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Rendering the tacit observable in the learning process of a changing body

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Abstract

To address the visual bias in architectural design, we explore ways to include vision impaired persons in architects' design process. In this context we studied the development of non-visual experiential knowledge in the process of becoming blind to explore its potential in designing multisensory space. A postphenomenological framework provides us a way of understanding the continuum of different relations between body and world. How we gain knowledge of our world depends on the situation and ranges from more tacit background and embodiment relations to more explicit alterity and hermeneutic relations. By analyzing John Hull's written accounts of becoming blind, we learn how his awareness of a multisensory environment grew. Because of his changing body, he gradually built up *connoisseurship* in engaging with his environments. Due to the gradual nature of the process, his first experiences were still explicit to himself, and his written accounts thereof can make explicit his gradually acquired *connoisseurship* to us. Closer to architects' design process are the processes of becoming blind that practicing architects Carlos Mourão Pereira and Christopher Downey underwent. Our interviews with them, analysis of their design tools and observations of Pereira's engagement with buildings, suggest that they underwent a similar process as Hull in which their *connoisseurship* became explicit to them. Moreover, they recognized the potential of their newly acquired skills and knowledge for design practice. In making the move to design, their knowledge becomes explicit not only as verbal account, but also in the shapes and materiality of their designs. Their design expertise, acquired before losing their sight, becomes explicit too. As their body changes, their expertise in using visual design artefacts becomes obstructed. Observations of the learning processes of changing bodies (and thus also changing body-world relations) can thus make explicit both newly acquired *connoisseurship* as well as previously acquired expertise, the latter in its failing.

Keywords

architecture, *connoisseurship*, learning process, visual impairment

Vision has a privileged position in architecture. The built environment is often designed with a visual appreciation or function in mind, to such an extent that some attribute a visual bias to architecture and architects' design processes (Frampton 1983, Pallasmaa 2005). A possible explanation for this visual bias can be found in the widespread use of visualisation techniques and the underrepresentation of the human body in architects' design process. However, we interact with the built environment using our entire body and all of its senses. Critique of this visual bias and architects' lack of attention to the multisensory qualities of the built environment comes from architects and theoreticians (see e.g. Pallasmaa 2005,

Dischinger 2006, Franck & Lepori 2007). It also comes from people living with a visual impairment, who daily deal with an environment that is often inadequately designed. On the other hand, through their bodily interactions with their environment, they have built up nuanced knowledge of its non-visual qualities (Herssens & Heylighen 2011). In line with a cultural model of disability (Devlieger *et al.* 2003), vision impaired people's knowledge may also challenge normative design practices and help to overcome the visual bias in architecture.

For this reason, we explore whether and how persons living with a visual impairment can be included in architects' design process. In this context we have studied how non-visual experiential knowledge is developed in the process of becoming blind in order to explore its potential in designing multisensory space. In this paper we set out to demonstrate how three persons, in losing their sight and learning to rely on non-visual perception to engage with their environment, develop a kind of differentiation or *connoisseurship*, a notion of expertise advanced by ecological psychologists (Gibson & Gibson 1955; Gibson 2000). In their view, expertise develops through perceptual learning, *i.e.*, through discovering distinctive features and invariant properties of things and events. James and Eleanor Gibson (1955) explain: "In this theory perception gets richer in differential responses and not in images. Instead of becoming more imaginary it becomes more discriminating. Perceptual learning, then, consists of responding to variables of physical stimulation not previously responded to. The notable point about this theory is that learning is always supposed to be a matter of improvement—of getting in closer touch with the environment." As a result of this perceptual learning, experts are able to differentiate, in their body or surrounding world, variables that are meaningless to novices. A sommelier, for instance, is able to discern various types of bitterness in wine, which remain unnoticed to an amateur wine drinker. Yet, these types of bitterness do contribute to the taste of the wine, and thus to the pleasure it offers the amateur wine drinker. Besides by professional activities, however, the development of *connoisseurship* may be triggered by other embodied factors, such as cultural elements or—the focus of this paper—sight loss.

For this demonstration, we adopt a postphenomenological framework, which provides a way of understanding the continuum of different relations between body and world as mutually co-constituting each other, and the mediating role of technologies therein (Ihde 1993, 2009; Verbeek 2005). How we gain knowledge of our world depends on the situation and ranges from background and embodiment relations to alterity and hermeneutic relations. The former are more tacit, the latter more explicit. For instance, a blind person's cane as a technological artefact informs the person about the tactual and acoustic qualities of her surroundings in such a way that rather than the cane she perceives the environment. The cane as technology is embodied by the person who is involved in an embodiment relation with her body, cane and world. When the person is about to leave the house and searches for the cane, the cane is perceived in an alterity relation, as an object with its own qualities. When after a walk the person sits on a bench to rest and take up the acoustic landscape, she holds the cane loosely in her hand. The cane is still there, keeping contact with the person and the ground, but in terms of perceiving the surroundings, it disappears to the background of attention. Finally, when learning for the first time to distinguish between different textures through the cane, the person has to learn to interpret differences in cane movements as differences in shapes of material surfaces. Here the relation occurring with the environment, through the cane, is called a hermeneutic relation.

The different perceptual body-world relations defined in postphenomenology can occur within the same situation and involve the same technological artefact. They also form part of a continuum. When something in a situation changes—*c.q.* the person's body—the relations can shift as well. Starting from this hypothesis, the remainder of this paper reports on three case studies of persons who lose their sight and learn to rely on non-visual perception to engage with their environment and—in two cases—to give shape to that environment through design. The case studies rely on a variety of empirical material, collected through face-to-face interviews—both with the persons themselves and with their collaborators, analysis of accounts written and design tools used by them, and participatory observation in combination with video-ethnography of a building visit by one of them.

John Hull: learning from sight loss

John Hull, in his book *Touching the rock* (1990) with additions in *On sight and insight* (1997), gives an autobiographical account of the process of becoming blind and how this alters his perception of the (built) environment. Although he does not explicitly label it as such, the way he analyses the transition of losing his sight to becoming blind closely resembles a phenomenological analysis. His highly detailed descriptions of his changing experience take into consideration both his body and his environment. By analysing Hull's written accounts of his becoming blind, we can learn how his awareness of a multisensory environment grew over time. Because of his changing body, he has gradually built up *connoisseurship* in engaging with acoustic, tactual¹ and olfactory environments. Indeed, by losing his sight he has learned to differentiate and perceive variables in his body and/or the surrounding world that were meaningless to him before (Gibson 2000). At the same time, however, because of the gradual nature of the learning process, his first experiences were still explicit to himself. It is then his written accounts of becoming blind that can make explicit his gradually acquired *connoisseurship*.

Hull (1990) describes how the loss of one of his sensory modalities step-by-step changes his world. At age 18, he lost his sight in one eye; 30 years later, after a gradual process of seeing less and less, he lost sight in the other eye as well. But even at the time he could not distinguish any light any more, he still did not consider himself as “being blind”, but rather as “a sighted person who cannot see” (ref.). In the first few years, visual memories (of places he visited, or faces of people he met) formed a large part of his experience in revisiting places or meeting people he knew before. But over time these memories faded and others started to emerge. “[The memories of the blind adult] focus upon what his body experienced, or underwent. This is quite different from visual memory, because your body does not feel what your eye sees” (*ibid.* p. 138). His body has changed, but it still has to learn to interact with its environment, which in the process changes as well. Moreover, for Tim Ingold, the “[powers of perception] are rather cultivated, like any skill, through practice and training in an environment. For this reason they can vary from one individual to another, even within a single society” (Ingold 2000, p. 283). This learning process takes time, the time that Hull needed to “become” blind.

¹ In line with Loomis & Lederman (1986), we will use the term “tactual” to describe “what has to do with the sense of touch”. This is comprises tactile, kinaesthetic and haptic perception, with the latter being a combination of the two previous ones.

The alterations in Hull's body, and thus also in the way he perceives his environment, include not only the gradual loss of his sight, but also the gradual embodiment of his cane. "It is natural for people to regard the white cane as a sort of walking stick. It is looked upon as something which gives support. It is not immediately thought of as an instrument of sense perception, as a way of gathering information about the world" (Hull 1990, p. 38). The cane is also a way to extend his tactual world a little, which is otherwise limited to his body.

The learning process of becoming blind was a reaction to his altered body, but his world seems to have changed as well. Part of it, the visual part, has simply disappeared. It is not as if it went dark; it just is not there anymore. When a sighted person shuts his or her eyes, the objects that make up his or her (visual) world are still there for that person. For Hull, these objects have disappeared and others have taken their place, or the objects have changed themselves. For instance, concerning the climate of his environment, he writes: "the wind has taken the place of the sun, and a nice day is a day when there is a mild breeze. This brings into life all the sounds in [the] environment" (Hull 1990, p. 16). Aural and tactual qualities make up his world now. But again, it took some time to learn to perceive this new world in all its richness. In the beginning, the great variety in visual sensations in different places—in particular office spaces—did apparently not translate into the same variety when it comes to aural and tactual qualities. Later he found out that certain places do make a stronger impression as he mentions when richly describing a park visit in terms of the sounds of people, the wind he felt, the feeling and trajectory of the path he took, the dimensions of the place, the handrails he touched, etc. The more he learns about his new world, the more he can distinguish between different places and even judge the pleasantness of being there, as he sums up in one of the later sections entitled "Touch is beautiful" (Hull 1990, p. 175).

One of the aspects of Hull's world that have changed is its size. Much of his world is made up of what is within reach of his body, whether or not this includes his cane. The haptic sense still allows him to "look" for things, helped by his memory of their position in previous encounters. But with sound, it is still different. Within a soundscape, he can still shift his attention to certain sound patterns within the whole. However, when the objects themselves stop making sound—because the wind drops or he stops walking and making sound with his cane and shoes—they disappear from his world. "Every point was a point of activity. Where nothing was happening, there was silence. That little part of the world then died, disappeared" (Hull 1990, p. 82). Therefore, according to Hull, the way to disclose the auditory part of his world that most resembles the visual world, is through the rain. The sound that the raindrops make creates a soundscape in which every object has its distinct contour and position, all at the same time and constantly presented to him.

To summarise, Hull has put the process of becoming blind over time into a very striking metaphor of a cake. "One should not think of the life of a blind person as a cake which has had a slice cut out of it. Rather, it is like a smaller cake. It is experience as being intact, although the scope of activity has in many ways become smaller" (Hull 1997, p. xii). Although in the beginning, not being able to see was experienced as a loss, it later became irrelevant in how his body and world relates, or more specifically how he perceives his environment.

Eleanor Gibson (2000) understands the process of perceptual learning as "process of differentiation, the specification of significant information. It is[...] a result of selection from an array of information about the events, objects, and layout of the surrounding environment in relation to the readiness and state of the perceiver's own body structure and capabilities." (*ibid.* p. 296) Don Ihde (1993,2009) adds to this relation between body and world the

mediating role of technology, e.g. the cane as part and extension of the tactual sense. But important here is the focus on differentiation and the body-environment relation. Because of a change in Hull's body, his (mediated) body-world relation changed through a process of differentiating ever more other sensory qualities than the mainly visual ones. Because the substantial change in his body and through reflection, this process of differentiation became explicit to him, to the extent that he was able to give a written account of his altered perception. On the other hand, the kind of differentiations he relied on as a sighted person gradually disappeared from his conscious memories.

Designing from and for blindness

One step closer to architects' design process are the processes of becoming blind that Carlos Mourão Pereira and Christopher Downey underwent. Both were practicing architects when they lost their sight. In our interviews with both architects, our analysis of their design tools and our participatory observations of Pereira's engagement with an Art Nouveau building, we found that they are undergoing a similar process as Hull in which their own *connoisseurship* is becoming explicit to them. Moreover, they also recognized the potential of their newly acquired skills and knowledge for the architecture they design and their design process.

Building a nuanced understanding of multisensory qualities: Carlos Mourão Pereira

The process of becoming blind is for Carlos Mourão Pereira an inspiring learning process about, amongst others, the multisensory qualities of architecture and space. Trained as an architect, he acknowledges a visually oriented interest in architecture—his interest in the Modernist architecture of e.g. Mies van der Rohe which he himself now describes as highly visual. Though he states that he has always had an interest in the broader human sensorium as well, he now admits that his knowledge of it was fairly limited. When his vision became impaired, Pereira discovered the potential opportunity to expand his non-visual knowledge about the built environment. Similar to what Hull (1997) describes as becoming blind rather than being blind, Pereira discovers a greater distinction in non-visual spatial qualities. “Nowadays, and due to the fact that I cannot use my vision, I am more awake to the listening, olfactive [sic] and the tactile components of architecture. [...] I am in a state of great receptivity to new influences, with particular emphasis to the ones of bigger sensory complexity.” (Pereira 2009a) For instance, he never could explain the why of his observation that people prefer 19th century houses to live in above modernist and contemporary houses. Now, through his bodily awareness of the complexity of auditory space, he has discovered differences in acoustic quality between houses from the respective architectural styles and thus attributes this preference to the acoustic qualities of a living space.

Eventually, this embodied knowledge helps him create richer architecture as he incorporates shapes and materials for their multisensory potential. In his design of a sea bathing facility at the Portuguese coast, for instance, the rounded shapes of the basin are chosen for their haptic qualities and seaweeds growing in the smaller basins are used for their olfactory and tactile qualities (see Fig. 1). At least for now, vision is still an important aspect of architecture for Pereira. When talking about the use of Lego blocks to communicate his design ideas with others, for instance, he hastens to point out that all blocks need to have the same colour (Peirera, 2009b). Also very telling is that in his design of an inclusive party installation—a

bathroom that is accessible and comfortable for all users, including wheelchair users and people with low vision—a major concern for him was to avoid the typical medical “look” (*ibid.*). For this visual aspect, Pereira relies on his memories and collaborators. Yet Hull’s description of fading memories of past visual experiences suggests that Pereira’s work might change on this account. As we write, the sight loss is still recent and the process of becoming blind only just started. As much as he relies on his memory for visual spatial knowledge, he extensively uses his own body to gain spatial knowledge concerning other senses. Therefore, he prefers visiting a building or site in order to get to know it. In the context of his research on safety for blind persons, for instance, he deliberately chose to study cases he was able to visit “The selection was to have more contact with the case studies. They are in Portugal ... there are also specific islands for me interesting but I prefer ... to go to the place.” (interview Pereira 2009) When describing a building or site he has visited, he mentions auditory qualities of sound and reverberation, olfactory qualities of smell and tactile qualities of shape, texture, temperature and pressure.



Fig. 1 Sea Bathing Facility, Lourinhã by Carlos Mourão Pereira

The reliance on his own experiences, bodily and mediated, is apparent in how he explores the building site, and similarly, projects designed by other architects. He engages an environment, a building or building element consciously with the whole of his body. During a visit to the Horta House in Brussels², he mostly used his hands to explore the complex shapes of the rich Art Nouveau detailing. Pereira even uses a repertoire of different gestures—going from pinching over grasping to subtle strokes with the back of his hands—to gain as rich an experience as possible (see Fig. 2). According to Gibson (2000) perceptual learning occurs through exploratory activity, of which Pereira’s different hand movements are an example. “Exploratory activity is more than a mere motor process accompanied by registration of input from the existing layout. It is itself an event, a perception-action sequence that has consequences. It brings about new information of two kinds: information about changes in the world that the action produces and information about what the active perceiver is doing.” (*ibid.* p. 296) This co-constituting body-world relation makes that some parts of the building or certain places invited him to touch with more than the hands: a

² The Horta House is the former home/atelier of Art Nouveau architect Victor Horta. Today, it is a museum exhibiting the architecture and furniture of the house and some design models made by Horta. For this visit, we obtained the privilege of touching the delicate details of the Art Nouveau building, which is normally prohibited by the museum conservator.

waiting place near a heating element in the entrance hall invited to be experienced while sitting down; also sofas and chairs invoked feelings of attention, relaxation and listening by suggesting different body postures; his feet informed him of the many subtle differences in flooring material and transitions between spaces; when entering a winter garden, his first reaction was to comment on the change in smell; and engaging with different materials through touch made him also experience the acoustic qualities of materials as the interaction produces different sounds. Even visual qualities remain important for Pereira's experience. For many building elements he asked about their colour in great detail.



JH: "Do you like that door handle?"



CP: "Yes, they have a human scale."



CP: "You have the very delicate size."

CP: "Well, what I see is incredible, because I know sometimes it's difficult with the design, to give very careful, the way of treating the steel or the metal. But they are incredible rounded finishes. But there are little contrasts, I'm very critical. What I see here is, for example the wood handrail has very different touch qualities than the steel, because the steel has a little arch, it's not completely rounded."



CP: "Do you want to touch?"
PW: "Yes."



CP: "Give me your hand."



CP: "So, here I think is very comfortable."



CP: "But here"
PW: "it's more sharp"



CP: "you find sharpness."

Fig. 2 Pereira engaging with a door handle and explaining his experiences through touch

Overcoming a visual bias: Christopher Downey

When Christopher Downey lost his sight he continued his design practice by working for Smith Group on the design of the Polytrauma and Blind Rehab Centre in Palo Alto. He helps the design team to understand the experiences of losing sight and learning to engage with the environment non-visually. He also consults the design team on communicating the design proposals to some of the blind staff working at the centre. To be able to understand the design and make propositions of his own he developed some tactual ways of representing the design, something that proved helpful in communicating the design to other blind persons as well.

Even more than for Pereira, for Chris Downey the process of becoming blind related first and foremost to acknowledging and overcoming a visual bias in his earlier work. Similar to Pereira's concerns with creating an inclusive built environment, for Downey a multisensory design approach to architecture benefits everyone. "[I] start to build these multisensory design strategies for the building that you can, everybody can benefit from. You can give some extra richness to the building, but it's also just an exciting different way of thinking about architecture, [...], and it gives more richness to everyone. And it gives a different sensory structure to work with if you're blind." (interview Downey 2011) Sensory richness is becoming a way for Downey to create interesting and supporting spaces for many activities. Creating acoustic or tactile landmarks helps in way-finding, but differentiation can also support resting places and places for informal encounters separated from a circulation space. Furthermore, sensory richness means paying attention to different senses. Touch and sound have received the most of Downey's attention in perceiving his environment.³ Yet vision remains important in his work as well. For him, sensory richness means not only expanding his attention to different senses, but also striving for differentiation in acoustic, tactual or visual qualities *an sich*. His more nuanced understanding of acoustic qualities has taught him that many spaces are acoustically too uniform to navigate easily. And he extrapolates this insight to other sensory modalities, including vision. He then wants to bring his acquired skills in differentiating multisensory qualities to the spaces he designs, making them explicit to the blind students of the Polytrauma and Blind Rehab Centre (see Fig. 3). For instance, he designed the ceiling of the lobby space to create a similar acoustic space as he experienced under a metal vaulted roof which gave him a distinct sense of direction as the sound of his cane travelled across the length of the roof. Here, his acquired *connoisseurship* is made explicit through his design rather than in verbal descriptions.

³ Downey underwent surgery that also influenced his sense of smell.

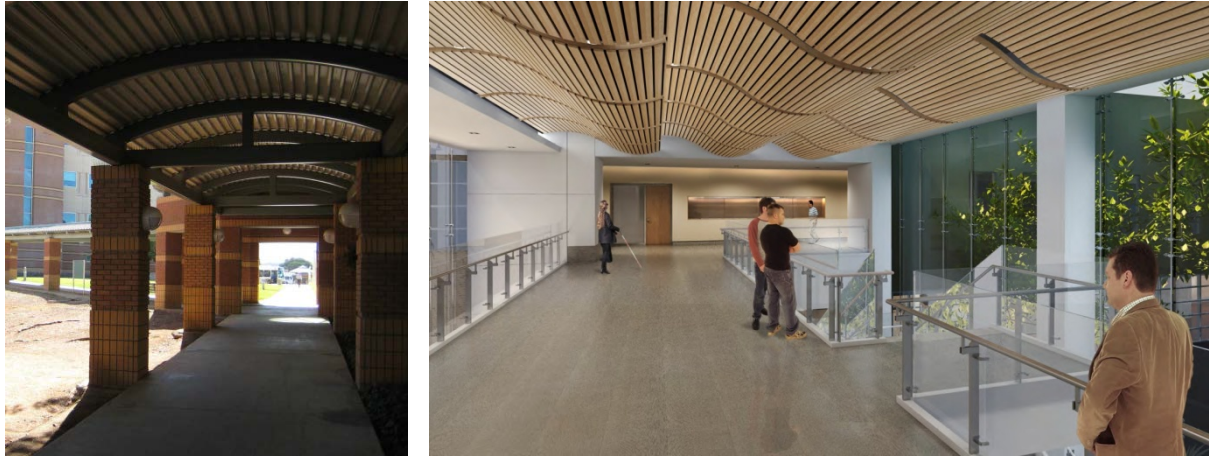


Fig. 3 Translation of auditory experience (left) to the lobby space in the Polytrauma and Blind Rehab Centre (right)

Downey's bodily experience has taught him more about engaging with the environment as a blind person. By working on the design of the Polytrauma and Blind Rehab Centre, he discovered a lacuna in the building codes when it comes to designing an environment that supports people with a visual impairment. And even if they are taken into account by codes, these mostly address dimensioning of circulation spaces and positioning of building elements to avoid collision. As he says: "Here in the United States we have the American Disabilities Act ... that was largely guided by, mostly physical disabilities. ... What I found is that there hasn't really been a way, a mechanism anticipated by the code available out there to really provide good way-finding ... if you're blind and enter a complex building." (interview Downey 2009) But there also, Downey finds that a more nuanced understanding of multisensory space may contribute to buildings that are safer for and support people with a visual impairment. An important aspect of accessibility for him is way-finding and the use of signage. Although regulations concerning the integration of Braille in signs do exist, the codes do not describe adequately how to find the sign in the first place. Therefore, Downey advocates a larger multisensory specificity and intelligibility. In his experience, many environments are too monotonous when it comes to non-visual cues. The critiques he formulates start from his own bodily experiences and do not contradict the building codes, but certainly do add to them. Limiting protruding objects is a good thing, but for Downey this addresses only one aspect of the way a person relying on a cane uses space: tapping at the level of the floor and assuming a protrusion along a vertical axis of the shapes they perceive there. Adding Braille to signs can be helpful, but only when you can find the signs; these are now often placed in places that are easy to find visually, but not necessarily through touch, or through touch as it is used in traversing the built environment. Instead, Downey proposes a more multisensory diverse space with distinct tactile and acoustic landmarks using for instance different flooring and ceiling materials. As a person new to sight loss, those are qualities of the built environment that he is more attentive to. As an architect he then tries to find out what combinations of materials in what configuration enhance those qualities. As such, this attentiveness gets integrated in his approach to designing architecture. Accessibility for blind people and a multisensory architecture go hand in hand, both informed by Downey's bodily experience.

“Learning to be affected” in becoming blind

When Hull, Pereira or Downey lost their sight, they had to develop new ways of engaging with the environment, other than the very visual way they were used to (as architects). They became aware of other sensory capabilities of their bodies and Pereira and Downey developed them consciously as exciting new tools to learn about the built environment. Using Bruno Latour’s (2004) terms, both are anew “learning to be affected” by their environment, which means in its broadest sense: being “effectuated, moved, put into motion by other entities, human or non-human.” (*ibid.* p. 205) Both recognized that through their altered body, they started perceiving the world in a different way. By opening themselves to their new perceptions, they developed a richer and more nuanced understanding of non-visual qualities of materials, shapes and spaces. Latour has termed such learning of different layers of difference “articulation”. Articulation is not only the ability to speak about differences in a sense of conscious and literary sophistication. More so, it has to do with differences eliciting different behaviour. “An inarticulate subject is someone who whatever the other [human or non-human] says or acts always feels, acts and says the same thing. [...] In contrast, an articulate subject is someone who learns to be affected by others—not by itself. [...] A subject only becomes interesting, deep, profound, worthwhile when it resonates with others, is effected, moved, put into motion by new entities whose differences are registered in new and unexpected ways.” (*ibid.* p. 210) Both Downey and Pereira recognize that becoming blind can be one of such ‘new and unexpected ways’ to learn to be affected by the built environment. Furthermore, as being articulate manifests itself in a person’s behaviour and reactions to others (*in casu* a building, a building element, a specific detail), for Downey and Pereira it becomes apparent in their bodily interactions with the built environment, even more so than in their verbal accounts of this interaction. For instance, as we observed during the visit to the Horta House (see Fig. 2), Pereira is more articulate in the different ways of touching a door handle than he is in describing verbally why this specific handle is so comfortable to touch. Also in the way he makes this knowledge explicit, he relies on talk in concordance with the hands, both of himself and of the other, to explain the different hand positions involved and what qualities to perceive.

Conclusion

Observations of the learning processes of changing bodies (and thus also changing body-world relations) can make explicit both newly acquired *connoisseurship* as well as previously acquired expertise, the latter in its failing. When Hull, Pereira or Downey explain the process of becoming blind as a learning process, they are describing how they build a new sensory *connoisseurship*, how they learn to distinguish different qualities in their environment. On the other hand, because of the changes in their body, Pereira and Downey also describe an apparent visual bias in architecture and in the design tools used by architects. In trying to overcome this bias, they also recognize how parts of their previously acquired expertise fails in the act. As their body changed, they became aware of certain embodiment relations they developed in perceiving their environment or in their design practices since these relations became impaired. Gradually they developed new perceptual relations, going through more hermeneutical relations before they got embodied. Since these relations involve more explicit interpretation, they are more easily explained verbally, or through other bodily actions. The hermeneutic relations taking part in the learning process allow to pass on the knowledge and practice involved before it becomes embodied and thus more difficult to pinpoint.

As they make the move to design, their knowledge becomes explicit in a second way: not only as verbal account or bodily activities, but also in the shapes and materiality of their designs. They investigate the space and material configurations of their daily environment in relation to their bodily experiences as designers and translate those in their designs. Their intentions are to instruct people on the sensory richness that can be perceived in their environment. They thus try to make explicit their newly acquired *connoisseurship* through the spaces and building elements they design.

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Ann Heylighen is research professor (associate professor) at the University of Leuven (KU Leuven, Belgium), where she leads the AiDA team, an interdisciplinary team of researchers with a background in architecture/engineering, design, sociology and anthropology. The team studies design processes in architecture and related design domains, and explores how the spatial experience of people of various abilities, ages and perspectives may expand the way in which we understand and design space. Ann studied architecture/engineering at KU Leuven and ETH Zürich (Switzerland). In 2000 she obtained her PhD with a study of design knowledge embedded in design projects. From 2000 until 2006, she was a Postdoctoral Fellow, conducting research at KU Leuven, Harvard University and the University of California - Berkeley, and extending her research focus from design projects to design processes as sources of design knowledge. She has been awarded several fellowships and grants including a PhD and postdoctoral fellowship by the Research Foundation Flanders, and a Starting Grant and ERC Proof-of-Concept Grant by the European Research Council.