of its correct use can be expressed in details of the design, e.g. how many persons can travel safely, the correct way to position one's feet and hands, and good accessibility of important controls and instruments.
- Signs (e.g. language, pictures or icons) can be used to communicate function (either in a manual or on the artefact itself).
- The uses of an artefact are often communicated and demonstrated in formal or informal learning settings; relative merits of artefacts and their functions are discussed in different social contexts, for example in the context of decisions between different artefacts that might be acquired.

In function-based interaction with artefacts, these sign processes are primarily used as means for reaching the goal of optimal functional use of the artefact. Our talent of perceiving functional aspects of artefacts can be traced

⁸ ›Text« is used here in the wide sense of cultural semiotics as ›coded sign-token(s)« or, equivalently, as ›use of sign systems (= codes)«. Roland Posner gives the following definition: »Wenn etwas ein Artefakt ist und in einer Kultur nicht nur eine Funktion hat, sondern auch ein Zeichen ist, das eine codierte Botschaft trägt, so wird es in der Kultursemiotik als ›Text dieser Kultur« bezeichnet. Texte sind immer ein Ergebnis absichtlichen Verhaltens, auch wenn nicht alle ihre Eigenschaften beabsichtigt sein müssen«. (POSNER 2003: 51) (»If something is an artefact and, in a given culture, not only has a function, but is also a sign with a coded message, it is called in cultural semiotics a ›text of this culture«. Texts are always the result of intentional behavior, but not all of their properties have to be intended« (translation M.S.).

back to our general ability to see affordances in objects, but probably goes beyond that in certain respects:

Humans show an extraordinary ability relative to all other species to create and learn about artefacts. Some of this special ability may revolve around a more sophisticated ability to see affordances. [...] However, we also have a more sophisticated ability for reasoning about the features of artefacts that is less relevant for understanding aspects of living kinds. Our ability to infer the intentions and goals of others helps us to identify and refine our categorization of a seemingly infinite class of artefacts. While this ability could play an obvious role in thinking about how an artefact was originally created, it may figure in an equally if not more important role early on in determining the functions of artefacts in real time through looking at goal satisfaction in others. (KEIL/GREIF/KERNER 2007: 245)

(2) A second interaction type is *meaning-based interaction with artefacts*. In this type of interaction, meanings and other sign processes are the primary component driving the interaction. ›Interaction‹, here, includes emotional reactions on artefacts, looking at them, buying, preserving or repairing them for their own sake, or collecting them. Meaning-based interaction with artefacts comes in different variants:

- We connect certain memories with artefacts (e.g. we still see our grandfather sitting in that specific armchair, or remember our child exploring the pattern of the old oriental carpet). These memories can endear things to us so that we take special care of them, but also make them disagreeable (e.g. a certain jacket that was a present by some past lover who hurt our feelings) and cause us to throw them away, even when they're still functioning.
- Through emotional attachment and habituation, things may become important for us even without special memories, simply because we feel good with them and don't want to miss them. A pair of lined boots might become our trusted companion for cold winter days, making us loath to even think about an replacement even when they're getting unreliable (just as we would be with a watchdog getting old). Again, function is not the primary objective of our interaction.
- Artefacts shape our psychological environment and make us feel secure and at home. They can become ›non-human friends‹, for example if we are lonely after moving to new surroundings, or if we wait for an operation in the hospital. In these and similar situations, familiar artefacts can help with emotional adaptation. There are indications that humans feel bereaved if they suddenly lose important artefacts, especially when the loss comes unexpectedly and shockingly (e.g. though fire or theft).
- Artefacts are usually based on schemata which allow different styles (i.e. ways of executing the schema); that makes it possible to identify a specific style and draw information out of it.
- Our relation to artefacts can be determined by their social connotations. We might like a car because it has the connotations

- ›modest‹, ›eco-friendly‹, or ›performance-oriented‹, buy accessories because we want to be part of a subculture or milieu, or wear an outfit that signals our social class, our political opinions, or our preferred leisure activities (sports, computers, clubbing, etc.).
- Sometimes we value artefacts, instead of in terms of their functional qualities or their monetary worth, in terms of their use in films or books we admire, or to their position in a collection we're building.

With all this said, it becomes clear why artefacts become important in our lives in much more ways than just through their function. In most cases, function-based interaction might well be the most important aspect. However, different kinds of meaning-based interactions take place at the same time; we often take less notice of them than of function-based interaction which is deemed more ›rational‹ and therefore culturally foregrounded, but taken together, they can outweigh function as our main concern and thus determine our interaction with artefacts.

3.2 Meanings in Culture and Design

In the last section, it was outlined that meanings are essential for understanding artefacts. Thus, one should think that designers would pay close attention to artefact semantics. Surprisingly, design theory and practice up to the 1960s paid little attention to artefact meanings. Klaus Krippendorff explains that the Ulm School of Design, where he studied at the beginning of the 1960s, was dominated by the doctrine ›form follows function‹.⁹ Though the design principles followed were themselves based on meanings (like ›maximal simplicity‹, ›mathematical justification‹, ›clarity of form‹ etc.), they were not recognized as such, but rather preached as ultimate principles of good design. Plurality in design principles, however, is the logical prerequisite for meanings, since only allowed differences in execution can produce meanings, whereas determinate principles can only produce the meanings ›right‹ or ›wrong‹ for artefacts adhering to them or breaking them.

⁹Functionalism probably was the most deeply engrained vocabulary at the Ulm School of Design. There, 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 artefact was understood, its form would naturally emerge« (KRIPPENDORFF 2006: 298). This functionalist conception was later developed to include different aspects: »Owing largely to the influence of Max Bill [...] the vocabulary of functionalism became refined and ended up recognizing four functions: technical, material, production, and aesthetic. [...] The technical function: All designs were expected to satisfy their mechanical purposes [...]. The material function: This dimension entailed the obligation to use materials appropriately [...]. 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 [...]. The aesthetic function: [Bill] visualized the domain of aesthetic decisions as a space of all options that the other three functions did not rule out. [...] In Ulm, the aesthetic function came to embrace such virtues as consistency, simplicity, symmetry, clarity, cleanliness, and honesty« (KRIPPENDORFF 2006: 298ff). Obviously, limiting the design problem in this way created artefacts with meanings connected to the fulfilment of these functions, but excluded all other possible meanings from consideration.

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. (KRIPPENDORFF 2006: 302)

A central meaning of every artefact is its function, as Krippendorff points out; but it is certainly not the only meaning, even for simple artefacts. A way to check for culturally shared meanings is to look at cultural works and representations (the ›texts‹ of a culture, in the wide semiotic definition of the term). To take an example, in 2007 the song ›Umbrella‹ became a number-one hit in many countries, including Germany and the US, for the Barbadian singer Rihanna. Its chorus comprises the lines:

»Now that it's raining more than ever
Know that we'll still have each other
You can stand under my umbrella«

Here, the word ›umbrella‹ is used as a metaphor for (1) ›protection‹ and (2) ›love‹. This metaphor can be created because the primary function of the artefact type *umbrella* is protection from the rain, and thus ›protection from the rain‹ is also the function-related primary meaning of the artefact type *umbrella*. From ›protection from the rain‹, meaning (1) ›protection‹ can be derived directly, and in the context (especially line two and the qualification ›my‹ of the umbrella), meaning (2) ›love‹ can be derived.

If we stop here, Krippendorff's suggestion that »for very simple tools, like [...] umbrellas«, there exists only one meaning referring to its function, from which other context-dependent sign contents¹⁰ might be derived, could be sustained. But if we look at other cultural works, we find that umbrellas have long since become conventionally associated with ›protection‹ and – at least in some cultures – also with ›love‹. If a contemporary film showed two lovers sharing an umbrella in the rain, it would probably count as a Hollywood cliché; in Japan, ›sharing an umbrella as a couple [...] is considered a romantic expression, and teens often draw an umbrella with their name and the name of their crush, a practice for which the term ›aiaigasa‹ has been coined. Thus, not only the conventional meanings ›protection‹ and ›love‹, but also more specific cultural associations are connected with umbrellas: in Japan, this might be the practice of ›aiaigasa‹, whereas someone living in the USA might think of the film *Singing in the rain* with the famous scene of Gene Kelly dancing with his umbrella.¹¹

It is obvious that an artefact meaning can have different degrees of conventionality. It might start out as a sign content that is not yet conventionalized, for example a spontaneous association (e.g. a couple realizes that be-

¹⁰ In this case, they should not be called ›meanings‹, which by definition are at least partly conventional (cf. note 6).

¹¹ Before he performs the title song, Kelly stands with Debbie Reynolds under the umbrella in the pouring rain. Before they kiss, Kelly remarks: *Where I stand, the sun is shining all over the place*, thereby expressing the protection from bad weather the umbrella (›love‹) gives him. This semantization makes it plausible why he dances with the umbrella as with an imaginary partner, and why he doesn't cover himself, as if the rain didn't exist.

ing together under an umbrella feels ›romantic‹) or a context-dependent index (e.g. when someone sees two people under an umbrella and guesses that they are lovers). Its conventionalization might begin with some people (e.g. the couple begins to use the umbrella as symbol of their ›love‹) or a certain group (e.g. film connoisseurs), before the meaning spreads to the whole culture.

In this case, a whole artifact category (›umbrella‹) is culturally semantized: it adopts a certain meaning in a culture. This kind of meaning can be taken into account in the design process. For example, a designer might choose to create an ›aiaigasa‹-umbrella with love symbols and appropriate coloring, or take care to avoid this meaning in creating a sober and elegant model that, by its materials, form and colors, intends to be semantized as ›businesslike‹ or ›grown-up‹. In this case, a subtype of the artefact (a certain design or style of umbrella) is intended to be connected with specific meanings. If the artefact is intended to be sold (in industrial or artisan production), the intended meanings are usually tailored to match the intended *target groups*, and factors like price, shop location, types, and locations of advertisement will be adapted accordingly.

However, the meanings that become connected with products don't always have to be the meanings intended by the designers. In every sign process, the *intended sign content* has to be distinguished from the *received sign content*. In the case of meanings (conventionalized sign contents) of artefacts, the intended meanings not only have to be transmitted, they also have to stick to the artefacts to be conventionalized. Thus, it is usually not enough to promote intended meanings in advertisements when a new product is introduced. The artefact needs to have some properties or features making the intended meanings plausible, and to remind people of them. Furthermore, semantizations of products often arise that were not intended.¹²

Meanings change over the lifetime of artefacts. Prasad Boradkar differentiates between three stages of artefact existence: in production, artefacts are designed and manufactured; in distribution, they are advertised, displayed in stores and shipped to customers; in consumption, they are used, stored, modified, and finally disposed of. The meanings that are created in the three stages vary, depending on the different perspectives and intentions of the people involved. The processes in different stages influence each other, since meanings created by designers and advertisers can be appropriated and adapted by users, and vice versa:

In the first stage, corporations create exchange-value as well as a sign-value for products through manufacturing and advertising. The structure of production and its agents control this stage of the creation of meaning. Once individuals buy these things, they create their own meanings by incorporating the objects into their lives. They may modify them,

¹² For instance, the semantizations expressed in the nicknames ›topolino‹ (little mouse) for the Fiat 500 and ›Ente‹ (duck) for the Citroën 2CV, or the semantization of the newly introduced Mercedes-Benz A-Klasse after a failed ›moose test‹ in 1997, which led to connections of this model with the test, with overturning, and with the animal moose, that were expressed in many cartoons and jokes.

redesign them, repurpose them, and generate their own sign values in this second stage of meaning-making. In the third stage, producers who carefully observe and document how people make sense of the things they buy, reappropriate these objects for mass production and introduce them as new commodities. (BORADKAR 2010: 245f)

The discussion in this section has shown that meanings cannot be discounted in design. Today, the functionalist domination of design has ended and different schools of thought have formed that consider the role of meanings in design. One example is the *Theory of Product Language* formulated at the Hochschule für Gestaltung in Offenbach (cf. STEFFEN 2000). Building on hermeneutic and phenomenological conceptions of meaning, it considers many different kinds of artefact meanings, for example information about production conditions, proposed uses, and world-view of their designers. It distinguishes between ›indicator functions‹, signs giving indications of the practical functions of the artefact, and ›symbol functions‹, meanings connecting the artefact to aspects of culture and society (KRIPPENDORFF 2006: 293). However, due to its hermeneutic origins, the *Theory of Product Language* conceptualizes all signs on the basis of language and thus is unable to describe the specific properties of sign processes connected with artefacts. For this reason, it can only give a general account, and cannot provide hypotheses on the principles that guide artifact semantization (cf. section 0).

Wim Muller, a design researcher at Delft University of Technology, has written a comprehensive book entitled *Order and Meaning in Design* that comprises many useful and interesting examples for product semantization through design. Muller discusses the merits of semiotics (MULLER 2001: 309ff.)¹³ and of cognitive semantics (MULLER 2001: 307ff.) as approaches to meanings in design, and tries to develop an analytical vocabulary based on distinctions like denotation and connotation and primary and secondary functions (MULLER 2001: 302ff.). However, the book recognizes only meanings that are connected to functions, which serves as a reminder of the influence functionalism still seems to have at design faculties, and fails to distinguish between meanings and communication,¹⁴ which underlines the importance of semiotics with its broad range of sign categories and analytical instruments.

Another tradition in design studies analyses the interaction of people with artefacts from a cognitive perspective. Though its main focus usually lies on more ergonomic design and the avoidance of design mistakes (NORMAN 1988; 1993), the cognitive approach includes different aspects of our interaction with artefacts, including artefacts as externalized aspects of cognition (HUTCHINS1995) and of the cognitive processes in design and planning (ARIELLI 2003). This tradition seldom discusses meanings of artefacts per se, but it takes them into account where they are relevant for the topics discussed (for example as cognitive guidance for the correct interaction with artefacts).

¹³ For a semiotic approach to design studies cf. MAGLI 2004.

¹⁴ The chapter dealing with product meanings is tellingly entitled *Communication of intended use* (MULLER 2001: 287).

Klaus Krippendorff and Reinhart Butter are the main proponents of *Product Semantics*. First introduced in 1984 (cf. KRIPPENDORFF/BUTTER 1984; 1989; 1993; KRIPPENDORFF 2006) the term refers to a new theoretic approach to design concentrating on artefact meanings. This approach is closely connected with a program called *Semantic Turn* that proposes a change in design practice »from technology-centered design to human-centered design« (KRIPPENDORFF 2006: 39). It demands the consideration of artefacts in their different social roles, for the role artefacts play in practical use and in communities, the acknowledgment of the role of language in constructing artefact uses and meanings, the consideration of all stakeholders (not just designers) and the meanings they attribute to artefacts, and the realization that artefacts have different meanings, in different phases of their lifecycle and for different groups of people. *Product Semantics* is a comprehensive and analytically detailed account of the role of meanings in design practice. From the viewpoint of a general description of artefact semantics, however, the limitation of this theory lies in its clearly stated focus on design (for example, meanings through individual experience are not considered, since they cannot be designed; cf. section 0, (4)). Furthermore, it wants to be a design theory as well as a manifest or manual for good design, thus mixing descriptive with deontic approaches.

3.3 Artefact Meanings in Archaeology and Anthropology

In archaeology, artefacts are often the only source of knowledge. The interpretation of artefacts is arguably what archaeologists do for a living:

[The] dispersal of modern humans from their African origin is principally mapped by the artefacts they left behind at newly created settlements in Asia, Australasia, Europe, and the Americas. There are no written records, and skeletal remains are extremely scarce. And so archaeologists rely on the discovery and interpretation of artefacts such as stone tools, fireplaces, dwellings, and art objects. (MITHEN 2007: 289)

Thus, artefacts are treated as indices for aspects of cultures that can no longer be directly observed, e.g. technological development, social structures, institutions, living conditions, artistic activities, and religious rituals. However, what these artefacts meant for these cultures is much harder to answer. Often, functions of artefacts and the practices and rituals they were connected with cannot be precisely reconstructed, but only guessed. Artefact meanings beyond the functions of the artefact in technology, rituals and daily life are even harder to reconstruct. However, similarly to design theory (cf. last section), in archaeology and cultural anthropology an awareness of the complexity of artefact meanings has emerged:

It is normal for artefacts made in the modern world to be multi-purpose – to have a utilitarian function, to carry social information, and to have a symbolic meaning. The design of our clothes, cars, and mobile phones are obvious examples. [...] Polly Wiessner (1983), for instance, studied the arrowheads of the !Kung bushmen of Southern Africa and documented how their specific shapes are not only effective at killing game but define individual and social identity. [...] When we find, for instance, the projectile points of prehistoric hunters, the potential exists to explore the social and symbolic lives of

past peoples rather than just their hunting methods and manufacturing techniques.
(MITHEN 2007: 290)

The anthropologist Ian Hodder studied the symbolic dimensions of material culture in field investigations in Kenya, Zambia and the Sudan; he called artifacts »symbols in action« because of the active and changing role they have in social interactions and cultural developments (HODDER 1985). Arjun Appadurai edited a collection of articles on artefact meanings in society that focuses mainly on economic functions of artefacts, considering them in their social context; it demonstrates that anthropology, economics and semiotics need to cooperate to form an adequate basis for artefact studies (APPADURAI 1986).

These examples show that anthropology has moved towards semiotics in its efforts to describe the role artefacts play in a society, because it was noticed that this role cannot be reduced to the primary function(s) an artefact was produced to fulfil. Another explicitly semiotic approach that has gained attention in anthropology is Clifford Geertz' *Thick Description* (GEERTZ 1973), a theory that investigates the symbolic dimensions of social institutions (e.g. politics, art, science, law, ethics, religion, and ideology; cf. ORT 2003: 33). It aims for a description of artefacts that doesn't reduce them to their function and the sign aspects indicating this function, but instead includes other artefact meanings. Thus, recent developments in anthropology follow the same general trajectory (inclusion of non-functional meanings) as the *Semantic Turn* in design studies (cf. section 0).

Interestingly, a complementary development took place in cultural semiotics. Semiotics, the discipline that studies signs and sign processes in culture and nature, focused for a long time primarily on sign systems (= codes). One could say that it took an idealist position, neglecting material aspects of culture. But this is no longer the case. Today, semiotics is aware of the important role artefacts play in cultures, and of the complex meanings that are connected with them. The term »material culture« was introduced for the realm of culture consisting of artefacts (POSNER 2003: 50ff.; cf. section 0), and semiotic approaches to different areas of culture describe the multiple meanings of the artefact types relevant for these areas.¹⁵

We have seen that a number of approaches to artefact meanings exist; up to now, however, there has been no comprehensive account of the types of processes in which artefacts get their meaning. In the next section, an account will be proposed that distinguishes between different principles of semantization, which can be separately defined and described. They make it possible to understand how artefacts get their meanings, what semantic are-

¹⁵ A number of articles in POSNER/ROBERING/SEBEOK 1997–2004 offer information, from different disciplines and viewpoints, on semiotic approaches and literature related to artefacts: DREYER 2003; FRANKE 1998; GUMBRECHT 1998; HUBIG 1998; KRÜGER/BAXMANN-KRAFFT/HARTLIEB 2004; LAGOPOULOS 1997; NÖTH 1998. Semiotic aspects of archaeology are discussed in FRERICHS 2003, semiotic aspects of ethnology in HEESCHEN 2003.

as these meanings belong to, and why some meanings are shared in cultures or social groups while others are only present for individuals.

4. How Artefacts Get Meanings

We have already encountered a number of examples for artefact semantization. In this section, seven principles of semantization are proposed and explained: semantization through (1) frame connection, (2) style, (3) iconicity, (4) individual experiences, (5) cultural allusions, (6) connection to social groups, (7) specific contexts. Together, these principles form a categorization of processes of semantization.

4.1 Principles of Semantization

›Semantization‹ is the process in which entities (in this context: artefacts) get meaning, thus becoming signs. In this section, a tentative list of principles of semantization that can be assumed for artefacts is presented and discussed.

(1) Function or connection to a frame:

Often thought to be their main characteristics, function is certainly a central notion for many artefacts. In the broad semiotic sense of the term used here, artefacts don't need to have functions (cf. note 5). However, prototypical artefacts that first come to mind when asked to give an example (e.g. ›cup‹, ›table‹, ›car‹) have clearly defined functions. In artefact classification by adults, function has been found to be the first criterion (but not for children, for whom form takes precedence; MALT/SLOMAN 2007: 89).

Thus, it is not surprising that meanings are often attributed to artefacts via their function and their daily uses. How these connections work, however, is not obvious – if we see an item of clothing, we often do not associate its function (e.g. ›keeping warm, protection against wind‹), but rather the whole frame it is associated with (e.g. ›sailing‹), or certain elements of that frame (e.g. ›sailor‹, ›captain‹, ›strong winds‹, ›sea‹, ›outdoor person‹, ›fun‹).

The notion of frame has, in the last decades, gained prominence in different research areas, among them artificial intelligence (MINSKY 1975), psychology (GOFFMAN 1974), and semantics (FILLMORE 1976; 1982). All these approaches converge on the notion of a frame as organized part of world-knowledge that describes a situation type, including roles, typical actions, and in many cases artefact types.

Frame ›sailing‹
<i>Roles:</i> captain/coxswain, sailor, guests, ...
<i>Personality attributes for roles:</i> outdoor person, wealthy, athletic, fun-loving, ...
<i>Action types:</i> sailing, relaxing, ...
<i>Artefacts:</i> sailboat, equipment, special clothing (appropriate for conditions), ...
<i>Conditions:</i> sea, strong winds, quickly changing weather, ...
<i>Feelings:</i> freedom, experience of nature, seeing places, adventure, fun, ...

In this example, ›special clothing‹ includes the artefact type ›sailing jacket‹, which therefore is connected to the frame ›sailing‹. It is postulated that different elements of the frame, or a combination of them, can be activated as associations for an artefact type that is connected to the frame.

Frames help to give a more precise account of the functions of artefacts. For example, the functions of the artefact type ›organ‹ can be precisely described if one looks at the frames ›church music‹ and ›service‹, where its different functions (e.g. ›accompanying the congregation‹, ›accompanying a choir‹, ›solo instrument‹, ›substitution of an orchestra‹) are specified. And even artefacts without a function are often connected to frames. For example, the transient artefact ›sounds of high heeled boots on a street‹ (cf. POSNER 2003: 51) is connected to the frames ›walking on a street‹ as well as ›clothing‹, and the meaning associated with it (›women walking along a street with elegant, but impractical shoes‹) can be explained via these frames.



Fig. 1:

A sailing jacket can evoke other elements of the frame ›sailing‹, e.g. ›outdoor person‹, ›freedom‹, and ›fun‹. Source: Sail Xtreme Shop
http://www.sailxtremeshop.com/upload/images/product/small_7636287.jpg. All rights reserved.
Used by permission. [accessed December 8, 2011]

(2) Style:

Though traditionally often studied in relation to aesthetics and rhetoric, style is in fact a central category in cognitive interaction with all artefact types (as well as behavior types). Styles are an important source of information in daily contexts as well as in disciplines like history and anthropology. The information content of styles gives them a comprehensive cognitive function: they enable us to attribute properties to producers, designers, or users of the artefacts carrying the style, as well as to values, priorities, aesthetic principles and technological knowledge of the group/culture in question (*Attribution theory* cf. FAHL-SPIEWACK 1995; WEARY/STANLEY/HARVEY 1989).

The author's doctoral dissertation¹⁶ investigates how styles create information and which cognitive processes enable us to extract this information out of artefacts and behaviors, thus making them signs. In regard to these processes, we can speak of *stylistic meanings* connected with artefacts. Thus, a model already exists for the construction of meaning via style, but the model given in the dissertation has to be integrated in a broader account encompassing different kinds of meanings connected with artefacts, and infor-

¹⁶ SIEFKES 2012/forth. This work gives a detailed description of the sign processes taking place when styles are created and/or applied (by a style producer) as well as apprehended (by a style receiver). The theory analyses style as a vehicle of information: Through processes of (intentional or unintentional) choice, the principles determining the choice are inscribed in the result of the choice (an artefact, a text or a behavior). In a further step, an interpretation of these principles extracts different kinds of stylistic meaning, which can range from objectively verifiable information concerning the style producer (e.g. about his experience, preferences, personality, or knowledge) and the culture and conditions that shaped the style, to highly subjective associations and speculations. An introduction to the theory is given in SIEFKES 2009: 63ff.; 2012.

mation which can be gained out of them. For a general theory of artefact semantization, style is to be understood as one of a number of principles of semantization, and studied in its interactions with these principles.



Fig. 2:
A lamp in ›art deco‹ style can be connected with meanings as ›made between 1925 and 1935‹, ›probably made by Muller frères‹, and ›quite expensive today‹
Source: galerieinsilicio@free.fr. All rights reserved. Used by permission [accessed December 8, 2011]

(3) Iconic associations through form or other properties:

Artefacts can be designed so as to bring other things to mind (e.g. the ›floral‹ forms used in art nouveau design and architecture); associations can also arise where none were intended. Meaning is constructed via these partly iconic signs, which often give rise to further associations (e.g. the feeling of ›freshness‹, ›youth‹ and ›new beginning‹ evoked by the floral turn in art nouveau, that stood in contrast with the preceding forms of historicism).

An example for iconic association through form is the Philips Roller portable radio (1982) that clearly takes the form of a motorcycle. Its successor shows a still more aggressive design, it looks like a Bazooka, a rocket launcher fired on the shoulder (MULLER 2001: 328f). Both designs show a recognizable similarity in form to the objects they denote, thus they are *iconic signs*. But these designs work only because these iconic associations can be interpreted as *metaphors*: The motorcycle form can be interpreted as the metaphor ›this radio is a motorcycle‹, giving rise to the meanings ›highly mobile‹, ›use on the road‹, ›loud‹, and ›fun‹ (these are properties of the source domain of the metaphor, motorcycles, that are transferred to the target domain, the Roller radio). The Bazooka form can be interpreted as the metaphor ›this radio is a Bazooka‹, giving rise to the meanings ›aggressive‹, ›dangerous‹, and ›dominating your surroundings‹. Both metaphors are made plausible through specific properties of the radio design in question: The motorcycle metaphor uses the mobility of the portable radio as an *anchor* to make it plausible, whereas the Bazooka metaphor is anchored through the conventional shoulder position for carrying this type of radio, as well as a Bazooka.

Another example for successful design in this area is a change of the American Express card design (BORADKAR 2010: 229f.). Since the introduction of the card in 1958, it had been purple – the colour of the company’s Traveller cheque. In 1969, the colour of the card was changed to ›dollar green«, and the design was adapted to resemble dollar bills in background, fonts and layout. Credit cards allow paying without giving money, thereby incurring debt. The knowledge that the use of credit card creates debt was countered by giving them the colour of real money, distancing the card from the fears connected with debt-making. At the same time, the association with cheques, another potential means of incurring debt, was removed. After the change, the card became a phenomenal success (SUDJIC 1985: 23).



Fig. 3:
The Philips roller radio, an iconic sign for ›motorcycle« that evokes metaphorical meanings as ›use on the road«, ›loud«, and ›fun«
Source: Christos V. <http://commons.wikimedia.org/wiki/File:Philips-roller.jpg>; License: CC BY-SA 3.0 (<http://creativecommons.org/licenses/by-sa/3.0>) [accessed December 8, 2011]

(4) Individual experiences:

Another form of semantization consists in personal memories connected with artefacts, as well as the associations and feelings evoked by these memories. For example, an old armchair can evoke the memory ›conversations with my late grandfather«, and the associations and feelings connected with it.

Things often get meanings for us because of their role in our life; such meanings can be an asset for artists and designers, giving them a personal approach to an artefact, but also a disadvantage because – contrary to cultural meanings, connotations, etc. – they are hard to convey to others. Personal memories and experiences should be studied as to their effect on design. Sometimes they may work as inspiration for seeing things in a certain way, or else they may stand in the way of a convincing design solution.

Little research has been done on this type of semantization. Neither in semiotics nor in anthropology or in design studies, the importance and complexity of personal meanings connected with artefacts has been fully understood. Only in recent times, research has begun on personal meanings, for

example about the conditions under which artefacts can gain personal importance for someone (JUNG/BARDZEL/BLEVIS 2011).



Fig. 4:
An old armchair can be connected with the memory ›conversations with my late grandfather‹, and associations like ›childhood‹, ›secureness‹, and ›loss‹
Source: capl@washjeff.edu. <http://capl.washjeff.edu/browserresults.php?langID=1&photoID=468>;
License: CC BY-NC-SA 2.0 (<http://creativecommons.org/licenses/by-nc-sa/2.0>) [accessed December 8, 2011]

(5) Cultural allusions:

A culture comprises a web of artefacts and representations that are interconnected in many ways. When artefacts acquire cultural meanings, these connections can be made in two directions: On the one hand, meanings can be assigned to artefacts and artefact types through descriptions in books, depictions in films, or uses in pictures (for the author of this article, for instance, the slasher film *The Texas Chainsaw Massacre* comes to mind in connection with chain saws). On the other hand, artefacts can themselves cite other cultural works (a house or a dress might be fashioned to evoke the film *Gone with the Wind*, including deviations from historical accuracy found in the film).

In semiotics, the theory of *intertextuality*, an elaboration of connections between texts by way of allusion, parody, and hidden influences, has been developed (cf. KRISTEVA 1980). Though ›text‹ is often used in semiotics in a generalized sense including all coded sign tokens (cf. section 2.1), the theory was seldom applied to artefact meanings. Another approach to cultural references, the theory of *cultural memory*, describes culture metaphorically as a memory retaining historical scenes, stories, associations, and connections to other works (ASSMANN 1992; ASSMANN 1999; HALBWACHS 1950; POSNER 2003: 64f.). Again, the focus lies mainly on discourse, texts, and rituals; only

specific categories of material artefacts are considered, for instance monuments (ERLL 2003: 177).

Whereas design theory is often still focused on form and function in the creation process, architectural theory is well aware of influences, imitation and citation as guiding creative principles (JENCKS 1977; JENCKS/BUNT/BROADBENT 1980; VENTURI/BROWN/IZENOUR 1972; 2004). However, an integration of the diverse approaches to cultural allusions of architecture is still missing. Furthermore, these theories often fail to distinguish between the simple use of general principles and meanings (conventionalized sign contents). For instance, the 1970s ›artificial ruin‹ motive in the Best supermarket chain (GÖSSEL/LEUTHÄUSER 1994: 278f.) evokes a whole tradition of artificial ruins that began with late 18th century landscape gardening (ZIMMERMANN 1989), and one might want to call this tradition a »meaning« of these buildings; however, probably not every principle of design whose use can be inferred from a building or artefact deserves this status, making it necessary to determine criteria (e.g. ›citation‹ as a process of explicit reference) for traditions to become meanings.

There is a substantial overlap of principle (5) with principle (2), since many cultural allusions are expressed through style (thus, a radio receiver might use current technology, but cite a classical Brown or Grundig model in its style). But this is not always the case. Stylistically insignificant details can be used, and functional aspects can be involved. Thus, a car design could cite a famous car model, say the Volkswagen Beetle, through its style, but also through functional properties, e.g. its rear-located, rear-wheel drive engine. Often, stylistic and functional aspects will be combined to make the citation more salient. Furthermore, whole artefact categories can acquire meanings, as the chainsaw example shows. In this case, the meaning obviously is independent of the specific style.



Fig. 5:
A chainsaw can be connected with cultural allusions, e.g. ›film Texas chainsaw massacre‹ and ›chainsaw used as murder weapon‹
Source: <http://www.flickr.com/photos/75842363@N00/2508518267/>; License: CC BY 2.0
(<http://creativecommons.org/licenses/by/2.0> [accessed December 8, 2011])

(6) Connections to social groups/organizations:

Artefacts can be seen as connected with certain social groups, professions, institutions, and lifestyles; these connections give them meaning and make them attractive or unattractive for others. Thus, subcultures often develop specific styles of clothing and living, investing certain items of clothing, furniture or decoration with meanings (e.g. ›belonging to the group‹, ›citing the group‹, as well as diverse associations and prejudices connected with the group in question). Artefacts play an important role in the expression of opinions, identity and social group membership: In establishing group identities, differences between ›us‹ and ›them‹ are often manifest in the selective ownership and use of artefacts, from having pierced ears to owning a Porsche (KRIPPENDORFF 2006: 188).

Furthermore, artefacts acquire meanings according to the role they play in people's lives, which often differs strongly for social groups. For a long time, designers concentrated on users and their interaction with artefacts. They didn't realize that artefacts pass through a life cycle of people inventing, designing, producing, selling, buying, using, repairing, collecting, recycling, and discarding them, for whom very different meanings can be connected with the artefact. A building might be ›well-functioning‹ and ›comfortable‹ for its users, but acquire a reputation to be ›impractical‹ or even ›dangerous‹ for the people who have to clean its facade, or might be hated by its neighbours for ecological or aesthetic reasons. Energy-saving light bulbs of the first generation had the meanings ›eco-friendly‹ (because of their high efficiency) and ›practical‹ (because of their long durability) for its users; for waste recovery people, they acquired the meanings ›polluting‹ (because of their mercury content) and ›impractical‹ (because they were thrown in the domestic waste, and not specially collected).

The example shows that designers have to consider intended meanings as well as functional adequacy for all stages of the artefact's life cycle. This includes consideration of the different stakeholders, i.e. social groups directly and indirectly involved with the artefact in question, and the consequences of its production and use (KRIPPENDORFF 2006: 189ff.).



Fig. 6:

A hoodie sweater can be connected with the meaning ›hip hop subculture‹

Source: Chuck Szmurlo. <http://commons.wikimedia.org/wiki/File:Hoodie-szmurlo.jpg>

License: CC BY-SA 3.0 [accessed December 8, 2011]

(7) Specific contexts:

In certain contexts, artefacts acquire additional meanings that depend on specific rules applying in these contexts.

One context that leads to specific meanings is given when artefacts are collected (*collecting as cultural practice* cf. BELK 1995; BORADKAR 2010: 252ff.; PEARCE 1998). Here, use-value, functionality and aesthetic properties matter to a certain degree, but are complemented by criteria like rarity, completeness of the collection, and even defectiveness, which can be a positive aspect under certain circumstances (e.g. when misprints of stamps or books are collected). Collecting, thus, creates meanings different from those of other uses and contexts, and creates them even for otherwise meaningless items.

Museums and exhibitions, archaeological excavations, or anthropological research are other contexts that give rise to specific sets of artefact meanings.

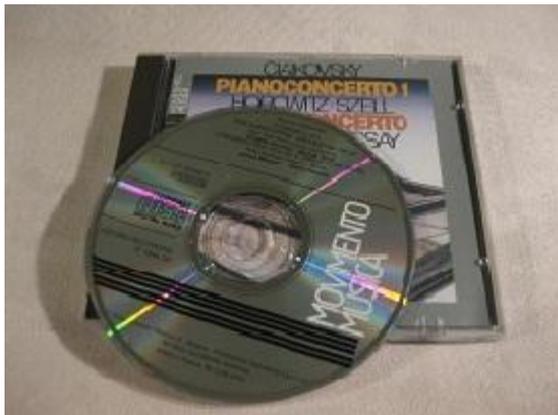


Fig. 7:
A specific CD of the pianist Horowitz can be connected with the meaning ›sold-out pressing of rare pirate recording‹
Source: Martin Siefkes. License: CC BY-SA 3.0 [accessed December 8, 2011]

The meanings created by these seven principles differ in their semantic content. For example, a meaning created by principle (6) will be the social group the artefact is associated with (it might also include properties associated with this group), whereas a meaning created by principle (7) will be the relative importance of the artefact for the collected area of artefacts, as well as for the collection and its completeness.

However, the semantic possibility spaces for the different principles also overlap. For example, a meaning created by principle (1), connection to function, might be the same as one created by principle (2), style. Thus, a sailing jacket could become connected with the meanings ›outdoor person‹ and ›adventure‹ through its function (which itself might be inferred from its design or simply be known), but it can also be designed in a style that expresses these meanings (e.g. through adding pockets, clamps, and UV-resistant layers).

4.2 Representing Processes of Semantization

For representing the processes involved, a notational system is needed that combines logical with semiotic notation. In this section, a notation will be described that enables the representation of processes of semantization. This notation is loosely inspired by notational systems employed in cognitive semantics (FAUCONNIER 1997; LANGACKER 1987–1991) and by the theory of mental models (HELD/KNAUFF/VOSGERAU 2006; JOHNSON-LAIRD 1983; LEGRENZI 2007; SOWA 1999). It is intended as a proposal to be worked on and improved in the future.

The notational system includes a causative relation between a representation space R_1 containing a *condition* (left),¹⁷ and a representation space R_2 containing a *sign relation* (right). In the sign relation, the *sign vehicle* is

¹⁷ The condition is formulated in predicate logic notation, with predicates defined as needed, supplemented with mathematical operators.

marked by a square and the *sign content* (= meaning) by a circle. Both representation spaces are linked with an arrow representing a causative relation: the fulfilment of the condition represented in R_1 causes the sign relation represented in R_2 to exist.

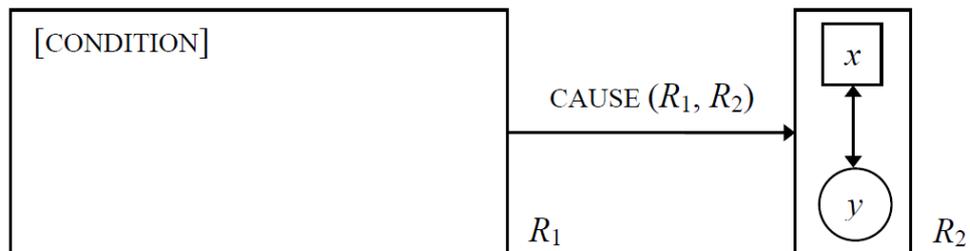


Fig. 8

The causative relation should not be confused with the logical implication; otherwise, the diagram would have to be read as a logical proposition that would only be true if the condition on the left was a sufficient condition for the existence of the sign relation on the right. In the cases we want to describe, this cannot be assumed, because the condition we give will probably only be a necessary condition, which can be imagined to be fulfilled without the sign relation on the right coming into existence. (There might be other factors influencing whether the sign relation is created or not.) Thus, the description should be read as a proposition about a causal relation: the fulfilment of the condition (on the left) *causes* the sign relation (on the right).¹⁸

The diagram as a whole can be read as description of a certain factual process of semantization (a *token*), or as a delimitation of a class of processes of semantization (a *type*). The diagrams in the remainder of this section are intended to be read as types.

The seven types described below correspond to the *principles of semantization* proposed in section 4.10. These are classes of processes of semantization that are given a special theoretical status, mainly because of good empirical evidence for them. However, other classes of processes of semantization can be defined with the given notation, either as descriptive categories, or as proposals for further principles of semantization.

¹⁸ This formulation is acceptable because ›causation‹ can be defined with the INUS-condition: A cause is the insufficient but necessary part of an unnecessary but sufficient condition for the effect (MACKIE 1974: 62). This definition informs us that a cause is necessary for a certain way the effect is achieved (a certain sufficient condition) that is not the only way the effect could have been achieved (not a necessary condition). Apart from the cause, sufficient conditions have other parts (background conditions, e.g. certain social conditions or the laws of physics).

(1) Principle ›Frame connection‹:

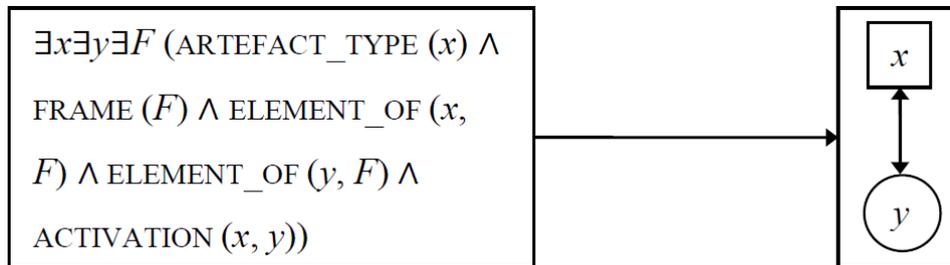


Fig. 9

Definitions: $ARTEFACT_TYPE(x) =_{df} \langle x \text{ is an artefact type} \rangle$, $FRAME(F) =_{df} \langle F \text{ is a frame} \rangle$, $ELEMENT_OF(x, F) =_{df} \langle x \text{ is an element of } F \rangle$, $ACTIVATION(x, y) =_{df} \langle \text{cognitive use of } x \text{ activates } y \rangle$.

The notation represents the fact that an artefact type x and a frame F of which x is an element exist and that x activates y which is also an element of F , and that this fact causes a sign relation where y becomes a meaning of x .

The 2-place-predicate $ACTIVATION$ refers to a relation of activation between two different elements x and y in a frame F , where the element x cognitively activates the element y : if someone thinks of x , y will be more easily accessible (a fact that could be verified in priming studies) and might even spontaneously come to mind. Although $ACTIVATION$ refers to a mental process, its causes are not only psychological: Relations of $ACTIVATION$ between elements of frames can be caused or strengthened by socio-cultural processes and conventions as well as psychological proclivities. In the former case, they will probably lead to artefact meanings that are shared in a community or culture. In the latter case, the produced semantizations can be shared in a culture (if they are caused by psychological traits common to all or most people) or only present for some individuals (for whom this process of psychological activation works).

The representation given above is useful as an extensional definition of the principle. If we want to represent special processes of semantization, we can insert values for the variables. Often, different meanings are created in a process of semantization: if n meanings are created, we can represent them as y_1, \dots, y_n .

Example: $x = \langle \text{sailing jacket} \rangle$, $F = \langle \text{sailing} \rangle$, $y_1 = \langle \text{outdoor person} \rangle$, $y_2 = \langle \text{athletic lifestyle} \rangle$, $y_3 = \langle \text{sea} \rangle$, $y_4 = \langle \text{relaxation} \rangle$, $y_5 = \langle \text{freedom} \rangle$, $y_6 = \langle \text{fun} \rangle$.

(2) Principle ›Style‹:

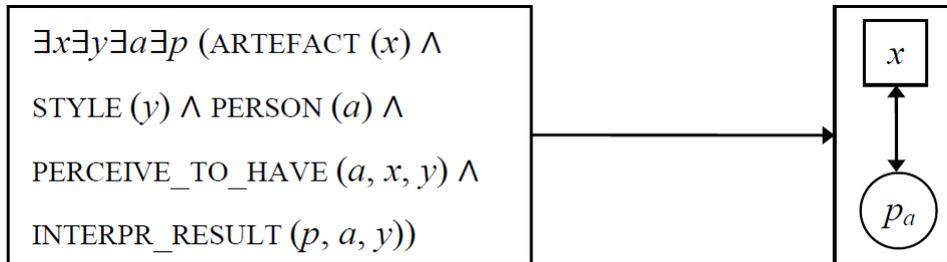


Fig. 10

Definitions: ARTEFACT (x) =_{df} › x is an artifact‹, STYLE (y) =_{df} › y is a style‹, PERSON (a) =_{df} › a is a person‹, PERCEIVE_TO_HAVE (a, x, y) =_{df} › a perceives x to have y ‹, INTERPR_RESULT (p, a, y) =_{df} › p is a result of an interpretation of y by a ‹.

p_a is used in the representation space on the right to represent the fact that the meaning p is created only for the person a (since it is the result of a stylistic interpretation of style y by a).

Example: x = ›chandelier‹, y = ›art deco; finely crafted‹, p_1 = ›made between 1925 and 1935‹, p_2 = ›possibly by one of the famous manufacturers [e.g. Muller frères, Daum, Degue]‹, y_3 = ›quite expensive today‹, p_4 = ›will probably go up in value in the next decades‹, p_5 = ›glass is probably pressed glass‹.

(3) Principle ›Iconicity‹ (with metaphor):

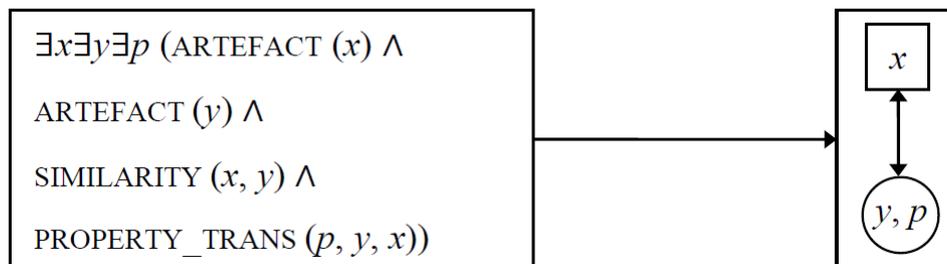


Fig. 11

Definitions: ARTEFACT (x) =_{df} › x is an artifact‹, SIMILARITY(x, y) =_{df} › x is similar to (i.e. stands in an iconic relation to) y ‹, PROPERTY_TRANS(p, y, x) =_{df} › p is a property of y transferred (metaphorically) to x ‹.

Example: x = ›Philips portable radio‹, y = ›motorcycle‹, p_1 = ›highly mobile‹, p_2 = ›use on the road‹, p_3 = ›loud‹, p_4 = ›fun‹.

Obviously, not every use of this principle involves a metaphorical transfer of properties from y to x . If the radio was designed to resemble a snail, few people would think about the metaphor ›this radio is a snail‹ and transfer

properties like ›slow‹ to the radio. For the case of iconicity without metaphor, the condition on the left is: $\exists x \exists y (\text{ARTEFACT}(x) \wedge \text{ARTEFACT}(y) \wedge \text{SIMILARITY}(x, y))$, and on the right, only the sign content ›y‹ is created.

(4) Principle ›Individual experiences‹:

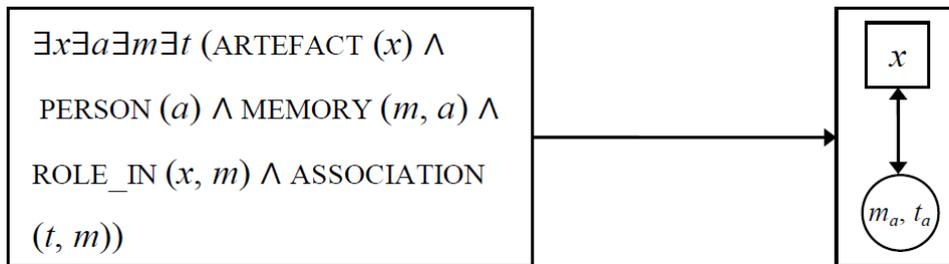


Fig. 12

Definitions: $\text{ARTEFACT}(x) =_{df} \rangle x \text{ is an artifact}$, $\text{PERSON}(a) =_{df} \rangle a \text{ is a person}$, $\text{MEMORY}(m, a) =_{df} \rangle m \text{ is a memory of } a$, $\text{ROLE_IN}(x, m) =_{df} \rangle x \text{ plays a role in } m$, $\text{ASSOCIATION}(t, m) =_{df} \rangle t \text{ is an association connected with } m$.

m_a and t_a are used in the representation space on the right to represent the fact that the meanings m and t are created only for the person a .

Example: $x = \rangle \text{armchair}$, $a = \rangle \text{Sarah}$, $m = \rangle \text{conversations } a \text{ had with her grandfather (while he sat in } x)$, $t_1 = \rangle \text{childhood}$, $t_2 = \rangle \text{secureness}$, $t_3 = \rangle \text{loss}$.

(5) Principle ›Cultural allusions‹:

A process of semantization of type (5), ›cultural allusions‹:

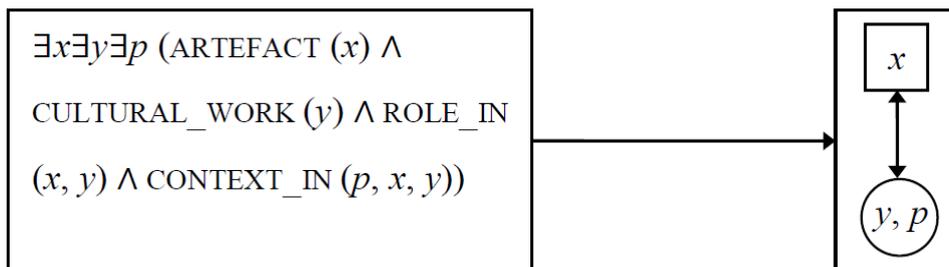


Fig. 13

Definitions: $\text{ARTEFACT}(x) =_{df} \rangle x \text{ is an artifact}$, $\text{CULTURAL_WORK}(y) =_{df} \rangle y \text{ is a cultural work}$, $\text{ROLE_IN}(x, y) =_{df} \rangle x \text{ plays a role in } y$, $\text{CONTEXT_IN}(p, x, y) =_{df} \rangle p \text{ is (part of) the context of } x \text{ in } y$.

Example: $x = \rangle \text{chain saw}$, $y = \rangle \text{film } \textit{Texas chainsaw massacre}$, $p = \rangle \text{chainsaw used as murder weapon}$.

It should be noted that for our example, we could probably define x as an artefact type, because the semantization extends to all chainsaws. However, the principle works also for specific artefacts (e.g. when the Eiffel tower reminds me of the film *Zazie dans le métro*) and for subtypes or styles of artefacts (e.g. when the house subtype ›Plantation style house‹ reminds me of the film *Gone with the Wind*). Since artefact types can be described extensionally as a set of artefacts, we can include them here by assuming that we assign a value for the variable x to each token of the type. Alternatively, we could define two cases for the principle, one defined as above, the other with: ARTEFACT_TYPE (x) =_{df} › x is an artefact type‹.

(6) Principle ›Connection to social groups‹:

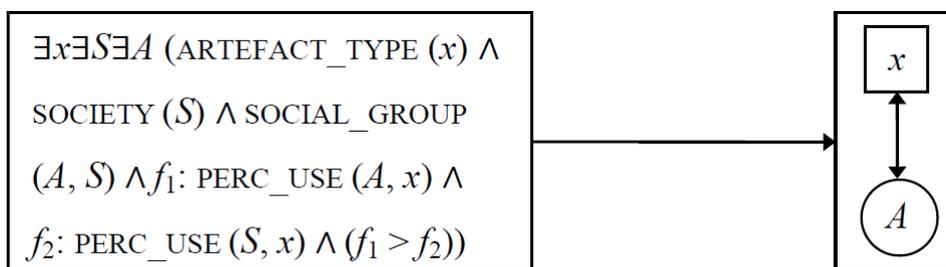


Fig. 14

Definitions: ARTEFACT_TYPE (x) =_{df} › x is an artefact type‹, SOCIETY (S) =_{df} › S is a society‹, SOCIAL_GROUP (A, S) =_{df} › A is a social group in S ‹, f : PERC_USE (A, x) =_{df} ›function: the percentage of individuals in A using x ‹.

Example: x = ›hoodie sweater [in the 1990s]‹, A = ›hip hop subculture‹.

For this principle, we have introduced functions (a step that could be implemented easily in a programming language). A formulation without functions is more cumbersome, but also possible. We would have to define a 3-place-predicate: PERC_USE (n, A, x) =_{df} › n is the percentage of individuals in A using x ‹, and formulate the condition as: $\exists x \exists S \exists A \exists n \exists m$ (artefact_type (x) \wedge society (S) \wedge social_group (A, S) \wedge perc_use (n, A, x) \wedge perc_use (m, S, x) \wedge ($n > m$)).

In both cases, the formulation is somewhat simplified: In fact, the percentage of use has to be sufficiently higher in A than in S to make the association of x with A plausible.¹⁹

¹⁹ The difference in percentage that is sufficient probably depends on a number of factors, some of them context-dependent, and intensity of use might also be relevant (even if the percentage of use is not higher in A than in S , the association might still be created if intensity of use was higher).

(7) Principle ›Specific contexts‹:

As detailed in section 0, this principle comprises different cases where special contexts lead to a well-defined set of meanings not found elsewhere. In the following, we represent the specific context ›collecting‹:

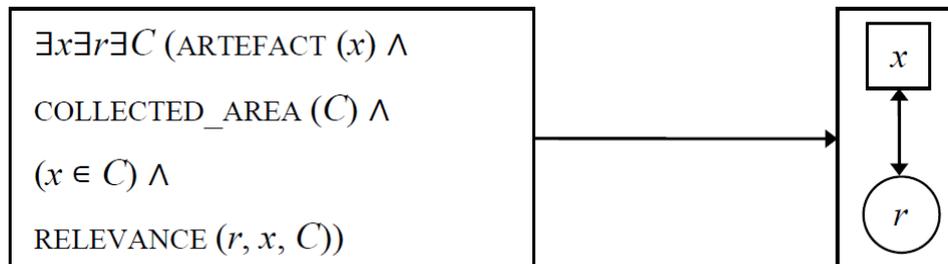


Fig. 15

Definitions: $ARTEFACT(x) =_{df} \langle x \text{ is an artifact} \rangle$, $COLLECTED_AREA(C) =_{df} \langle C \text{ is an area of artefacts that is collected by some collectors} \rangle$, $RELEVANCE(r, x, C) =_{df} \langle r \text{ is the specific relevance of } x \text{ for } C \rangle$.

Example: $x = \langle CD \text{ (Tchaikovsky Piano Concerto No.1, Horowitz/Szell, Movimento Musica 051-007)} \rangle$, $C = \langle \text{classical music} \rangle$, $r = \langle \text{sold-out pressing of rare pirate recording} \rangle$.

5. Conclusion

It was shown in this article that artefact semantics is an important topic that merits closer attention. The role of artefacts in cultures cannot be reduced to their functions, even if sign processes connected with these functions are included (cf. section 3.1). Though artefact meanings have been studied in design theory (cf. section 3.20) as well as anthropology and cultural semiotics (section 3.3), a comprehensive account of the different ways in which artefacts can get meanings is still lacking. In different disciplines, the topic is usually reduced to specific areas (e.g. in design studies to the effective indication of function, or in anthropology to ritual or technological meanings). The variety of different types of meanings associated with artefacts has not been treated in a systematic fashion.

To fill this gap, the article proposed a number of *principles of semantization* that explain how meanings come to be connected with artefacts (section 4.10), and a way to represent them (section 4.20). Further research is needed to determine if these principles form a plausible categorization, if they should be delimited differently, and if they should be supplemented by further principles. Apart from theoretical considerations and analysis of examples, empirical research could help to establish answers to these questions.

Simple tests could be based on free answers to questions asking for ›meanings‹, ›associations‹, ›everything that comes to mind‹. The answers are counted as ›meanings‹; two coders would independently categorize the answers as to the semantization principle that most likely created them, and the percentage of answers attributed to the principles could be counted. In this way, the problem that subjectivity of meanings and of their verbal expression makes a numerical comparison on the level of meanings impractical would be avoided: On the level of principles, a comparison might well yield reliably quantifiable results, without classifying meanings as to their semantic content. The test could be given to different groups (e.g. professionals and laypersons of the respective areas): If the results would differ significantly between the two groups, the conclusion might be that professionals and laypersons perceive artefacts differently. For example, the hypothesis could be tested that design professionals concentrate more on form-related meanings – principle (3) –, whereas laypersons are more interested in function and its expression – principle (1). If differences were found, this would certainly be of interest to the professionals, who design primarily for laypersons and not for themselves: It would help them to make their designs work if they were aware of the differences between the laypersons' perceptions and their own.

Another study could look for priming effects. If meanings are activated in artefact perception, they might have priming effects in association tests or free recall memory tests. If such priming effects are measurable, they would prove that artefacts influence our interaction with the world not only through the direct use we make of them, but also through the meanings we associate with them. It could even be tested if artefacts influence the outcome of problem-solving tests: If so, it would be telling us that the things we live with influence our thinking and daily life quite strongly – a hypothesis that is plausible since many people report that their mood, creativity, and quality of work depend on the room they are in, and that a change of furnishings can make a big difference. Artefacts could be added to other environmental factors (as light, ambient sound, air quality) that influence our well-being and the direction of our thoughts and feelings.

References

- APPADURAI, ARJIUN: *The Social Life of Things. Commodities in Cultural Perspective*. Cambridge, GB [Cambridge UP] 1986
- ARIELLI, EMANUELE: *Pensiero e progettazione. Psicologiacognitiva del design e dell'architettura*. Milano [Mondadori] 2003
- ARISTOTELES: *Perihermeneias. Translation and Commentary by Hermann Weidemann*. Vol. 1(2): *Werke in deutscher Übersetzung*. Darmstadt [Wiss. Buchgesellschaft] 1994

- ASSMANN, JAN: *Das kulturelle Gedächtnis. Schrift, Erinnerung und politische Identität in frühen Hochkulturen*. München [C.H. Beck] 1992
- ASSMANN, ALEIDA: *Erinnerungsräume. Formen und Wandlungen des kulturellen Gedächtnisses*. München [C.H. Beck] 1999
- BELK, RUSSEL W.: *Collecting in a Consumer Society*. London [Routledge] 1995
- BLACKMORE, SUSAN: *The Meme Machine*. Oxford [Oxford UP] 1999
- BORADKAR, PRASAD: *Designing Things. A Critical Introduction to the Culture of Objects*. Oxford [Berg] 2010
- BOYD, ROBERT; PETER J. RICHERSON: *Culture and the Evolutionary Process*. Chicago [U of Chicago P] 1985
- DAWKINS, RICHARD: *The Selfish Gene*. Oxford [Oxford UP] 1976
- DE SAUSSURE, FERDINAND: *Cours de linguistique générale*. Edited by Charles Bally, Albert Sechehaye. Lausanne [Payot] 1916
- DREYER, CLAUS: Semiotische Aspekte der Architekturwissenschaft. Architektursemiotik. In: POSNER, ROLAND; KLAUS ROBERING; THOMAS A. SEBEOK (eds.): *Semiotik – Semiotics. Ein Handbuch zu den zeichentheoretischen Grundlagen von Natur und Kultur*. Vol. 3. Berlin [de Gruyter] 2003, pp. 3234–3278
- ERLL, ASTRID: Kollektives Gedächtnis und Erinnerungskulturen. In: NÜNNING, ANSGAR; VERA NÜNNING (eds.): *Konzepte der Kulturwissenschaften. Theoretische Grundlagen – Ansätze – Perspektiven*. Stuttgart [Metzler] 2003, pp. 156–185
- FAHL-SPIEWACK, RENKE: *Attribution und Handlungsfähigkeit. Eine subjektwissenschaftliche Perspektive*. Berlin [Argument] 1995
- FAUCONNIER, GILLES: *Mappings in Thought and Language*. Cambridge, GB [Cambridge UP] 1997
- FILLMORE, CHARLES J.: Frame Semantics and the Nature of Language. In: *Annals of the New York Academy of Sciences. Conference on the Origin and Development of Language and Speech*, 280, 1976, pp. 20–32
- Fillmore, Charles J.: Frame Semantics. In: Linguistic Society of Korea (eds.): *Linguistics in the Morning Calm. Papers Presented at the Seoul International Conference on Linguistics*. Seoul [Hanshin UP] 1982, pp. 111–137
- FRANKE, URSULA: Zeichenkonzeptionen in der Kunstphilosophie und Ästhetik von der Renaissance bis zum frühen 19. Jahrhundert. In: POSNER, ROLAND; KLAUS ROBERING; THOMAS A. SEBEOK (eds.): *Semiotik – Semiotics. Ein Handbuch zu den zeichentheoretischen Grundlagen von Natur und Kultur*. Vol. 2. Berlin [de Gruyter] 1998, pp. 1232–1262
- FRERICHS, KLAUS: Semiotische Aspekte der Archäologie. In: POSNER, ROLAND; KLAUS ROBERING; THOMAS A. SEBEOK (eds.): *Semiotik – Semiotics. Ein Handbuch zu den zeichentheoretischen Grundlagen von Natur und Kultur*. Vol. 3. Berlin [de Gruyter] 2003, pp. 2977–2999
- GEERTZ, CLIFFORD: Thick Description. Toward an Interpretive Theory of Culture. In: GEERTZ, CLIFFORD: *The Interpretation of Cultures. Selected Essays*. New York [Basic Books] 1973, S. 3-30

- GOFFMAN, ERVING: *Frame Analysis. An Essay on the Organization of Experience*. London [Harper & Row] 1974
- GÖSSEL, PETER; GABRIELE LEUTHÄUSER: *Architektur des 20. Jahrhunderts*. Köln [Taschen] 1994
- GRANDY, RICHARD E.: Artifacts. Parts and Principles. In: MARGOLIS, ERIC; STEPHEN LAURENCE (eds.): *Creations of the Mind. Theories of Artifacts and Their Representation*. New York [Oxford UP] 2007, pp. 18–32
- GUMBRECHT, HANS ULRICH: Sign Conceptions in Everyday Life from the Renaissance to the Early 19th Century. In: POSNER, ROLAND; KLAUS ROBERING; THOMAS A. SEBEOK (eds.): *Semiotik – Semiotics. Ein Handbuch zu den zeichentheoretischen Grundlagen von Natur und Kultur*. Vol. 2. Berlin [de Gruyter] 1998, pp. 1407–1427
- HALBWACHS, MAURICE: *La mémoire collective*. Paris [PU de France] 1950
- HEESCHEN, VOLKER: Semiotische Aspekte der Ethnologie. Ethnosemiotik. In: POSNER, ROLAND; KLAUS ROBERING; THOMAS A. SEBEOK (eds.): *Semiotik – Semiotics. Ein Handbuch zu den zeichentheoretischen Grundlagen von Natur und Kultur*. Vol. 3. Berlin [de Gruyter] 2003, pp. 3278–3296
- HELD, CARSTEN; MARKUS KNAUFF; GOTTFRIED VOSGERAU: *Mental Models and the Mind. Current Developments in Cognitive Psychology, Neuroscience, and Philosophy of Mind*. Amsterdam [Elsevier] 2006
- HODDER, IAN: *Symbols in Action. Ethnoarchaeological Studies of Material Culture*. Cambridge, GB [Cambridge UP] 1985
- HUBIG, CHRISTOPH: Zeichenkonzeptionen in der Ästhetik vom 19. Jahrhundert bis zur Gegenwart. In: POSNER, ROLAND; KLAUS ROBERING; THOMAS A. SEBEOK (eds.): *Semiotik – Semiotics. Ein Handbuch zu den zeichentheoretischen Grundlagen von Natur und Kultur*. Vol. 2. Berlin [de Gruyter] 1998, pp. 1466–1482
- HUTCHINS, EDWIN: *Cognition in the Wild*. Cambridge, MA [MIT Press] 1995
- JENCKS, CHARLES: *The Language of Post-Modern Architecture*. New York [Rizzoli] 1977
- JENCKS, CHARLES; RICHARD BUNT; GEOFFREY BROADBENT (eds.): *Signs, Symbols, and Architecture*. Chichester [Wiley] 1980
- JOHNSON-LAIRD, PHILIP: *Mental Models. Towards a Science of Language, Inference, and Consciousness*. Cambridge, GB [Cambridge UP] 1983
- JUNG, HEEKYOUNG; SHAOWEN BARDZELL; ELI BLEVIS; JAMES PIERCE; ERIK STOLTERMAN: How Deep is Your Love. Deep Narratives of Ensoulment and Heirloom Status. In: *International Journal of Design*, 5(1), 2001, pp. 59–71;
<http://www.ijdesign.org/ojs/index.php/IJDesign/article/viewFile/854/318>
[accessed December 8, 2011]
- KEIL, FRANK C.; MARISSA L. GREIF; REBEKKAH S. KERNER: A World Apart: How Concepts of the Constructed World Are Different in Representation and in Development. In: MARGOLIS, ERIC; STEPHEN LAURENCE (eds.): *Creations of the Mind. Theories of Artifacts and Their Representation*. New York [Oxford UP] 2007, S. 231–245

- KRIPPENDORFF, KLAUS: *The Semantic Turn. A New Foundation for Design*. Boca Raton [Taylor & Francis] 2006
- KRIPPENDORFF, KLAUS; REINHART BUTTER: Exploring the Symbolic Qualities of Form. In: *Innovation*, 3(2), 1984, pp. 4–9
- KRIPPENDORFF, KLAUS; REINHART BUTTER (eds.): *Product Semantics. Special issue. Design Issues*, 5(2), 1989
- KRIPPENDORFF, KLAUS; REINHART BUTTER: Where Meanings Escape Functions. In: *Design Management Journal*, 4(2), 1993, pp. 30–37
- KRISTEVA, JULIA: *Desire in Language. A Semiotic Approach to Literature and Art*. New York [Columbia UP] 1980
- KRÜGER, REINHART; EVA-MARIA BAXMANN-KRAFFT; BERND HARTLIEB: Zeichennormung für Handwerk und Industrie. In: POSNER, ROLAND; KLAUS ROBERING; THOMAS A. SEBEOK (eds.): *Semiotik – Semiotics. Ein Handbuch zu den zeichentheoretischen Grundlagen von Natur und Kultur*. Vol. 4. Berlin [de Gruyter] 2004, pp. 3510–3570
- LAGOPOULOS, ALEXANDROS: Sign Conceptions in Architecture and the Fine Arts in Ancient Greece and Rome. In: POSNER, ROLAND; KLAUS ROBERING; THOMAS A. SEBEOK (eds.): *Semiotik – Semiotics. Ein Handbuch zu den zeichentheoretischen Grundlagen von Natur und Kultur*. Vol.1. Berlin [de Gruyter] 1997, pp. 900–911
- LANGACKER, RONALD W.: *Foundations of Cognitive Grammar*. Vol. 1: *Theoretical Prerequisites*. Vol. 2: *Descriptive Application*. Stanford, CA [Stanford UP] 1987-1991
- LEGRENZI, PAOLO: *Creativity and Innovation*. 2007; http://www.iauav.it/Ricerca1/Dipartimen/dADI/Working-Pa/wp_2007_02.pdf [accessed December 8, 2011]
- MACKIE, JOHN L.: *The Cement of the Universe. A Study of Oxford* [Oxford UP] 1974
- MAGLI, PATRIZIA: *Semiotica. Teoria, metodo, analisi*. Venice [Marsilio] 2004
- MALT, BARBARA C.; STEVEN A. SLOMAN: Artifact Categorization. The Good, the Bad, and the Ugly. In: MARGOLIS, ERIC, STEPHEN LAURENCE (eds.): *Creations of the Mind. Theories of Artifacts and Their Representation*. New York [Oxford UP] 2007, pp. 85–124
- MANDLER, JEAN M.: The Conceptual Foundations of Animals and Artifacts In: MARGOLIS, ERIC, STEPHEN LAURENCE (eds.): *Creations of the Mind. Theories of Artifacts and Their Representation*. New York [Oxford UP] 2007, pp. 191–211
- MARGOLIS, ERIC; STEPHEN LAURENCE (eds.): *Creations of the Mind. Theories of Artifacts and Their Representation*. New York [Oxford UP] 2007
- MINSKY, MARVIN: A Framework for Representing Knowledge. In: WINSTON, PATRICK HENRY (ed.): *The Psychology of Computer Vision*. New York [McGraw-Hill] 1975, pp. 211–277
- MITHEN, STEVEN: Creations of Pre-Modern Human Minds. Stone Tool Manufacture and Use by Homo habilis, heidelbergensis, and neanderthalensis. In: MARGOLIS, ERIC, STEPHEN LAURENCE (eds.):

- Creations of the Mind. Theories of Artifacts and Their Representation.* New York [Oxford UP] 2007, pp. 289–311
- MULLER, WIM: *Order and Meaning in Design.* Utrecht [Lemma] 2001
- NÖTH, WINFRIED: Zeichenkonzeptionen im Alltagsleben vom 19. Jahrhundert bis zur Gegenwart. In: POSNER, ROLAND; KLAUS ROBERING; THOMAS A. SEBEOK (eds.): *Semiotik – Semiotics. Ein Handbuch zu den zeichentheoretischen Grundlagen von Natur und Kultur.* Vol. 2. Berlin [de Gruyter] 1998, pp. 1761–1784
- NÖTH, WINFRIED: *Handbuch der Semiotik.* 2., rev. and ext. ed. Stuttgart [Metzler] 2000
- NORMAN, DONALD A.: *The Psychology of Everyday Things.* New York [Basic Books] 1988
- NORMAN, DONALD A.: *Things That Make Us Smart.* New York [Addison Wesley] 1993
- NÜNNING, ANSGAR; VERA NÜNNING (eds.): *Konzepte der Kulturwissenschaften. Theoretische Grundlagen – Ansätze – Perspektiven.* Stuttgart [Metzler] 2003
- ORT, CLAUS-MICHAEL: Kulturbegriffe und Kulturtheorien. In: NÜNNING, ANSGAR; VERA NÜNNING (eds.): *Konzepte der Kulturwissenschaften. Theoretische Grundlagen – Ansätze – Perspektiven.* Stuttgart [Metzler] 2003, pp. 19–38
- PEARCE, SUSAN M.: *Collecting in Contemporary Practice.* London [Sage Publications] 1998
- PEIRCE, CHARLES S.: *Semiotische Schriften.* 3 volumes. Edited and translated by Christian J.W. Kloesel, Helmut Pape, Frankfurt/M. [Suhrkamp] 2000
- POINSOT, JOHN: *Tractatus de Signis. The Semiotic of John Poinsot. Interpretive Arrangement by John Deely.* South Bend [St. Augustine's Press] 2008
- POSNER, ROLAND: Linguistische Poetik. In: ALTHAUS, HANS-PETER; HELMUT HENNE; HERBERT ERNST WIEGAND: *Lexikon der Germanistischen Linguistik.* 2nd edition. Tübingen [Niemeyer] 1980, pp. 687–697
- POSNER, ROLAND: Pragmatics. In: POSNER, ROLAND; KLAUS ROBERING; THOMAS A. SEBEOK (eds.): *Semiotik – Semiotics. Ein Handbuch zu den zeichentheoretischen Grundlagen von Natur und Kultur.* Vol.1. Berlin [de Gruyter] 1997, pp. 219–246
- POSNER, ROLAND: Kultursemiotik. In: NÜNNING, ANSGAR; VERA NÜNNING (eds.): *Konzepte der Kulturwissenschaften. Theoretische Grundlagen – Ansätze – Perspektiven.* Stuttgart [Metzler] 2003, pp. 39–66
- POSNER, ROLAND; KLAUS ROBERING; THOMAS A. SEBEOK (eds.): *Semiotik – Semiotics. Ein Handbuch zu den zeichentheoretischen Grundlagen von Natur und Kultur.* 4 volumes. Berlin [de Gruyter] 1997–2004
- SIEFKES, MARTIN: Zeichenmaterie und Zeichenträger bei stilistischen Zeichen. In: *Kodikas/Code. Ars Semeiotica*, 32(1-2), 2009, pp. 63–83
- SIEFKES, MARTIN: Style. A New Semiotic View on an Old Problem. In: *Kodikas/Code. Ars Semeiotica*, 34(1-2), 2012

- SIEFKES, MARTIN: *Stil als Zeichenprozess. Wie Variation bei Verhalten, Artefakten und Texten Information erzeugt*. Berlin, Technische Universität, Diss. Würzburg [Königshausen & Neumann] 2012/forthcoming
- SOWA, JOHN W.: *Knowledge Representation. Logical, Philosophical and Computational Foundations*. Pacific Grove [Brooks Cole] 1999
- SPERBER, DAN: *Explaining Culture. A Naturalistic Approach*. Oxford [Blackwell] 1996
- STEFFEN, DAGMAR: *Design als Produktsprache*. Frankfurt/M. [Form] 2000
- SUDJIC, DEYAN: *Cult Objects. The Guide to Having it All*. London [Paladin] 1985
- VENTURI, ROBERT; DENISE SCOTT BROWN; STEVEN IZENOUR: *Learning from Las Vegas*. Cambridge, MA [MIT Press] 1972
- VENTURI, ROBERT; DENISE SCOTT BROWN: *Architecture as Signs and Systems. For a Mannerist Time*. Cambridge MA [Harvard UP] 2004
- WEARY, GIFFORD; MELINDA A. STANLEY; JOHN H. HARVEY: *Attribution*. New York [Springer] 1989
- WIESSNER, POLLY: Style and Social Information in Kalahari San Projectile Points. In: *American Antiquity*, 38, 1983, pp. 253–257,
- ZIMMERMANN, REINHOLD: *Künstliche Ruinen*. Wiesbaden [Reichert] 1989