

A Cognitive Semiotic Approach to the Aesthetic Interplay between Form and Meaning in Responsive Environments

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Abstract. The aim of this paper is to introduce a cognitive semiotic approach, which offers a clearer understanding of how interactive design products communicate their meaning to users.

The ongoing shift in contemporary design towards making user interfaces aesthetically more engaging (tangible, intuitive, etc.) challenges traditional design semiotics on a number of its basic assumptions about meaning construction. One major problem being that design semiotics often restricts its idea of semiosis to object oriented recognition where ‘cognitive models’ are unambiguously matched against a visual form. As has been pointed out on several occasions this does not capture the cross modal interaction between body movement and vision, emotion and vision that plays such a crucial role when we make sense of interaction design.

In order to achieve this I will argue that design semiotics can benefit largely from picking up models from morphodynamics and neurocognitive research into how our brain, body and mind mutually shape one another. By applying these models in an analysis of a case example, the paper intends to demonstrate that these models provide an explanation of how conceptual meaning in responsive environments is anchored in morphologies and structures in perception. What I call *the aesthetic interplay between form and meaning*.

Keywords: Cognitive semiotics, responsive environments, para-functionality, morphology, image schemas, embodied meaning

0. Introduction

Interaction design represents a remarkable shift towards making user interfaces aesthetically more engaging (tangible, intuitive, etc.) (McCarthy & Wright 2004; Dourish 2001; Moggridge 2007). What characterizes the new user interface is that – contrary to traditional interactive systems – there is not just a single point or device of interaction, but multiple (cf. Dourish 2001: 51). Instead of being restricted to clicking on graphical icons and windows on a screen (GUI), our interaction with interactive design products unfolds somewhere inbetween image, object and the surrounding space (cf. Winograd, 1997). As a consequence, making sense of these design products become

to a significant degree dependent on a multi-sensory coordination of vision, movement and body.

This cognitive complexity of meaning construction poses a number of critical problems for design semiotics and product semantics. First of all, it reveals the shortcomings of the widely shared idea that semantic decoding operations in design can be satisfactorily explained as an object oriented recognition process where ‘cognitive models’ are unambiguously matched against a visual form (Krippendorff, 1989). No doubt cognitive models play a crucial role in our recognition and interpretation of the intended use of design objects, but the fundamentals of meaning in design are simply not captured this way. At least, what is required is a much more differentiated understanding of how conceptual meaning such as cognitive models is anchored in dynamic morphologies and structures in perception or more precisely the aesthetic interplay between them.

In this paper I shall argue that cognitive semiotics in fact offers such an understanding to design semiotics. My argument will take off from a careful analysis of a wearable piece of computing, the braincoat designed by Steve Rubin of Ear Studio. This analysis shall serve to isolate the crux of the problem and to redirect the attention of design semiotics from cognitive models to the key role of image schemas in understanding the conceptualization of embodied meaning in interaction design and in particular responsive environments.

Even if the potential use of image schemas for design and design research has recently been the object of much interest (Hurtienne & Israel 2007), it is not clear how they fit into an overall semiotic framework. Notably how cognition, sign structures and meaning relate to one another. In the concluding remarks I shall sketch out a few ideas from cognitive semiotics in order to clarify this question.

1. The Shortcomings of cognitive models

The aesthetic nature of the new user interface is closely related to what is called ‘physical’ or ‘tangible’ computing. According to Dourish (2001: 50) this computing paradigm can roughly be characterized in two ways: ‘tangible computing [...] might attempt to take familiar objects and invest them with computation, or it might present us with entirely new artefacts that disclose something of the hidden world inside the software system.’



Fig. 1 Braincoats - smart wear designed by Steve Rubin of EAR Studio as an essential interactive element of Diller + Scofidios Blur Building.

As an ordinary raincoat “invested with computation”, Steve Rubin’s braincoat clearly belongs to the first category. Rubin designed this smart wear as an essential interactive element of Diller + Scofidios spectacular Blur Building exhibited at the Swiss Expo 2002.



Fig. 2 Diller + Scofidios Blur Building whirling above Lake Neuchatel

Blur Building was literally made out of fog, an artificial cloud whirling upon Lake Neuchatel as a result of 31.000 tiny nozzles covering a thin metal space frame with an ether-like atmosphere. Before entering the blur, visitors had to fill in a questionnaire with personality data to be used as input to the installation’s pervasive computer system. Each visitor was then equipped with a braincoat – plastic raincoats that protected them from the misty environment, and served as a very tangible interface between user and building. By using surveillance technology the master computer of this system was in

fact able to track each visitors movements and to make their braincoat react electronically – blushing either red or green – according to similarity or difference between personality profiles of people unknown to each other.

Now, the interesting semiotic question is: How do we make sense of the braincoat as an interactive design object? According to Krippendorff (1989) what happens is that we are perceptually “guided” by the visual appearance of the object in order to fetch the right ‘cognitive model’ for its use from long-term memory. But since the braincoat affords one known and one unknown function at one and the same time, it seems to offer a certain cognitive “friction” against a product semantic scenario like this. Not only does the braincoat shield the body from the wet climatic forces, it also functions as a kind of display device.

Krippendorff would probably disagree claiming that product semantics is indeed geared to deal with this kind of polysemic meaning thanks to his notion of ‘context of use’, which is intended to explain the different and even conflicting functions of one and the same object. For instance, a ‘knife has all kinds of uses; cutting is merely the most prominent one. Prying open a box, tightening a screw, scraping paint from a surface, cleaning dirty fingernails are as imaginable as picking a pickle from a pickle jar.’ (Krippendorff 1989: 159) Hence Krippendorff defines meaning in design as features of an object being connected to the features of the context(s) by means of the cognitive model (ibid.).

Suppose we willingly accept this line of thought, the semantics of the braincoat could be schematized the following way:

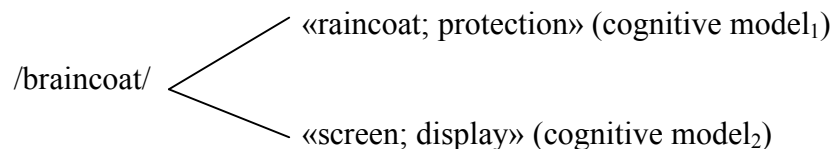


Fig. 3

‘Multi-functionality’ is how this semantic phenomenon in design is commonly described – as if multi-functionality consisted in two cognitive models being fused into a conceptual or cross-categorical blend. But the way I see it, the concept of multi-functionality does not explain the cognitive friction that the braincoat causes. Instead, I

prefer to see the braincoat as exemplifying what Dunne (2005) has appropriately termed the ‘para-functional’. By para-functional Dunne is referring to an electronic or digital object that ‘go beyond forms of estrangement grounded in the visual and instead explore the aesthetics of use in functionality, turning to a form of strangeness that lends the object a purposefulness.’ (Dunne 2001: 41-42) Due to this strangeness the para-functional object can be ‘conceptually difficult to assimilate’ (ibid: 67).

Judging from fig. 3 there appears to be nothing odd about the braincoat. After all, you just cognitively add ‘raincoat’ and ‘display’ as two semantic models on top of each other. However, a careful morphological analysis will reveal a conceptual ambiguity or even strangeness, to use the wordings of Dunne that this *additive* semantic principle must leave unanswered. Let me try to illustrate this point by using the concept ‘image schema’ from cognitive linguistics (Lakoff & Johnson 1980; Lakoff 1987; Johnson 1987).

2. How to model the para-functional with image schemas

Johnson (1987) defines the image schema as ‘a recurrent, dynamical pattern of our perceptual interaction and motor programs that gives coherence and structure to our experience.’ Through so-called ‘metaphorical projections’ the images schemas can be figuratively mapped from the experiential onto more abstract semantic domains such as knowledge and language. This way they act as underlying gestalt structures or morphological skeletons ensuring the unity of meaning. ‘Because they are so central to meaning structure, they influence the ways in which we can make sense of things and reason about them.’ (Ibid: 38)

Among the 30 to 40 image schemas that have hitherto been identified (Hurtienne & Israel 2007), the COINTAINER schema is one of the most pervasive in meaning construction. Like every other image schema, the CONTAINER schema is a dynamic pattern rather than fixed and static. This means that it is malleable according to how it is semantically specified or manifested.

I would like to suggest that by focusing on the properties of the CONTAINER schema, it is possible to broaden the semantic understanding of the braincoat. In particular I wish to conceptualize the ‘para-functional strangeness’ that the braincoat offers to our cognitive system and which stems from two simultaneous and apparently

conflicting morphological figurations of the CONTAINER schema as modelled in fig. 2:

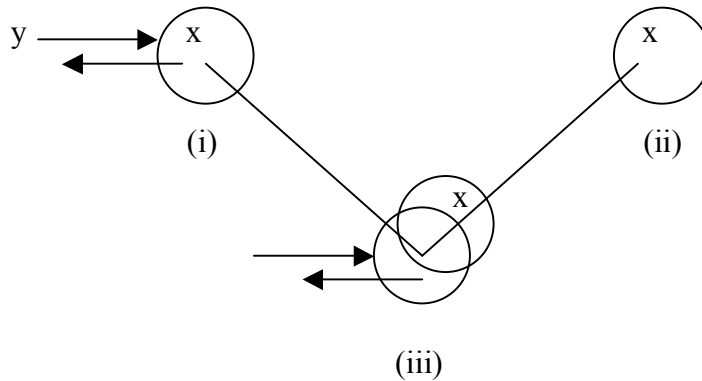


Fig. 4

Fig. 4 illustrates how the image schematic structure of containment organizes the semantics of the braincoat. Being in part a raincoat, the braincoat offers a bounded space protecting the body X from external forces Y (the wet and humid environment). At the same time and due to modern textile technology, the braincoat is designed like every other raincoat as to allow body heat to slip out to prevent internal overpressure. These unique image schematic features of the braincoat are modelled as two trajectors in opposite directions in (i).

But there is another *in-out* orientation at stake in the braincoat design. Our personality data is not something we typically hand *out* to strangers. Normally we keep such matters to ourselves implying that they are bounded-*in*, hidden, unknown or unavailable to other people except our family and closest friends. As depicted in (ii), the hermetic sealing off of who we are also involves the CONTAINER schema although in a metaphorical manner and only implicitly as the personality stuff is not in any way hidden away in the Blur Building. On the contrary the braincoat design is in fact based schematically on a morphological projection of (i) and (ii) into a new hybrid semantic space (iii).

The merging of the two morphologies entails a different understanding of the meaning of (display) surfaces than that being expressed in the influential essay by Norbert Bolz (1994). Here meaning is not restricted to visual signs *on* the surface, but is conceptualized as being communicated *through* it in a tangible and tactile way. And this

is exactly where the para-functional strangeness of the braincoat resides and why a product semantic analysis at the level of cognitive models and visual forms is inadequate. To grasp this strangeness, it is necessary to see not only *that*, but especially *how* meaning is grounded in embodiment. In particular, how the structure of containment is motivated by kinaesthetic feelings (cf. Johnson 1987: 25).

The respiration quality of the braincoat is identical to the anatomical properties of the human skin. When our body heat exceeds 37,5° either due to internal or external forces (a virus or hot weather conditions), the surplus of body temperature evaporates as sweat through the skin. As such haptic sensations and feelings are repeated over and over again, there arises a recurrent, dynamic and kinaesthetic pattern of containment that may be mapped, for instance, onto the conception of artefacts, textiles, etc. Notice, however, that the para-functional strangeness in question is not reducible to the morphodynamics of the trajectors and the kinaesthetic surface element of this CONTAINER schema.

It is in the hybrid semantic space (iii) that the real conceptual twist is being made. Here qualities defining the entities or states in morphology (i) are allowed freely to cross over or as it were wrap around the entities or states located in morphology (ii). Through this truly metaphorical exchange the transmission of personality data is conceptualized *as* vaporizing sweat or humid from the body. This means that the red and green blushing between the visitors in Blur Building is to be perceived as indexing foggy, humid or even ether-like atmospheres wherein new forms of social interaction is taking place. The blurring conceptual space of the braincoat is thus mimicking or mirroring the misty and floating architectural space of Blur Building in its entirety.

Enough with this seemingly endless interpretive process of semiosis. Let me just summarize what has been revealed so far. First, I have demonstrated how by applying the concept of image schema it is possible to formalize Dunne's (2005) valuable notion of parafunctionality.

Second, the morphological analysis supports Dunne's essential claim that in order to understand the semantics of the parafunctional we must move beyond the 'forms of estrangement grounded in the visual and instead explore the aesthetics of use'. Thus, it is from the kinaesthetics of the body that there arise an image schematic structure which acts as an organizing semantic principle in our conception of the parafunctionality of the braincoat.

Third, by exploring the dynamics between image schema and cognitive models I hope to have suggested how an approach like this is able to convey the aesthetic interplay between form and meaning in design.

3. Concluding remarks: Image schemas, iconicity and cognitive semiotics

The concept of image schema is not in any way new in design research and theory as is fairly well documented by Hurtienne & Israel (2007). In fact, it was already anticipated by the concept ‘semantic space’ offered by Lannoch & Lannoch (1989). However, it is still unclear how image schemas fit into a semiotic framework. So, in order to conclude this paper I wish briefly to sketch how this question is answered by the development of what is known as ‘cognitive semiotics’ (Bundgaard et al. 2003).

Cognitive semiotics is based on the assumption of a structural likeness or *iconicity* between our phenomenological world and the way we either conceive or express our experiences of this world in thought, language and art. It is absolutely legitimate to use the term iconicity in this strong structural sense. Even if we are used to think of iconicity as something completely vague or undetermined (a quality of feeling, a mere tone of cognition), iconicity for Peirce could also mean a ‘structural diagram’ or ‘skeleton plan’ that is applied to the manifold of sensation through perceptual judgment (Eco 1999: 103), thereby forming the Immediate Object. The way I see it, image schemas are identical to this second meaning of iconicity.

Similar to Peirce, cognitive semiotics also regards the image schemas as being applied or projected onto more abstract inferential processes. However, to understand their iconic nature it is necessary to take a closer look at how they emerge from our perceptual and senso-motoric interaction with the outside world. Interaction is the key term here. Since cognitive semiotics is not in any way subscribing to the dualistic or even ‘schizophrenic’ ontology that semiotics has been accused of (e.g. Krippendorff Transcending semiotics, 30). Instead the prototypical principle active in the formation of image schemas is identified precisely on the threshold between the objective and the subjective (cf. Petitot 1985; Lakoff & Johnson 1999).

In explaining, for instance, how the *in-out* schema arises from body space interaction, Johnson (1987: 30) lists the first steps of our daily routines. We wake *out* of a deep sleep and peer out from beneath our covers *into* the room. We pull ourselves *out* from under the covers, climb *into* your robe, stretch *out* your limbs, etc. These are

examples of the way an image schema arise from the phenomenological localisation in space.

The central problem for cognitive semiotics is of course to demonstrate how the iconic structures resulting from interaction in this base space constrain meaning construction at higher order symbolic levels. This task basically consist in providing evidence for the so-called Spatialization of Form Hypothesis which is described by Lakoff (1987: 283):

Strictly speaking, the Spatialization of Form hypothesis requires a metaphorical mapping from physical space into a 'conceptual space'. Under this mapping, spatial structure is mapped into conceptual structure. More specifically, images schemas (which structure space) are mapped into the corresponding abstract configurations (which structure concepts). The Spatialization of Form hypothesis thus maintains that conceptual structure is understood in terms of image schemas plus a metaphorical mapping.

The image schemas and metaphorical mapping seems so pervasive that we barely notice them. Unless, of course, in situations where the anchoring of conceptual meaning gets blocked or frustrated. Dourish (2001: 145-150) is providing us with a particular clear example of this when describing the unforeseen consequences of the media space RAVE which Dourish and his colleagues created at EuroPARC in Cambridge, England. RAVE was an audio-visual video conferencing system designed to create a virtual collaborative working environment across boundaries of time and space. However, the offices connected by the video connection had different orientations, i.e. the video equipment was oriented asymmetrically (fig. 5). Consequently, as Dourish explains, 'the orientation of my virtual image on my colleague's monitor was not the same as my own physical orientation, so when I would point in one direction, my image would point in another.' (ibid.: 148).

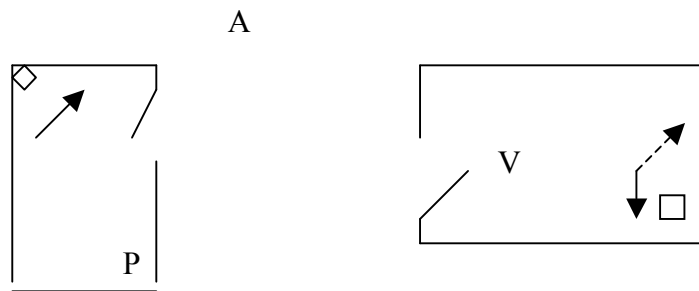


Fig. 5. Pointing through the media space. *P* and *V* have asymmetrical office layouts. When *P* points at *A*, as indicated by the arrow, the camera relays his image to *V*'s monitor. In *V*'s office, *P*'s image appears to point in the direction shown by the solid arrow, rather than in the desired direction shown by the dotted arrow. (From Dourish 2001: 147)

This example is interesting, because it draws attention to the potential validity of the Spatialization of Form Hypothesis. Due to its asymmetrical structure, RAVE separates basic frames of orientation from communicated meaning; it interferes with the motivated relationship between embodied action and meaning. Now, cognitive semiotics could serve as a powerful analytical tool in understanding how perception and body movement shape the way we conceive and design responsive environments. With this paper I have suggested how cognitive semiotics could become design semiotics in use.

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