Sheffield Hallam University

SHARPENS YOUR THINKING

Disciplining the body? Reflections on the cross disciplinary import of 'embodied meaning' into interaction design

MARKUSSEN, Thomas

Published version

MARKUSSEN, Thomas (2009). Disciplining the body? Reflections on the cross disciplinary import of 'embodied meaning' into interaction design. In: Undisciplined! Design Research Society Conference 2008, Sheffield Hallam University, Sheffield, UK, 16-19 July 2008.

Undisciplined! Proceedings of the Design Research Society Conference 2008.
Sheffield, UK. July 2008

Disciplining the body?

Reflections on the cross disciplinary import of 'embodied meaning' into interaction design[i]

Thomas Markussen, Kolding School of Design, Denmark.

Abstract

The aim of this paper is above all critically to examine and clarify some of the negative implications that the idea of 'embodied meaning' has for the emergent field of interaction design research.

Originally, the term 'embodied meaning' has been brought into HCI research from phenomenology and cognitive semantics in order to better understand how user's experience of new technological systems relies to an increasing extent on full-body interaction. Embodied approaches to technology design could thus be found in Winograd & Flores (1986), Dourish (2001), Lund (2003), Klemmer, Hartman & Takayama (2006), Hornecker & Buur (2006), Hurtienne & Israel (2007) among others.

However, fertile as this cross-disciplinary import may be, design research can generally be criticised for being 'undisciplined', because of its tendency merely to take over reductionist ideas of embodied meaning from those neighbouring disciplines without questioning the inherent limitations it thereby subscribe to.

In this paper I focus on this reductionism and what it means for interaction design research. I start out by introducing the field of interaction design and two central research questions that it raises. This will serve as a prerequisite for understanding the overall intention of bringing the notion of 'embodied meaning' from cognitive semantics into design research. Narrowing my account down to the concepts of 'image schemas' and their 'metaphorical extension', I then explain in more detail what is reductionistic about the notion of embodied meaning. Having done so, I shed light on the consequences this reductionism might have for design research by examining a recently developed framework for intuitive user interaction along with two case examples. In so doing I sketch an alternative view of embodied meaning for interaction design research.

Keywords

Interaction Design, Embodied Meaning, Tangible User Interaction, Design Theory, Cognitive Semiotics

Interaction design is commonly viewed as a dominating trend in Human-Computer Interaction (HCI) that focuses on designing user experiences with technology. With the advent of tangible and physical computing, there have, over the last decade or so, emerged new opportunities for interaction designers to create technological systems or products that engage nearly every aspect of human experience: emotional feelings, vision, movement, gestures, and all sorts of interrelations thereof. As has been pointed out, interaction is simply no longer unfolding by means of viewing and clicking on graphical icons on a screen, but is embedded into an *augmented reality* in-between image, object and the surrounding space (cf. Winograd, 1997; see fig. 1).

In addition to this extended user interface (sometimes referred to as 'tangible', 'graspable', 'intuitive', and so on), interaction design also represents the proliferation of information technology into new territories of our everyday life. As a consequence, the attention of interaction designers is shifting from mere usability, functionality, and efficiency to playful, explorative and emotional interaction.

Following from this radical design evolution, current HCI research is struggling to increase understanding of the emergent new forms of user interaction. In particular, interaction design poses two challenges to HCI research, which must be addressed. First, there is an urgent need to acquire more knowledge of the new cross-modal experiences that characterize full-body interaction with technological user interfaces. Related to this is the second challenge, which concerns the question of how users are able mentally to interpret novel technology use for practical purposes, play and social interaction. Since interaction design often implies the use of technology in unfamiliar contexts, users cannot always rely on their previous experiences and background knowledge, but have to create meaning and understandings of their own or collaboratively. Clearly, experience and meaning construction are mutually intertwined in user interaction, so these two topics must be dealt with as co-constitutive aspects of the same problem.

By picking up recent theories of the 'embodied meaning' and 'embodied interaction' from phenomenology and cognitive semantics, current HCI research has in fact made considerable progress in understanding this problem. Basically, these theories share the underlying assumption that people's subjective, felt experience of their bodies in action play a key role in shaping human cognition and language (cf. Gibbs, 2005). However, to understand the full heuristic potential of this cross-disciplinary import, it is necessary first to pinpoint the knowledge gap in traditional HCI that the notion of embodiment is generally believed to have filled in.

From Cognitive Models to Embodied Meaning in HCI

It is widely acknowledged that traditional HCI and product semantics simply offer a too limited understanding for interaction design (see e.g. McCarthy & Wright, 2004; Dunne, 2006). Generally, these frameworks tend to treat user interaction as a disembodied abstract recognition process, where *cognitive models* are matched more or less unambiguously against the visual form and surfaces of an object (Norman, 1988; Krippendorff, 1989). A cognitive model is usually conceived to be a product of people's long-term memory, which has been stored through repeated actions and experiences in the past. Thus, for instance, when I see the sharp contours of an oblong item in my kitchen, I automatically fetch the cognitive model of a 'knife' without even being aware of it. I simply recognize the object by relating its visual form to my previous experiences with knifes. The KNIFE MODEL provides me as it were with tacit knowledge for the appropriate use of the object under the given circumstances (e.g. cutting vegetables and meat, peeling skin of tomatoes, etc.). In this way cognitive models are to a large extend responsible for the smooth flow of everyday activities and at the same time for freeing cognitive resources for other purposes such as social interaction (e.g. conversing your partner while preparing a meal).

However, this conceptual framework is not equipped with sufficient explanatory power for dealing with central aspects of interaction design (cf. Markussen, 2008). For instance, principles of tangible and graspable user interaction do not necessarily obey the same kind of rules as visual recognition processes. Also, by embedding computational resources in physical environments users are sometimes confronted with hybrid functionalities that they have never experienced before. In such cases, either there simply is no cognitive model available for immediate recognition, or existing cognitive models must be reorganized or invented anew to fit the novelty and innovative aspects of technology use. In fact, it is an acclaimed goal of many interaction designers to create "aesthetic experiences comprised of both a bodily sensation and an intellectual challenge" (Petersen et al., 2004). Or to put it in other words: interaction design is no longer just used for fulfilling well prescribed goal-oriented tasks, but often requires that user's build new concepts and learn through their bodily interaction with technology.

The related ideas of 'embodied meaning' and 'embodied interaction' have been brought into HCI research from phenomenology and cognitive semantics in order to account for this subtle interplay of bodily interaction and meaning construction (see e.g. Winograd & Flores, 1986; Dourish, 2001; Fels, 2001; Klemmer, Hartman & Takayama, 2006; Hornecker, 2005; Hornecker & Buur, 2006; Hurtienne & Israel, 2007). Contrary to cognitive models, embodied meaning is not to be understood in terms of abstract mental representation, but as primitive spatial patterns giving order and coherence to our experience. As mentioned above, these patterns are held to be responsible for the internal organization of meaning "at more abstract levels of cognition" (Johnson, 1987, pp. xix-xx). In this transfer of lower-level structures from an experiential domain onto higher-level domains of abstract meaning, imaginative and metaphoric capabilities of the human mind are assumed to play a key role. This potentially widens the notion of meaning construction in design from recognition to include learning and the invention of novel interpretations.

In the following I look more closely on how this notion of embodied meaning in one particular instance has been developed into a new theoretical framework for interaction design.

Embodied Meaning and Metaphorical Extensions in Intuitive User Interaction

Most recently, Hurtienne & Israel (2007) has made a plea for using cognitive semantic theories of embodied meaning in the description of basic levels of intuitive user interaction. More specifically, they ground their framework on Lakoff & Johnson's Conceptual Metaphor Theory (Lakoff & Johnson, 1980; Johnson, 1987). In order to give an overview of these levels the authors start out by presenting a model of the 'continuum of knowledge' that they believe cover intuitive interaction (see fig. 1):

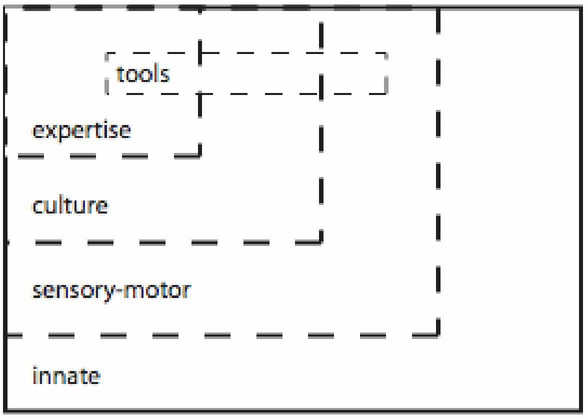

Fig 1. The Knowledge Continuum for Intuitive User interaction.

Adapted from Hurtienne & Israel (2007)

The first and most basic level concerns the body's innate knowledge acquired through reflexes, instinctive behaviour and other neurobiological skills. The next 'sensor-motor level' consists of general knowledge structures arising in infancy from developmental learning and interaction with the physical world. "Children learn for example to differentiate faces; they learn about gravitation; they build up concepts for speed and animation" (Hurtienne & Israel, 2007, p. 128). Then there is the 'culture level' of knowledge, which is sensitive to the place and location where people live. For instance, it makes good sense to build interfaces upon the desktop metaphor in Western cultures, but this happens not to be the case worldwide. Finally, Hurtienne & Israel distinguish a 'specialist level' of knowledge that consist of expertise acquired through one's education, profession or hobby.

Having done so, Hurtienne & Israel further suggest that the cognitive semantic concepts of 'image schema' and 'metaphorical projection', laid out by Lakoff & Johnson (1980, 1999), Lakoff (1987) and Johnson (1987), may help us to better understand the interweaving of those levels in tangible user interaction with technology. To see what is at stake here, let me just summarize what is meant exactly by these two concepts.

The Relation between Sensor-motor and Socio-cultural levels of Meaning in Conceptual Metaphor Theory

In *The Body in the Mind* (1987) Johnson defines an 'image schema' as "a recurrent, dynamical pattern of our perceptual interaction and motor programs that gives coherence and structure to our experience." For instance, there is the CONTAINER schema for in-out orientations in space, the PATH schema for directions in space, and over 2 dozens other schemas that in a similar vein structure how the world show up for us (cf. Gibbs & Colson, 2006).

What is particularly interesting is that Johnson (1987, pp. 30-31) in fact employs everyday design-related activities to account for how image schematic structures come into existence:

> Consider, for example, only a few of the many in-out orientations that might occur in the first few minutes of an ordinary day. You wake *out* of

> a deep sleep and peer *out* from beneath the covers *into* your room. You gradually emerge *out* of your stupor, pull yourself *out* from under the covers, climb *into* your robe, stretch *out* your limbs, and walk *in* a daze *out* of the bedroom and *into* the bathroom […] You reach *into* the medicine cabinet, take *out* the toothpaste, squeeze *out* some toothpaste. (*my obliteration*)

The idea here is that through such simple manipulations of objects and bodily actions, invariant spatial structures become gradually extracted and entrenched in our long-term memory system in the form of image schemas. In all of the above-mentioned experiences there are thus an underlying image schematic structure of containment, which can be represented diagrammatically as in fig. 2:

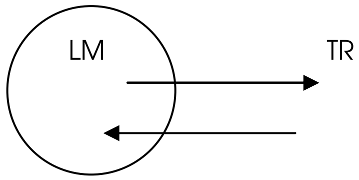

Fig. 2 CONTAINER schema

The encircled 'landmark' (LM) is illustrating how in all of the above examples boundedness is perceived in relation to a container serving as a more or less stable reference point. In the waking out of a deep sleep, it is the sleep; in peering out from beneath the covers, it is the covers; in walking out the bedroom, it is the room, and so forth. On the other hand, that which moves is organised experientially as a trajector (TR) moving along a path, either out of (the arrow pointing to the right) or into the container (the opposite arrow). This indicates that most often the image schema involves some kind of force dynamics as well. In the waking up sequence, our consciousness is experienced as moving (as TR) out from a dazing to a waking state; in peering out from the covers and in climbing into the robe, it is respectively our gaze and whole body that operate as trajectors. Apart from such IN-OUT orientations, there are schemas for UP-DOWN, LEFT-RIGHT, NEAR-FAR, and numerous other experiential relations in space (Johnson, 1987, p. 126).

It is important to note that the image schemas are not found as such in objective physical reality, but act rather as spatial structures that we are able to project onto inanimate or non-physical entities. Just think about the aforementioned action of stepping out of bed and climbing into your robe. Beds and robes do not possess an inside and an outside by themselves. This organization is utterly dependent on a subjective embodied experience of moving from one location to another location in space or feeling oneself being surrounding by a soft piece of textile. Moreover, these spatial structures must somehow be projected onto the objects at hand.

Metaphorical Projection

It is this figurative extension of structures from the sensor-motor level onto higher semantic levels in thought and language that is being referred to as 'metaphorical projection'. By studying an impressive range of verbal expressions and sentences, Lakoff & Johnson (1980) found out that image schemas in fact act as 'morphological skeletons' ensuring the unity of *conceptual meaning*. Consider again the CONTAINER-schema, which is crucial for our ability to comprehend events, states, or our being among other people meaningfully. Thus, we retrieve this schema for conceptualizing economic transactions ("The salesperson *closed* the deal"), emotions ("I'm *in* love!"), time ("you need to be here *in* five seconds!"), social relations ("He's an *out*sider"), and so on.

In Lakoff (1987, p. 283) the whole idea of how image schemas are metaphorically elaborated into conceptual meaning structures is summarized by what he refers to as the Spatialization of Form Hypothesis:

> 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.

From this quote, it appears that metaphorical projections of image schemas rely on a unidirectional *source-target* construal principle as depicted in fig. 3:

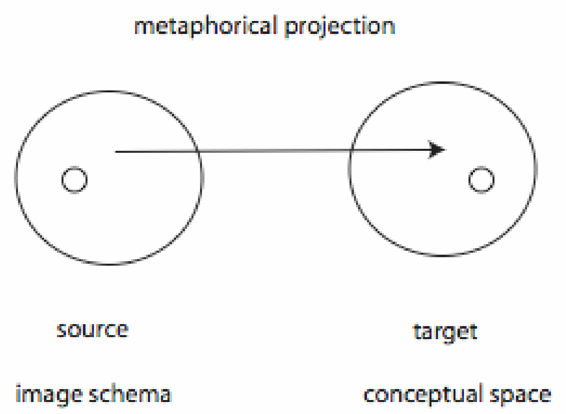

Fig. 3

However, as Kimmel (2005) among others has convincingly argued this way of thinking entails a certain *reductionism* that we need to be aware of. First, the Spatialization of Form Hypothesis presupposes that embodied image schemas are ascribed ontological and functional primacy, whereas the impact of cultural and contextual factors in shaping conceptual structure is reduced to a minimum.

Secondly, despite the fact that Johnson originally conceived image schemas as being relatively malleable, so that they can be modified to fit many similar, yet different, situations (Johnson 1987, p. 30), in many of his successors, there is clearly a tendency to treat image schemas as pure idealizations, i.e. invariant structures of long-term memory being uninfluenced by the local contextual conditions. Yet I believe with Kimmel (2005) that there is a need for a concept like 'situated image schemas' accounting for how image schemas are co-determined by their concrete embodied instantiation.

Thirdly, image schemas are most often conceived as simple and isolated patterns in experience. However image schemas usually do not occur in isolated fashion, but rather are experienced grouped as gestalts or wholes involving the co-activation of several and even competing image schematic structures. This observation was made more than ten years ago by Cienki (1997), yet investigations of it seem only to be sparse. One of the things that Cienki drew attention to was that the gestalt groupings of image schemas cannot be understood merely as" a process of composition, given the nature of a gestalt structure that it has properties not simply derivable from its parts" (Cienki, 1997: 9). As we will see shortly, this phenomenon poses a challenge to the source-target construal principle.

Mapping Image Schemas between the Physical and Digital World

Interaction designers can no doubt benefit largely by turning towards conceptual metaphor theory and cognitive semantics. After all, metaphors have long been used in the design of digital media as a means for letting users understand new forms of human-computer interaction in terms of what they already know.

The recent interest of Hurtienne & Israel (2007), but also Lund (2003) in using image schemas in the design of computer user interfaces should be seen along this very same line. The overarching aim in designing with image schemas is to enable users intuitively to comprehend abstract digital data in terms of knowledge rooted in their direct perceptual and bodily interaction with the physical world. However, if designers are not fully aware of the inherent reductionism underlying the standard image schematic framework, then it might cause some limited understandings of embodied meaning and meaning construction at large. Consider, Hurtienne & Israel's own fictitious example – The Tangible Memories Box:

Fig. 4. The Tangible Memories Box (reproduced from Hurtienne & Israel, 2007)

The Tangible Memories Box consists of 6 trays each of which represent a time period of 2 months. Each tray contains a memory item: an elephant for a visit to a zoo in January, a shell for a holiday trip in March, a dice from a gaming evening in May, and so forth. When connecting the box to a computer, folder icons for each item group appear on a screen. Then by placing a special cylinder in one of the smaller trays above, the display shows icons of each digital file, which belong to the item in the tray (Hurtienne & Israel, 2007, pp. 132-33).

In their design of this box, Hurtienne & Israel describe how they made use of essentially two organizing schemas – the CONTAINER and COLLECTION schema respectively. At the largest scale, the box itself is a CONTAINER mapped onto another (illusionary) CONTAINER, the screen. Inside the box, the 6 trays act as smaller CONTAINERS for a COLLECTION of objects, which correspond to a COLLECTION of digital images stored in CONTAINERS on the screen, viz. the file folders.

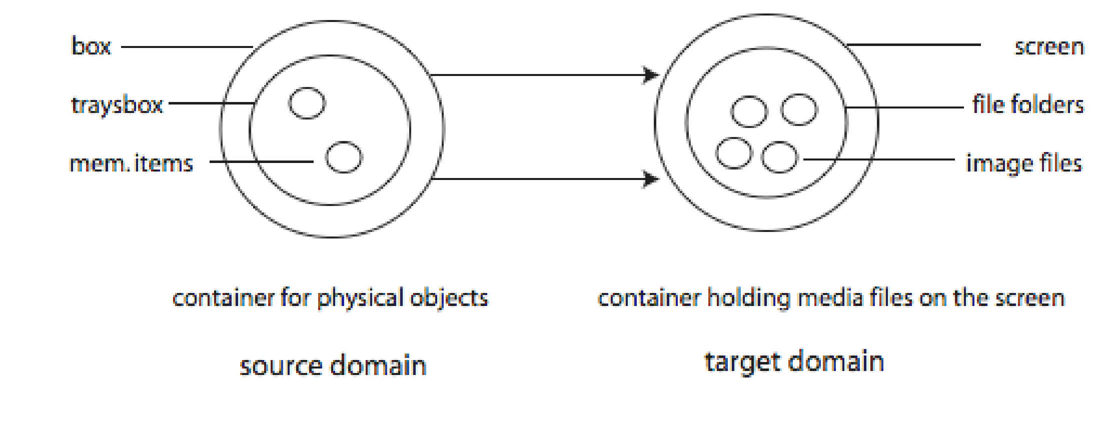

Fig. 5

I agree with Hurtienne & Israel that intuitive ease of use and comprehension is likely to follow from this part of their artefact. Especially, it is worth noting how the interface design cues users to extend their physical experience of containment metaphorically into a coherent conceptualization of otherwise scattered temporal events. More specifically, the computer interface plays on the conceptual metaphor TIME IS A CONTAINER, which allows for making different inferences such as MEMORIES ARE PHYSICAL OBJECTS IN A CONTAINER. Recalling Bergson's philosophical laments, one could say that this *spatialization* process rectifies time, thereby making a fugitive and abstract phenomenon intuitively graspable.

The Reductionism of Embodied Meaning in Interaction Design

However, there are a few uncertainties in Hurtienne & Israel's argument having to do notably with the intermediate object, i.e. the cylinder. Or more precisely with their idea of how the image schematic structures involved in manipulating the cylinder is mapped 'physically' onto the manipulation of digital screen data.

There is two different image schemas involved in the cylinder interaction: (1) rotating the cylinder is organized experientially according to the LEFT-RIGHT schema; (2) placing the cylinder in an upright position is organized according to the UP-DOWN schema. Now, Hurtienne & Israel propose a way of mapping these structures onto two corresponding manipulations of digital data. Thus, left-right rotation of the cylinder would correspond to left-right navigation of the cursor from one image file to the next on the screen (fig. 6.1), whereas UP-DOWN positioning of the cylinder should entail IN-OUT zooming on the image (see fig. 6.2). Yet, this might not be as intuitive as it is presumed to be.

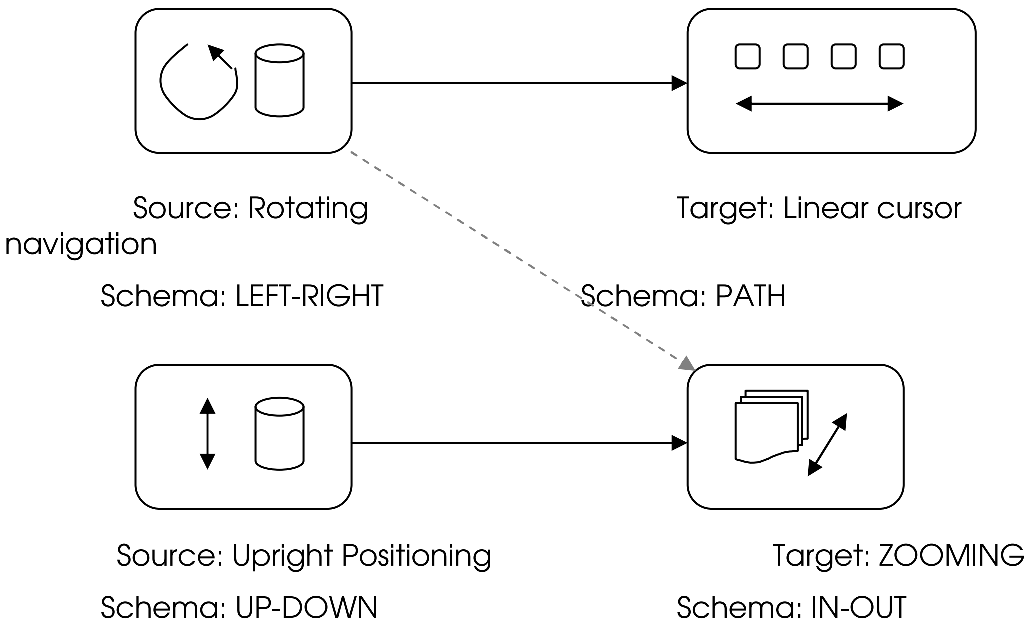

Fig. 6.1, above: Rotation of cylinder mapped onto sequential navigation of the screen cursor. Fig. 6.2, below: UP-DOWN positioning of cylinder mapped onto IN-OUT zooming on an image

The Role of Cultural and Contextual Factors

Rotating a cylinder is something we typically associate strongly with IN-OUT zooming (the dashed diagonal arrow) not sequential navigation along a linear PATH. This associative link has become culturally entrenched as rotating cylindrical lenses on cameras, telescopes and binoculars have been used for this purpose for hundreds of years. And the current context, where users are presented with a cylinder for image manipulation seems only to revive this link in the users mind. So, unless users are able mentally to block this linkage to their long-term memory and straightforwardly to couple rotation with sequential navigation instead, this feature of the Tangible Memories Box is likely, I would claim, to be experienced as counter-intuitive. Simply because it runs counter to user's contextually motivated expectations of use.

One of the main reasons why Hurtienne & Israel ignores the potential impact from such cultural and contextual factors on the mapping of image schemas is that they view innate and sensorimotor levels as functionally prior to these factors. Admittedly, they do operate with both a cultural and a specialist level of knowledge in their continuum model (see fig. 1 above). Yet, these levels are not regarded as playing any constitutive role when designing with image schemas. Thus, the authors write: "with our approach we would like to stick to the original intention of using TUI (tangible user interfaces) and stay at the sensorimotor level of our continuum of knowledge." (Hurtienne & Israel, 2007, p. 130). But it is an error to believe that designing with embodied schemas is about 'stripping off' cultural layers in order to get down to the basics. Of course, it is possible from a purely analytical point of view, but the Tangible Memories Box itself more than indicates that it is reductionistic.

Situated Image Schemas

Another challenge for Hurtienne & Israel, as I see it, is to explain how user's pre-existing cognitive model of zooming becomes co-structured in accordance with the UP-DOWN schema. To account for this, it is necessary to see "how compound image schemas emerge when simpler ones hook up in time or space to create more complex groupings" (Kimmel, 2005: 289). Appropriating the cylinder as an instrument for zooming thus requires that the user succeed in mentally fusing the UP-DOWN and IN-OUT schemas into a new integrated model of zooming.

It is important to notice here that this meshing of schemas, or 'blending' as it is dubbed in Fauconnier & Turner (1998, 2002), makes new structural properties available that are simply not derivable from the act of manipulating a cylinder or digital data in itself. Neither is it possible to understand the zooming of image in terms of a unidirectional mapping of UP-DOWN onto the target domain, since the IN-OUT is in fact playing just as active an organizing role as do UP-DOWN. Instead, what this case reveals is that schemas from both the source domain and the target domain are grouped into a third hybridized structure serving inferential purposes for local understanding and meaningful interaction: Positioning of the cylinder up or down is inferred to be the cause of zooming effects on the screen.

I believe with Kimmel (2005) that cases like this points to the 'situatedness' of image schemas. That is, how image schematic formation in user experience is highly sensitive to its local embedded instantiation. In its present state Hurtienne & Israel's framework is unable to account for the situatedness of image schemas, since image schemas are viewed as invariant and de-contextualized units. Moreover, as situated image schemas might rely on the contribution of structures from both source and target domains, it violates the source-target construal principle, which is the only mapping procedure recognized by Hurtienne & Israel.

The Compound Nature of Embodied Schemas

So far I have accounted for two reductionist notions of embodied meaning inherent in, but not in any way limited to Hurtienne & Israel (2007): (1) the ruling out of contextual and cultural factors in the mapping of image schemas onto conceptual structure; and (2) the view of image schemas as pure idealizations of long-term memory uninfluenced by the local contextual conditions. In this final section, I argue that we also need to overcome the tendency to view image schemas as isolated and simple patterns in experience.

In the existing research literature it is common to use the human body as a way of describing the bodily experience, whereby the CONTAINER schema comes into existence. Thus, Johnson (1987, p. 21) writes:

> Our encounter with containment and boundedness is one of the most pervasive features of our bodily experience. We are intimately aware of our bodies as three-dimensional containers into which we out certain things (food, water, air) and out of which other things emerge (food and water wastes, air, blood, etc).

Johnson's descriptions could perhaps give the impression that a primitive and simple structure of CONTAINEMENT like that depicted in fig. 3 is repeatedly activated in the experience of our body. However, Johnson is himself careful to recognize that slightly differing activations of even the same image schema might occur simultaneously in bodily experience. Let me try to illustrate this with the following example.

RoBlood is a series of blood-taking robots that is meant to replace bio-analysts in the Danish health care sector. Now we all know that blood-taking is a very personal and intimate affair. So, in order to design a robot that patients would feel secure and safe about, the design team decided to push the soft and emotional aspects to the fore (Wetton, 2007). This design strategy is clearly reflected in the way in which technology use, emotions and form are unified in one of the design proposals named *Sessio*. *Sessio* integrates advanced blood-taking robotic technology into the armrest of an organically shaped interactive chair. When the patient places her arm on the armrest, it automatically adjusts in height and follows the patient's movements. Then a comfortable vacuum surrounds the arm, so that it is enclosed and kept tranquil. The blood-taking process starts, when after the position and depth of veins have been identified, a needle from the armrest is inserted into the patient's arm (Nørhave, Madsen & Springborg, 2007).

Fig. 7 *Sessio* – a blood-taking robot

The *Sessio* experience interestingly reveals how stimulation of a fairly restricted area of the body's surface may give rise to two seemingly competing activations of one and the same image schema. *Sessio*'s surrounding of one's arm is experientially organized according to a schema of ENCLOSING as depicted in fig. 8.1. The open square illustrates how *Sessio*'s armrest acts as a CONTAINER closing in on a part of the body (the circle). On the other hand, the insertion of a needle is evoking the sense of an ENTRY into a CONTAINER (fig. 8.2). Here, the needle is experienced to follow a penetrating PATH that creates an opening of its own into the body. In this instance the body is itself profiled as being the CONTAINER (the square) of a contained object (a portion of blood; the small circle). Since all this is happening as an integrated part of the same haptic experience, it is reasonable to conclude from this that image schemas should not per definition by seen as simple and primitive patterns in experience. On the contrary, it might be better to see the body as a reservoir for complex and even ambiguous image schematic activations (fig. 8.3).

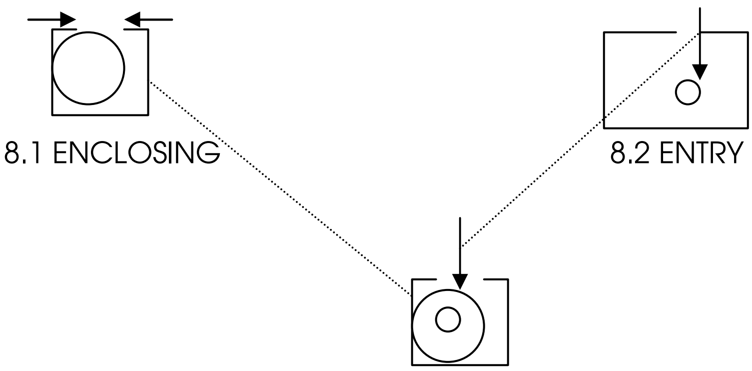

Fig. 8.3.

Compound Image schema

Note again, how the source-target principle is violated as both image schemas contribute with structures to a third higher-level experiential gestalt. To account for this gestalt, it may be useful to look at the emotional responses involved. Having a foreign and pointed object inserted into our body is typically not experienced is being particularly pleasant. On the other hand, people tend to approve of experiences where larger parts of their body are being surrounded in a smooth and comfortable way as in a hug, being covered by a blanket, etc. As the two image schemas are co-activated in the *Sessio* experience, an emotional tension is likely to emerge. The unpleasant feeling from the sting of a needle is as it were downplayed or even counter-balanced by the pleasantness of comfortable vacuum embracing the patient's arm; something that might motivate the formation of a new conceptual meaning – 'an emotional robot'.

Conclusion

The findings of this paper point towards the need to revise some reductionist notions of embodied meaning currently influencing interaction design research. The reductionism found to be present in Huritenne & Israel (2007) could, for instance, be traced in Lund (2003) and Hornecker & Buur (2006) as well.

Needless to say, as I have focused primarily on theoretical issues and concepts, this conclusion must be further investigated through empirical studies. Thus, it would be of much interest to develop methods for retrieving information on the effect that the deliberate designing with image schemas might *actually* have on user experience. Do users really experience the artefact as the designer think they would?

These missing empirical data notwithstanding, I suggest that the image schematic approach do have some positive implications for design. In my opinion the concept of image schemas is of valuable use to designers as a powerful descriptive tool in analysing central aspects of embodied meaning in technology design. Not only in users embodied interaction with, but also in the creative production of digital artefacts. However, on the basis of my case analysis, I find it relevant to single out 3 future developments that should be devoted to the concept of image schemas.

(1) What the *Sessio* example was only able to indicate is that the understanding of compound image schemas in lived experience could benefit from richer phenomenological and qualitative descriptions of bodily experience.

(2) There is a need to develop a dynamic description of how compound image schemas are build up in the scenario-like sequence of user experience. Thus, we have seen that image schemas are not necessarily instantiated as static transcontextual structures as Hurtienne & Israel among many others seem to maintain. Rather, image schemas can be transformed and tied up with each other according to dynamic principles related to how users experience the design context. The good question is of course what kind of principles? In Imaz & Benyon (2007) and Markussen (2008), it is demonstrated that the principle of 'conceptual blending' laid bare by Fauconnier & Turner (1998, 2002) might be the most promising way of accounting for these principles. But since this has only just begun to be studied in respect to interaction design further evidence is required.

(3) More knowledge must be acquired as to how culturally motivated models of use interweave with the mapping of image schemas. The example of the Tangible Memories Box indicates that such cultural factors might play a constitutive role, and that we therefore have to revise the source-target construal principle. This issue is the object of a study by Quine (1991), who posits that higher-level cultural models indeed govern the mapping and grouping of image schemas. But Quine's claim is still much discussed and there is therefore a need to clarify this question further.

Obviously, design research must lean towards neighbouring disciplines such as cognitive semantics and phenomenology in its attempt to solve these problems. However, what I hope to have demonstrated is that if ideas from these disciplines are uncritically imported into the design field, then there is a risk of disciplining the body in unproductive ways as it might isolate the body from its contextual situatedness. Disciplining design research, on the other hand, could lead instead to a fruitful understanding of how the body and contextual factors always act as two sides of a flipping coin.

References

Markussen, T. (2008). A Cognitive Semiotic Approach to the Aesthetic Interplay between Form and Meaning in Responsive Environments. In S. Vihma & T-M. Karjalainen (eds.) *Design Semiotics in Use.* University of Art and Design Helsinki. (*forthcoming*)

Dourish, P. (2001). *Where the action is: the foundation of embodied interaction.* Cambridge, Mass.: MIT Pr.

Gibbs, R. W. (2005). *Embodiment and Cognitive Science*. Cambridge U. Pr.

Gibbs, R. W. & Colston, H. L. (2006). The Cognitive Psychological Reality of Image Schemas and their Transformations. In D. Geeraerts *Cognitive Linguistics: Basic Readings* (pp. 239-268). Berlin: Mouton de Gruyter. (Original work published 1995 in *Cognitive Linguistics*)

Hornecker, E. & Buur, J. (2006). Getting a grip on tangible interaction: a framework on physical space and social interaction. *CHI 2006 Proceedings*. Montréal, Quebec, Canada: ACM.

Hurtienne, J. & Israel, J. H. (2007). Image schemas and their metaphorical extensions: intuitive patterns for tangible interaction. *Proceedings of the 1st International Conference on Tangible and Embedded Interaction.* ACM Press.

Imaz, M. & Benyon, D. (2007). *Designing with Blends: Conceptual Foundations of Human-Computer Interaction and Software Engineering.* MIT Press.

Johnson, M. (1987). *The Body in the Mind. The Bodily Basis of Meaning, Imagination and Reason.* Chicago & London: The University of Chicago Pr.

Kimmel, M. (2005). Culture Regained – Situated and Compound Image Schemas. B. Hampe (ed.) *From Perception to Meaning. Image Schemas in Cogntive Linguistics* (pp. 285-312). Berlin: Mouton de Gruyter.

Klemmer, S., B. Hartmann & Takayama, L. (2006). How Bodies Matter: Five Themes for Interaction Design. *DIS 2006* (pp. 140-149). Pennsylvania: ACM.

Krippendorff, K. (1989). On the Essential Contexts of Artefacts. In V. Margolin & R. Buchanan (eds.) *The Idea of Design*, 1995, 156-184.

Lakoff, G. & Johnson, M. (1980). *Metaphors We Live By.* The University of Chicago Pr.

Lakoff, G. (1987). *Women, Fire, and Dangerous Things. What Categories Reveal About the Mind.* Chicago & London: The University of Chicago Pr.

Lund, A. (2003). *Massification of the Intangible: An investigation into embodied meaning and information visualization.* Ph.d.-diss.http://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-145

McCarthy, J. & Wright, P. (2004). *Technology as Experience.* Cambridge, Mass.: MIT Pr.

Norman, D. (1988). *The Psychology of Everyday Things.* Basic Books.

Nørhave, K. L., Madsen, M. & Springborg, Louise (2007). Sessio. In B. Wetton (ed.) *Robots Blood – A Methodology*. Kolding: Designskolen Kolding.

Petersen, M.G., Iversen, O., Krogh, P. & Ludvigsen, M. (2004). Aesthetic Interaction - A pragmatic Aesthetics of Interactive Systems. *Proceedings of ACM DIS2004*.

Quine, N. (1991). The Cultural Basis of Metaphor. In J. Fernandez (ed.) *Beyond Metaphor. The Theory of Tropes in Anthropology*. Standford: Standford U. Pr.

Ulmer, B. Ishii, H. & Jacob, R. J. K. (2005). Token+Constraint Systems for Tangible Interaction with Digital Information. In *ACM Transactions on Computer-Human Interaction*, 12 (1), 81-118.

Wetton, B. (2007). *Robots Blood – A Methodology.* Kolding: Designskolen Kolding.

Winograd, T. & Flores, F. (1986). *Understanding Computers and Cognition: A New Foundation for Design*, Ablex Publishing Corporation, Norwood, NJ

Acknowledgments

[i]I would like to thank one anonymous reviewer for valuable comments on an earlier version of this paper.

Thomas Markussen

Markussen (b. 1973) holds a MA-degree in comparative literature and semiotics from the University of Aarhus (DK). He is currently affiliated to Designskolen Kolding (DK) where he is working on a PhD research project dedicated to the developing of a cognitive semiotic framework for understanding the interweaving of aesthetic experience and meaning construction in interaction design.

In his earlier work, which includes lecturing, writings and media productions, Markusen has been focusing on the impact of technology use within art, architecture and design. He continually pursues these research interests as a member of the editorial committees behind the international journals *Fibreculture* and *Inflextions*.