Seminar

Stichting Geluid in Zicht
(Foundation Sound in Vision)

Report
20 of October 2010
Building the Sieraad -Amsterdam

Seminar program Sound in Vision October 20, 2010

Wednesday October 20, 2010 10.00 am – 4.30 pm

Building the Sieraad, Postjesweg 1, 1057 DT Amsterdam

09.30 Arrival and registration

10.00 Opening by **Henke Baars**

Henke Baars is president of the Stichting Geluid in Zicht and moderator of the seminar.

10.10 Introduction by **Hannes Wallrafen**

Born in 1951, Hannes Wallrafen has been based in Amsterdam since 1972. After his training at the Rietveld Academy, he worked since 1976 as a professional documentary photographer. An eye illness meant an end to his career as a photographer. Since then, he has changed his focus and he is now creating sound-scapes. He is the initiator of the scale model project, which is executed by the

Stichting Geluid in Zicht.

Short motivation Wallrafen, Baars: when he became blind, he couldn't experience new public buildings anymore, but his curiosity stayed. This is how the idea to make scale models was born. A scale model can be touched, felt and experienced. It seemed to us that the use of audio was essential to make the experience complete through a second sense. We started to build, fold and explore. But suddenly, we realized that too many questions remained unanswered and still cannot be answered. We are convinced that this seminar and the follow-up studies will give us some answers and that eventually, we will be able to build the 'ideal' scale model for blind and visually impaired people.

10.30 **Ans Withagen**

Ans Withagen (MA) is special educationalist at Koninklijke Visio, National Foundation for the Visually Impaired and the Blind. In 2008, she won the Award of the Dutch Association of Health Care Providers for People with Disabilities / VGN (*Gehandicaptenzorgprijs*), for her project *Tactiel Profiel*, which is an instrument used to study and observe tactile functioning of blind children aged between 0 and 16 years. With the cash prize she wrote a book, together with some colleagues, for the parents of blind children, entitled *FanTASTisch, een inspiratiebron voor ouders van blinde kinderen* (fantastic, a source of inspiration for the parents of blind children).

Short information on her lecture: the presentation will go into different forms of touching. Perceiving an object one can hold in his hand, is much easier than perceiving big objects that cannot be grasped, for example, a block of apartments. Several characteristics of touching will be presented, for example, the fact that perception takes place in a sequential way (pieces of information are observed one after another), as opposed to visual perception. This will be placed in the perspective of perception by a blind person. Of course some provoking suggestions will be made which can be used in the debate about the 'ideal' scale model.

10.50 **Reinier Jansen**

Reinier Jansen (M Sc) was trained to be a designer for interaction at the Technical University of Delft, Industrial Design Engineering. One of the tools he developed is the Product Sound Sketching Tool. He does a promotional research on how to convey meaning through feedback sounds, in the section Human Information & Communication Design.

Short information on his lecture: 'Sound gives insight'. In my presentation, I will go into the role of sound in the perception of space, and how people often use sound subconsciously. It is proven that sound can influence (strengthen) tactile perception and that people can make a reasonable estimation of the size of an object by hearing its sound (for example, try to imagine what you hear when a truck or a small car is approaching from behind). One of the problems I will present is the effect of scalability when converting a space to a scale model. To illustrate this: the time you need to cover a distance with your finger in a scale model is different than the time you need to cover this distance in the real building. Do we use the exact sound of the building, of is it more adequate to use illusionary effects? This can only be sonified well, if we can describe the interaction between the user and the scale model and the interaction between a visitor and 'real' space (René van Egmond and Reinier Jansen).

11.10 Coffee break

11.30 **Rob van Lier**

Rob van Lier, PhD, is Associate Professor in Cognitive Psychology and Principal Investigator at the Donders Institute for Brain, Cognition and Behaviour, Radboud University of Nijmegen. He researched the issue of visual illusions in order to understand perception. How does the brain convert rays of light to meaningful images? In the future he will research multimodal perception.

Short information on his lecture: 'perceiving the non-visual'. I'll start with a short explanation of the visual system. Roughly, the brain is divided in two visual information streams. Recognizing objects and navigation are both important functions. In term of recognizing objects, we found that we generally observe much more than what could be expected based on physical stimulus. Often, only a part of an object is visible, for example, because we only see one aspect of the object, or because another object is hiding it partially. Nevertheless, the brain generates a complete interpretation of the object; it fills up the missing parts as it were. Another fact is that we get to know a complex visual space much better if we navigate through it. The sensorial input is linked directly with the position of the body in space. I will explore to what extent these findings apply to non-visual perception and to what extent they are useful for the scale model plan.

11.50 Questions and evaluation of the lectures

12.30 Lunch in the Atrium and visit of the building by

PJ Roggeband and **Hannes Wallrafen.** PJ Roggeband operates on the intersection of drawing, language and theatre. Furthermore he is involved in several forms of ´public art´. He activates places, neighbourhoods or buildings. By linking these places to a story or a history, he brings them to live again. He initiates (urban) expeditions to these unknown locations. As a guide, he presents unexpected approaches and surprising starting points, such as an inspection by night, a scooter expedition or a ramble safari.

After lunch

13.30 Film about the scale model of the Reichstag building in Berlin, with an interview with **Burkhard Lüdtke**

In 2004, Burkhard Lüdtke (designer, musician and professor) designed a scale model for blind visitors of the Reichstag building in Berlin, which was developed and realized with students of the Department of Model Building at the Technical University of Berlin. The model measures 1.50 x 1.50 m.

13.45 **Astrid Kappers**

Prof. Astrid Kappers, PhD, is trained as an experimental physicist at the University of Utrecht. She did a promotional research on automatic speech analysis at the Technical University of Eindhoven at the Institute for Perception Research, IPO, where she took her PhD in 1989. She came back to the University of Utrecht, first as a university teacher, then as a senior lecturer and since 2005 as professor Physics of Man. She is specialized in haptic and visual perception.

Short information on her lecture: what one perceives by touching, often depends on illusions. I will give some examples from my own research. What people perceive as being parallel, is often far from parallel. When blindfolded test subjects are asked to put two sticks parallel to each other, some subjects put them at right angles, having

the impression that they are parallel. A pyramid doesn't feel as big as a ball of the same weight and material: the pyramid feels much bigger. If you lay your hand for a short while (for example, 10 seconds) in a hollow shape, a flat surface feels round afterwards. To put it briefly, what we think we feel, can be something completely different than what we really feel.

14.05 **Bert Steenbergen**

Prof. Bert Steenbergen, PhD, is professor Perception and Action Problems at the Radboud University of Nijmegen. The chair of Perception and Action Problems sees a direct link between science and the practise of visual and physical limitations in relation to learning and behaviour. Steenbergen will contribute to the development and improvement of support and revalidation programmes for blind, visually impaired and motor disabled persons, based in the Behavioural Science Institute (Section Remedial Education: Learning and Development). Bert Steenbergen is Doctor of Cognitive Psychology.

Short information on his lecture: the human memory can be roughly divided in two systems, each of them with its own characteristics: the working memory (or short term memory) and the long term memory. The working memory is used for temporary storage of incoming information and has limited capacity. The long term memory, on the contrary, has a very large capacity and is used for long-lasting storage of information. For the scale model project, the short term memory is the most important. By touching the scale model, blind people visualize the space(s) they will enter. The information they receive is (temporarily) stored in the working memory and then used to navigate in space. The limited capacity of the working memory has important consequences for the information density and content of the scale model(s).

14.25 Tea break

15.00 Develop casus

16.00 Concrete arrangements on follow-up and closure

16.30 Drinks in Café Restaurant Edel

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Rijksgebouwendienst
Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer

Participants of the Seminar Sound in Vision, 20 October, 2010

1	Gerard van Wolferen	HKU	
2	Henk van the Beld	Bartimeus	
3	Marij van den Wildenberg	Bartimeus	
4	Dorine in 't Veld	Bartimeus	
5	Dror Cohen Rapoport		
6	Jan Visser	Centrum Wakan	
7	Tinah Visser	stichting IZA Kassandra	
8	Sanny van der Steen	Koninklijke Visio	
9	Jan Willem van der Raadt	GBOW	
10	Suzanne Mouissie	Visio	
11	Mw. M.Kemper-Buiskool,		
12	Marieke Sonneveld	TU Delft	
13	Anneke Blok Koninklijke Visio	Visio	
14	Tineke Bosselaar	Bartimeus	
15	Willemijn Prins	HKU	
16	Suzanne van den Bercken-Boonacker	View Free	
17	Annelies Buurmeijer	Visio	
18	Marina Langbroek	Visio	
19	Marc Groenewegen	HKU	Teacher informatics for music
20	Trude Obbink	Visio	
21	Wim Pierik	Visio	
22	Hilde Koetsier		Student Radboud University
23	Danielle Arets		Press nb
24	Chrit Wilshaus		Press nb
25	Carlos Apers		academie bouwkunst maastricht
26	Carlijn Blom	Visio	
27	Narda Beunders	academie voor bouwkunst R'dam	Student
28	Anneke Betten	Visio	trainee psychology
29	Mohamed El Asmi	Achmea	General and technical services

30	Koos Ramakers	Achmea	
31	Wim Poot	Achmea	
32	Mariska Langerak	Achmea	
33	Hans van den Ban	Min. VROM	
34	Joost Hartveldt	Bartimeus	Secr. social proj.
35	Marjolein Smit	Bartimeus	
36	Martine des Tombe,	Bart Weggeman	
37	Meike Brendel		clientenbelangamsterdam
38	Guus Braam		clientenbelangamsterdam

1	Marianne Poppenk	Kubes
2	Henke Baars	GIZ
3	Hannes Wallrafen	GIZ
4	Maartje Wildeman	GIZ
5	Bert Steenbergen	Radboud University Nijmegen
6	Astrid Kappers	University Utrecht
7	Rob van Lier	Radboud University Nijmegen
8	Ans Withagen	Visio
9	PJ Roggeband	artist
10	Marjolijn Hessing	Organisation

Report:
* 10.00 Opening by **Henke Baars**, president of the Stichting Geluid in Zicht and moderator of the seminar. Henke Baars welcomes all participants. He expresses the wish that in a few years, the ideal scale model for blind and visually impaired people will be a reality, so they will be able to understand and experience a building, especially the inside. A scale model which unfolds the building and makes it possible to explore its soul and experience it. The objective of Stichting Geluid in Zicht is to develop a scale model on the short term. But he explains that "while we were looking for practical solutions, we were mainly confronted with questions and we found out that lots of research is needed". Henke Baars hopes that the discussion won't concentrate on practical solutions, but will depart from the questions.

* 10.10 Introduction by **Hannes Wallrafen,** sound artist and initiator of the scale model project, which is being carried out by Stichting Geluid in Zicht. Hannes was a documentary photographer. When he became blind, he couldn't experience new public buildings anymore, but his curiosity stayed. That's how the idea to make scale models was born.

Hannes Wallrafen explains his situation: he became blind six years ago. In the room there are no more than five people he knows from the 'visual world', whom he can visualize. He now gets to know people through other senses than the eye: feeling (shaking hands), sound (voice), pace, etc. or by smelling. Hannes says: "Ways of seeing are significant to me, information channels that can create an image".

Hannes Wallrafen is now curious to discover this new world. His experience is that things that are invented in theory for the benefit of blind and visually impaired people, sometimes don't work in practise. This happens for example, because the product or service wasn't tested with blind or visually impaired people, but implemented right away. He tells about an experience he had with a guidance path, which was implemented in public space: the architect didn't want the path to lead directly to the main entrance, so it led to a blank wall.

Hannes Wallrafen explains that the frame of reference of blind and visually impaired people -which gives them their imagination- is important for the creation and use of scale models. The frame of reference of late-blind individuals is probably the visual world to which he/she once belonged. For people blind from birth, the situation is completely different. An idea is created through feeling, sound, etc.
Hannes gives the example of an imaginary acquaintance, Djoeba, who lives near Timbuktu. He gives him the scale model of the Beurs van Berlage. Djoeba can't visualize anything at all, because he doesn't live in a built-up area.
That's why Hannes felt the need to add audio to the tactile aspect of the scale model. He believes these two sensory perceptions should become one and wonders: what happens in my brain when I want to unite two simultaneous experiences?

* 10.30 **Presentation by Ans Withagen (MA).** Ans Withagen (MA) is special educationalist at Koninklijke Visio, National Foundation for the Visually Impaired and the Blind. In 2008, she won the Award of the Dutch Association of Health Care Providers for People with Disabilities / VGN (*Gehandicaptenzorgprijs*), for her project *Tactiel Profiel*, which is an instrument used to study and observe tactile functioning of blind children aged between 0 and 16 years. With the cash prize she wrote a book, together with some colleagues, for the parents of blind children, entitled *FanTASTisch, een inspiratiebron voor ouders van blinde kinderen* (fantastic, a source of inspiration for the parents of blind children).

In her presentation she goes into several forms of feeling. Ans starts her presentation by distributing closed envelopes, containing three-dimensional objects, to the members of the audience. She asks the audience to close their eyes and discover the object in the envelope. Ans asks questions such as: How does it feel, smell, is it a symmetrical object, or not, etc. Through this exercise it becomes clear that people have lots of unconscious information. Information which can be different for each and every visually impaired or blind person. Seeing and late-blind persons are inclined to optical transformation. Ans believes that many people, after receiving the envelope, immediately tried to translate its content, the three-dimensional object, in a visual image.

She then goes on with the question: **how do we build an ideal scale model from the 'perspective of touching'?**

Some principles related to tactile sense
- Tactile sense is a sense of nearness, just like smell and taste.
Tactile information reaches people through:
- Cutaneous sense = perception with the skin (cutis = skin)
- Proprioceptive touch = the deep muscle feeling, built up through information from the muscles, tendons and joint capsules. The information goes through the muscles to the head/brain, so one can tell if something is 'high' of 'low', in terms of the proportions of a scale model or a building.
- Tactile sense is a sequential perception, which means that the pieces of information come in one after another and ask a lot from memory.
- Perception in three dimensions. Casus: when Ans tries to explain to a visually impaired or blind client what a car is, she first uses a toy car and then she lets him or her touch a car on a parking lot (from the car mirrors to the scale/dimension, outside, inside).
As opposed to seeing people, who are mainly geared to two dimensions, visually impaired and blind persons are geared to three dimensions. Seeing people function well with the aid of two-dimensional images and let go of the real three-dimensional situation.

Next subject: **concept development of scale**

Concept development takes place by 'creating an image' based on our surroundings. Several senses give us information about our surroundings. Based on this information, we build so-called 'concepts' and gain insight into the world surrounding us.
Some concepts are difficult to explain. For example, a window and a mirror. They feel the same; they are smooth and cold, but their function is quite different. A blind girl once told me how complicated she found it to learn these things. She also found it strange that one could look through a window and see things that were outside, because a house feels totally closed for a blind person.

Clara Lindes did some research on the function of language in relation to the target group and uses the following classification:
- *Words expressing nearness:* she shows a slide of a scale model of a tower and a house.
- *Words expressing distance*: an apartment building, for example, or a terrace house. Generally it is difficult to explain this concept.
Ans explains that, while teaching, she tries to bring back 'words expressing distance' to a notion that is as near as possible. For a child, this could be his or her own house or bedroom. In handicrafts class, the child can produce little bricks and build its own

house. Through building its own house, many concepts can be communicated to the child.
- *Abstract words:* idea, time, etcetera. Generally these words are not so difficult to explain.

Subject: **goal of the scale model**

As opposed to seeing people, who are mainly geared to two dimensions, visually impaired and blind people are geared to three dimensions. Seeing people function well using two-dimensional images and let go of the real, three-dimensional situation.

A scale model is a three-dimensional object that gives global information about a building. Based on the global information, we go into further details. In other words: from the global to the details (several touching strategies) and the reference is 'body-centured'.
A scale model gives an overview and insight into a building, which makes it possible to communicate the 'concept' of this specific building. It is also a way of giving information on objects of interest and the route in a building. By touching the model, a blind person is able to make his own choices, for example, about the room he wants to visit in a building, or what he wants to experience or explore further.

In order to perceive details by touching things, you need more space, for example between lines, beams, etcetera. If not, you can't experience it. Instead of representing something with lines, you can also choose to use surfaces and textures. Researches have shown for example that for blind or visually impaired people, perceiving a bend is much more difficult than for seeing people. While walking, a blind or visually impaired person hardly perceives a faint bend. In these cases a raised-relief map can be the solution, also for orientation.
For a blind person, windows and mirrors feel the same. But the window is transparent. A ceiling can be perceived as a floor. For seeing people this is easy to understand, but if you don't have a concept perception of a building, this is more difficult to imagine.

Questions and dilemmas
- Ans believes that the size of the model should be perceptible at arm's length.
- It is important to ask ourselves how many details and information a scale model should contain. For example, do we add information that (in reality) can't or shouldn't be 'felt'?
- Should a scale model for visually impaired and blind people be a faithful reproduction, like scale models made by architects? Maybe it is important to get a first impression of the whole building by touching the model, and then of the rooms next to each other, instead of on top of each other, in accordance with the sequential perception. The same could be done for the route information.
- The target group of the scale model are blind and visually impaired children and adults. But it is important to realize that there is a difference between persons blind from birth and late-blind individuals.
- Another important question is the **material** which will be used to build such a scale model. Materials are experienced in different ways, from nice to unpleasant. Should the material be sustainable, dependent on the place where the scale model is situated, inside or outside, and the extent to which it can be touched?
- Another question: should the scale model be visually attractive for seeing people? **Colours** can have a function for visually impaired people; this needs attention as well.
- Is it an idea to give visual accents to 'underline' the tactile and audible input, for people who have limited visual possibilities?

- Is it important to take into account how much time there is to touch the model. If there is little time available, the design should be global with less details.

Comments from the audience
Hannes Wallrafen asks if and how it is possible to have one product for all target groups. Based on her experiences with the instrument/product *Tactiel Profiel* of Visio, Ans advises to start from the 'lowest' level, people blind from birth, and add what is necessary for other groups, for example, visual information for visually impaired people.

A gentleman who is visually impaired asks what experiences there have been with visits to Madurodam. A staff member of Visio explains that experiencing a series of scale models at a stretch is very tiring, because people get too much information. In these cases, one-to-one guidance is necessary.

* 10.50 **Presentation by Reinier Jansen, M Sc.** Reinier Jansen is a designer for interaction. He is now a PhD candidate at the Technical University of Delft and examines how to convey meaning through feedback sounds.

Sound gives insight
The goal of this presentation is to use some examples and principles to give insight into:
- How sound can contribute to the scale model project
- What has to be researched in order to apply sound in a useful way

Surroundings & materials
Reinier starts his lecture with some sound-recordings and asks the audience to guess where these sounds were recorded. In other words, what association do people get from each sound. When hearing the sound made by a person walking down stone stairs, the audience perceives the resonance of the steps in the staircase. Both the materials and the space are important.
A person who walks down wooden stairs in a small room, makes a short sound of steps on the stairs and people hear the creaking wood.
Another recording contains sounds that refer to a restaurant, or a canteen, food, forks and knifes, people talking. We can ask ourselves at what time this recording was made, for example, during lunch.

When linking sound and touch, for example, when a person rubs his hands together, it is possible to strengthen the texture by using a higher frequency, which makes the sound of the rubbing rougher. **Sound can help to strengthen a tactile experience!**

He also asks: **what is interaction?**
Ideally someone should, dependent on how he or she wants to experience a scale model, get a corresponding response from the model.

Questions we should ask when using a scale model
- How does someone experience a scale model? Do we have to depart from the individual perspective, as if the person were present in the room and receives all the information in a sequential way? Or do we want the person to get an overview, and how do we create this overview? Maybe the last solution isn't a very useful one.
- Where is the model situated, near the entrance of a public building? And in which building: a museum, the Parliament? How long is the scale model used each time? And how is it used? With one hand, two hands, with or without gloves? Small differences that can have a big impact. We also have to ask ourselves what 'experiencing' means.

- Furthermore it is important to know why a person visits a building; is it for business reasons (wanting to know the way), recreation (a day off)? How long does a person stay?
- And how do blind and visually impaired persons navigate? What do they want to hear? How many details are useful? Which details?
Questions on the scale model project should be answered by interaction with the product, the user(s) and the context. According to Reinier, we need insight into context & interaction, by doing research (observation, asking questions, building something together) and by developing (building interactive prototypes).

Scal(ability), real versus illusion: the perception of sound is sequential, just like touching, and is linked to **acoustics**. Here we see several problems. For example, there is a printer in a building. If you walk past the printer, it gives you another sound experience than 'walking past' a printer in a scale model. In the latter case, the sound experience of the printer is a quick flash. Acoustics can help us to make an estimation of the dimensions and the nature of a room. Counting footsteps can help us to estimate a distance. The problem in the case of a scale model is, once again, that covering a distance with a finger goes quicker than covering it, in reality, on foot. The question is **how to produce a true-to-nature sound,** in the case of a scale model, when someone 'walks past a printer' with his finger. The same happens when we want people to hear the sound of a person climbing stairs. A solution is the use of **auditive illusion:** we share the sound of a few steps, but they have the same effect.

The question remains, **how is sound perceived and how to apply sound in a scale model?** For example, should we fix speakers to a scale model? Earphones or an iPod don't seem to be ideal, because then the room is perceived inside your head, but the idea is to perceive the sound as if you were standing in the room itself. Through **experiments, evaluation, in relation to design & sound & touching**, questions will pop up. Experiences will be the best teacher to help and answer those questions.

Comments from the audience
Hannes Wallrafen remarks that he can estimate distance by counting his footsteps and wonders if this can be translated by moving fingers in a scale model? He also wonders how sound is translated and functions for persons who are blind from birth. Answer: Suzanne M. Van den Bercken, who has only 10 to 12% sight left, works with children who are blind from birth. These children also generate images, not visually, but on a three-dimensional and an emotional level. When ideas of concepts are created, we can describe them in terms such as left, right, long stairway, short stairway. But sound can be misleading too, and lead to misinterpretations. For example, if you hear the sound of three steps, in the case of a scale model, some people might think that in reality the stairs only have three steps.

The frame of reference is important: what do you hear: a subway, but where? Have you ever been there before, were you blind then, or not?

*** Presentation by Rob van Lier**. Rob van Lier PhD, is Associate Professor in Cognitive Psychology and Principal Investigator at the Donders Institute for Brain, Cognition and Behaviour, Radboud University of Nijmegen.

The illusion of perception
Rob van Lier gives us a scientific explanation on the functioning of the brain in relation to the eye and perception.
He explains that there are roughly two visual streams of information. The so-called ventral stream is responsible for what we see: recognition of objects, faces, in other

words, perception. This visual underflow also perceives colours and movements for example.
In a nutshell: What?, in relation to Perception.

The dorsal stream defines the position of the body in a room. It is related to action: we want to move, grasp something, perform actions with one or more objects.
In a nutshell: Where?, in relation to Action.

Measuring the surprise impulse:
Attention and perception are linked; they play a game with each other that eventually results in perception. Rob shows us a trick with playing cards, where the public is cheated while its attention is being diverted. In the example of the cards, perception is sequential instead of parallel.

He also shows a short animation of two pictures: on one of the pictures, a blue box is missing on the boat. If you alternate the pictures quickly, this is hardly noticed, because leaving away the blue box usually doesn't attract attention. Only if the attention is drawn to the place where the box appears and disappears, our attention is attracted to the box. Generally we have the idea that our brain contains a detailed representation of the external world, but this is not the case. Only the part where our attention is coincidentally drawn to, is processed in great detail. This example shows that perception is sequential and driven by attention.

Some slides show us how we perceive a face when it is positioned normally. It becomes clear how difficult it is to perceive details when the same face is shown upside down. At first, it seems that the expression is the same, but after a while it becomes clear that the lady has a distorted mouth and that the picture was manipulated.

Tests haven proven that people interpret quickly, and therefore sometimes perceive things in a subjective way. This means that perception often doesn't match reality. To research this phenomenon, several perception tests were developed, some of which are demonstrated by Rob.

A famous example is: **what do you see, two faces or a vase**? This is a so-called ambiguous picture. Rob uses this example and others to explain how our brain functions and how seeing people unconsciously think in three dimensions, although the picture only has two. But also how we make choices in what we think we see, although this doesn't match the reality of the picture. We make unconscious and very fast choices in what we consider to be the foreground and background of a picture.

Unconsciously our brain completes objects that are partially hidden by other objects. A rectangle which is hidden partially by an object is 'seen' as a rectangle, even if we only see a part of it. These interpretations of objects are often driven by simplicity. For example, it became clear that car drivers didn't recognize the tapering shape of the Schiphol Tunnel, but interpreted it as a rectangle. They got the impression that they were driving too fast and suddenly braked and caused accidents.

Rob also explains how our brain makes decisions based on colour and how the use of colours in relation to perceiving shapes generates other interpretations. **Illusions** play a role in this process.

Scale model: when building a scale model, we have to take into consideration how the **What** and **Where** are processed in the brain.

A test– of Simons and Wang – showed that when a subject is required to match the rotation of a rotating platform or a round table, with objects placed on them, it is easier for him to see if the objects are still in the same position, than when the rotating platform is turned and the subject has to stand still, and – after opening his eyes – has to see if the position of the objects was changed. The conclusion is: if you walk around the table, you bring along your own frame of reference and therefore, it is easier to perceive changes of positions. In a follow-up research, it was established that late-blind individuals benefit from this fact.

Some provisional advice, suggestions and discussion points for the scale model plan

- Take into consideration that interpretations might be ambiguous. Keep it simple, but not too simple, make it exactly complex enough.
- Make it possible to walk around the scale model.
- Make it possible to touch the scale model per floor.
- Facilitate the 'spatial updating', by giving feedback about the position in space while a person is walking. A blind person should know where he/she is in space, in relation to the scale model.
- An idea is to place partial scale models in several locations, in addition to the large scale model situated near the entrance of the building, with a clear indication of its position. Another option is to hand over a raised-relief map of each floor to blind persons, indicating landmarks that correspond to the (partial) scale model.

Comments from the audience

Hannes Wallrafen wonders how a blind person makes interpretations, not through the eye, but through the finger (texture versus shape). Rob answers that lots of research is being done on information streams in tactile perception. The texture and shape are processed through separate channels, comparable with the colour and shape of the visual field. According to some researchers the ventral or 'What' stream in object recognition has quite some overlap with the tactile information stream.

The size of a scale model is another theme of discussion. It is asked to what extent it is important for a blind of visually impaired person to walk around a scale model and/or to be able to touch it from one position at arm's length.

We then talk about the notion of landmarks. Landmarks are situated in the real building. The question is how to describe landmarks (a pillar, an important room, a work of art) and which landmarks can be visited by blind and/or visually impaired people, and how they can they get there. In a scale model a link can be made to the landmarks in a building.

Reinier wonders if changes can take place in a building while developing a scale model; in other words, situate landmarks in the real building

Someone else wonders to what extent it is possible to process symbols in a (raised-relief) map, linked to a key to symbols.

Lunch break: during lunch it is possible to explore the **products/materials for touching,** realized by Suzanna M. Van den Bercken: **'View Free'** and Ans Withagen: **'*Tactiel Profiel*'**, as well as the **scale model** developed and used by the **Stichting Bartiméus** (Joost Hartveld), in combination with an information pen which is linked to a certain point in the scale model and which helps visually impaired and blind people to familiarize with their newly-built house.

After lunch it is possible to participate in **'Stappenplan'**, a stroll with artist **JP Roggeband** (*Elfletterig Genootschap*).

* 13.30uur: movie on the **scale model of the Reichstag building in Berlin** and an interview with **Prof. Burkhard Lüdtke** (designer and musician), recorded and made by Hannes Wallrafen and Henke Baars. The scale model (1.50 x 1.50 m) was designed in 2004 for blind visitors of the Reichstag building, and was developed by Lüdtke, with students of the Department of Model Building of the Technical University in Berlin.
Lüdtke teaches architecture, model building and design development at the University. He builds models that come into existence as an image. Image development is very important to him.

Visual communication
The Reichstag scale model was developed in cooperation with organisations of blind people. The organisations were involved in all phases of development. It was decided to make a model of the complete building. 'We have done research into what aspects are interesting. We have chosen the details that can be perceived because of their size. So dimensions were important. Then we researched what scale we should choose. We researched all options, because we also wanted to know what wouldn't work. We decided to use a scale of 1:100, in principle a normal scale, also for architects. We found many parallels between seeing people and blind people. Blind people found that too many details made the perception impure, it is not possible to perceive all details'.

The choice of the materials
The eagerness to touch is important in Lüdtke's way of thinking, but he wanted to build the scale model for blind and for seeing people. His model must be recognized, because seeing people also want to touch it, although they are a bit shy at first. They are not used to touching things. 'The material (processed synthetic) is a real enrichment and it really can be touched. It is possible to include details, and it is stable. Everything -oblique -sharp -angles, etc. can be shown. This is not possible in bronze. Everything is round, not a real architecture model, so slightly discriminating'.
'For two years we have been experimenting with this material. We have seen that this synthetic mix makes the scale model stronger and warmer, and sometimes, if it is desirable, rougher. It makes it easier to control the process. In the case of the Reichstag, a sandstone building, we have developed the material as if it were sandstone.

The scale
'It is important to add the factor scale. This is difficult in small models. In this case, we used a piece of a ludo game. We used the correct scale, so we made it a bit smaller. By taking the piece in your hand, it is possible to compare'.
'This was a conscious decision. Much was made manually. We had to model a lot. If we had used a computer, the model would have been different. If we had decided to use a 3D plotter and a scanner, the model would have become prohibitive, but that wasn't my intention'.

Position with respect to the scale model
'A blind person has to be able to enclose the scale model. He stands on both legs, in front of the model. In fact, a seeing person does the same. He touches the model, looks for a reference point, and his hands set off on adventure. With his left hand he remains on the point of reference and he looks further with his right hand. He then brings his right hand back to his left hand. Again, there are many parallels with seeing people'.

Test group
'We worked with a test group that consisted only of blind people, there were no visually impaired individuals. This is a problem for the developer, for example, when we talk about contrast, etc. A visually impaired person needs contrast, but contrast is loud. We wanted to produce an aesthetic model. For the visually impaired, contrast is very important. The perception of a blind person is soft rather than strong. They feel in a slow way.
As a developer, I had to compromise and try to combine general functionality and aesthetics. The visually impaired are slightly discriminated against'.

Inside model
'In fact, inside models are opposed to outside models. Outside models are rather abstract, have less details, use one material. An inside model needs more materials to show everything which is inside. Think of a doll's house. But it can become too childish. It is necessary to choose a very consistent form and research should be done into the choice of materials'.

*01.45 pm: **Presentation by Prof. Astrid Kappers, PhD.** Since 2005, Astrid Kappers is professor Physics of Man at the University of Utrecht.

Astrid's presentation makes us realize again that what we think we feel, or the estimates we make, don't necessarily correspond to reality. She explains this using different examples of experiments.

Centuries ago, it was believed that touching was a direct way of perceiving. Visual perception was considered to be more complex and deluding. The idea was that tactile sense, which was nearby, could verify visual perception. This idea was abandoned long ago. Based on experiments, Astrid shows that tactile sense can be deluded too.

One test is related to the measurement of curvature discrimination. A curvature is felt and experienced because of differences in inclination. In the case of a circle, if you feel a little piece of the curvature, the experience is different than feeling half a circle. There is no difference in curvature, but half a circle feels more curved.
At first, the research on curvature discrimination didn't advance, but then enormous after-effects were discovered. For example, if you touch a curvature with your finger during two seconds, this influences your experience when you touch another form. If a test subject lays his hand on a hollow form and after that on a flat surface, the flat surface seems to be round, and the other way round.
This after-effect was still felt and measurable a minute after having touched the first object. The conclusion is that everything you touch influences your next perception. Based on this experiment, the curvature discrimination measurement was developed.

Length influences how curved an object feels. Our hand is long and no so broad. If the curvature is influenced by the length with which you feel it, the prediction is that a ball doesn't feel symmetrically curved. But when you pick up a football, you don't notice this. So knowledge of the world influences you as well. In a lab situation, the result is that the curvature that you feel vertically along your hand, is perceived as more curved than a curvature you feel perpendicular to your hand.

Perception of volumes
The research question is: does form influence the perception of volumes? First, some information on the perception of volumes: which object has the largest volume? Astrid shows a slide with several three-dimensional forms/objects, such as

a cube, a ball and a pyramid. If you place one of those objects on the palm of your hand, you feel the weight. If you place the same object on a stand and fold your hand around the objects, you feel the form, but not the weight. Results show large systematic differences between tests with or without information on weight. For example, a pyramid of 3 cm^3 is perceived the same way as a ball of 5 cm^3 and a cube of 4 cm^3 in terms of volume. In other words, these objects feel as though the volumes were equal.

A final remark of Astrid: what does this mean for the scale model? Answer: not everything will be felt the way it was intended to.

Another test which Astrid explains is the parallelity experiment of Blumenfeld, 1937, which shows that haptic parallel lines are not physically parallel. A blindfolded test subject was asked to place two sticks, held in the left hand and the right hand, parallel to each other on a table. The arms were spread, the distance between the sticks was rather large.
The test shows that subjects are usually convinced that they placed the sticks parallel to each other, but in reality this is often not the case. It also became clear that there is no difference between left-handed and right-handed individuals. It did became clear though that women show larger deviations than men. It is also important to know that the distance between the sticks, and therefore, between the hands, influences the final result. A smaller distance results in less mistakes. The position of the hand is important in all cases. The table is a frame of reference, but the own body, the hand, as well. In tests with three-dimensional objects, the position of the hand (and the body) is also of crucial importance for the final result. This should be observed when using a scale model.

Astrid's message for building a scale model is that not everything is felt the way you want it to be felt. Making a scale model is not impossible, but there are many unexpected things one can stumble across and we will have to learn by doing.

Hannes Wallrafen wonders if you can turn around the parallellity test; for example, if you feel with both hands the (two) parallel walls of a scale model, and if you perceive them as if they were inclined. Astrid: if you know it is a building, the knowledge comes from the seeing world, so you suppose you'll find right angles. Experiences are based on interpretations.

* 02.05 pm. **Presentation by Prof. Bert Steenbergen, PhD.** Bert Steenbergen is professor Perception and Action Problems at the Radboud University of Nijmegen.

Scale models and memory
The representation of space: how does a scale model of a building reaches your brain. People have at least four sources of information, the visual (seeing), the olfactory (smell), the haptic (touch) and the audible (hearing).
Bert gives us some information on the neurological functioning of the brain. The parietal lobe integrates information streams and this results in a correct perception. Nevertheless, errors can occur as well. For example, you are in a hospital, smell a hot dog and believe you are in a snack bar. Bert explains this in further detail:

Building up representation: sources of information
- First of all we collect information, through our smell, touch, etc. We then store it and retrieve it again.

Storing and using information: the memory
- There are three primary memory processes, namely:

‘**Acquisition**’; information is collected by the senses and transformed in neural codes for the brain.
‘**Storage**’; information is stored in the short term memory, the working memory, long term memory (scale model information is most probably stored in the working memory).
‘**Retrieval’**; stored information must be retrieved from the memory in order to be used.

The way we store and use information shows that we have three kinds of memory: the short term memory, the long term memory and the working memory. Information is stored for a few seconds in the short term memory. The long term memory is for permanent storage of information. The working memory stores information for a limited period of time. The storage and use of information is mainly a task of the working memory.

According to **Miller**, the working memory can remember seven items (The magical number seven, plus or minus two: some limits on our capacity for processing information, Psychological Review, 1956). You can remember something temporarily, and use it at the end of the afternoon (useful for shopping lists).

The long term memory is used for example for remembering telephone numbers. People us the chunking method to remember telephone numbers, which means that they use tricks to cluster information. For example, combining numbers, allow for a break between the first and the second cluster, etc. In other words: chunking is a strategy to make efficient use of the working memory by recoding information in meaningful unities.

Storing and using information: the working memory and the long term memory
The storage capacity of the working memory is limited, and the availability of the information is temporary. The representation of the scale model in the working memory will fade away within hours. It is crucial that people are given the possibility to refresh knowledge by taking another look at the scale model or by touching partial scale models that are placed in several locations.
The capacity of the long term memory is unlimited and the availability of information ‘never-ending’.

The working memory model of **Baddely** (1998, Psychological Review) is used most frequently in tests and researches. Bert shows a slide with the following information:
- Central Executive: controls the three subsystems and decides to which information attention will be paid;
- Phonological Loop: storage and manipulation of verbal (phonological) information;
- Visuo-spatial Sketchpad: storage and manipulation of visual and spatial information;
- Episodic Buffer: integration of information from different modalities, components of the working memory and the long term memory.

The comparison of the working memory of blind and seeing people
The findings of several researchers are not unanimous (partly because the tasks, methodologies, etc. were different).
A selection of research results by different researchers:
- Bliss et al., 2004; no difference
- Vecchi et al., 2004; no difference
- Raz et al., 2007; blind people store information in a more **sequential** way
- Swanson & Luxenberg, 2008; no difference (children)
- Koetsier & Withagen (both present at the seminar), in preparation; blind children have a better working memory

‘Blindfold chess’, one possible explanation is that blindfold chess has more to do with **‘mental imagery’** and less with the working memory **(Kulchenko, 2006).** You have to remember your position (32 pieces and 64 fields), be able to evaluate this position and anticipate to possible moves of the opponent.

Questions for science
- How does the working memory work for tactile information?
- Which characteristics has mental imagination based on tactile information; allocentric/egocentric?

Implications for the scale model
- How much information does the scale model have to contain? Is the mental imagery shaped by haptic information, allocentric or egocentric? (Bert believes the Reichstag scale model is nice to see, but it gives too much haptic information).
- What information does the scale model have to contain; is it easier to remember one characteristic rather than the other (chunking)?
- How long does a person stay in the building, updating information from the memory? How long is the information useful?

Recommendations
- Place a simple scale model that gives an overview near the entrance of the building (a spatial map) and place a specific scale model in each room. These partial models refresh the information in the working memory and give information about the room you’re in (spatial information).They are placed near a landmark, so the location of the room can be found on the scale model near the entrance (‘retrieval’).
- Does the scale model have to contain sound?
Hannes Wallrafen wonders how mental imagery is created in people who were blind from birth and people who became blind.
Answer: people who became blind create an image from an egocentric framework. People who were blind from birth create an image from a allocentric framework. For this group of people, it is important to bring along a map with the landmarks.

Remark of Wim Pierik: it is difficult to link the perception of where you are, and the representation of the space. From an egocentric frame of reference it is difficult to imagine yourself in a room. In other words, where do you stand in that room?

Questions from the audience to the speakers’ panel
Recently, former pupils of the Bartiméus school in Zeist have experienced the old school, which was demolished, using a structure scale model, under supervision. It was surprising to see what the ex pupils remembered of the old school and what they now use as a reference to ‘see’ the new school. A successful action.

- Please apply and insert soundscapes, the way we heard in the sound art fragment by Hannes Wallrafen, for example, a creaking door.

- When Princess Laurentien visited an institution, the flower arrangements that are usually placed near the entrance had to be removed, because they were standing in the way, according to the direction. But the flower arrangements usually function as landmarks for blind residents and facilitate their orientation, so they are not standing in the way.

- Dorine in ’t Veld of Bartiméus explains that a museum in Madrid has several scale models of buildings of cultural heritage. If you visit such an exhibition with blind people, their working memory is exhausted after two hours.

She's in touch with an employee of the museum Cité des Sciences la Villette in Paris, where an experiment is taking place, in which a cartoonist is involved and which consists of translating three-dimensional objects in two-dimensional drawings. (Dorine can be reached at: ditveld@bartimeus.nl).
She herself uses raised-relief drawings in education for visually impaired and blind people. The question is how many details you can offer and how big the scale model should be. A scale model is useful to offer a global overview of information. Details can maybe be shown on site (landmarks, rooms, etc.).

- Somebody remarks that the question "what does a blind or visually impaired person want with a scale model?" should be central.

- Another person believes that a scale model only works if many people use it actively. If not, it is seen as an obstacle in the room, it is put in corner, or worse. Maybe it is not wise to develop something exclusively for blind people.

- A participant suggests to build a 'talking' scale model that gives information when it is touched, with an explanation in Braille elsewhere in the building.

- The question remains for which goal, in relation to a room, the scale model is developed. What can you do in this room, what can you touch? It is important to know what the function of the user is, and the function of the building.

- Gerard van Wolferen, Senior Lecturer at Hogeschool voor de Kunsten in Utrecht states that they regularly work together with the Bartiméus Foundation for blind people. The user has to be helped. (After the seminar, Gerard sends and email explaining some details, which is added as an **annex** to this report.)

- Stichting Kubus organises walks in Zutphen. There is a bronze scale model of the city, which for some blind people was a way to get acquainted with the city's design. A raised-relief map wasn't very useful for them.

- It seems that a blind person developed a scale model, which in practice wasn't useful at all.

- A bronze scale model of the Martini Tower didn't prove to be interesting for seeing people, but it was very fascinating for blind people.

- An employee of Bartiméus explains that there are scale models which have proved to be useful, this (practical) knowledge can be used in a follow-up of the scale model project.

- According to Joost Hartveld of Bartiméus, there is professor, Roman Huisman, working at University of Jerusalem, who also made scale models for and with visually impaired and blind people.

- A question which keeps many people busy is the objective of the scale model.

- What exactly do you want to bring across?

- What do you want to feel, experience?

- Does a scale model have to match the three-dimensional reality?

- Does the monumental aspect of a building has to be expressed in a scale model?

- And how is the interaction going to take place, for example, in a museum or in the Muiderslot?

- In some cases it isn't allowed to touch objects, for example, in some museums (including the Muiderslot).

- Or is the goal of such a scale model to understand how to get from A to B? The accessibility of the scale model itself also plays an important role.

- Maybe it is possible to develop a 'report of effects on handicapped people'.

- Bert: build a scale model and test it by experiment.

It is clear that much is still unknown, many questions unanswered, and that further research is necessary, together with professionals and target groups. In brief, experiment!

Annex:

Reaction per email by Gerard van Wolferen:
Hereby I describe my findings. I would like to share them with you as food for follow-up.

I have talked to David Crombie about the possibility to work with students to produce a website for Geluid in Zicht. He is positive and we'll try to get resources to make a generic or portable design, which could be used as well by organisations of blind people. I'll explain this later on.

My remarks about the seminar:

My starting point is that all knowledge and technology of the world are available to us. But the experience of the users is much more important. As Reinier stated, there are several goals, contexts of use and users; this requires flexible applications. Because of the current state of technology, it isn't necessary anymore to develop one and only solution for everybody. It seems more logical to find individual solutions for each and every goal, context and user.

We have to forget about how the scale model looks. It is important to know what kind of information the user needs and the most appropriate way to get that information. It would be tragical if the concept scale model were a prejudice of seeing people, and that non seeing people had to learn how to handle it. Especially the high level of realism of scale models seems to get in the way of their functionality. On the other hand, the concept seems to have advantages in terms of experiencing space and the way spaces are situated in relation to each other (Joost Hartveld). We don't have to abandon the idea that a scale model can be useful, but we have to try and understand everything in its own proportions.

We currently concentrate on touch and hearing. Both subjects can be investigated for decades. But we can shorten that route by experimenting a whole rang of options, together with some users. Options in which touch and sound play a role and, if possible, other senses as well.

First we can formulate some routes that can lead to the final realisation. We can start with a case, for example, a user who has to perform some tasks in the city hall of The Hague. We

can work step by step and develop tools to make it as easy as possible for different users to perform those tasks. Each step will be carefully discussed and evaluated. By applying this model several times, we can approach a generic solution. A solution that makes it possible to adapt elements to different goals, contexts and users. You could think of a solution with menus:

goals - - > contexts - - > users

In each of the three cases, a preference can be given.

The goals can roughly be divided in:

• get information (interact with the information source)
• go somewhere (the shortest, quickest, safest way to the counter)
• experience surroundings (museum, library)
• meet people (reception, course, bar)

Contexts we can distinguish:

• visit a building for the first time?
• is it a one time visit or is it more frequent?
• which tools are already present in the building? (guidance path)

Users

• people who were blind from birth
• people who became blind
• persons with different kinds of visual challenges
• persons with more than just a visual challenge (for example, a limitation of the sense of hearing)

This rough classification gives lots of space to ideas and concepts and also defines the place of those ideas, if they are to be a part of all design criteria.

Another remark on the scale model concept:
Maps give us two kinds of graphical information: absolute information and relative information. Absolute information is about the place where something is situated and relative information describes directions and distances between places on a map. We implicitly believe that we are interested in the absolute representation of information. That is what I meant to say when using the image of the scale model as a prejudice of seeing people. We forget to take into account that relative information can be much more useful for the traveller whose goal is to get from A to B, and that is about distance and directions.

Maybe we think too much in terms of absolute scale models instead of relative scale models. Maybe relative scale models they look strange, but they are not meant for seeing people. Furthermore it might be very interesting for seeing people to see a model that works for people who cannot see; this can be very illuminating.

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