Experiences with collaborative design by constructing metaphoric objects

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1. Context

This chapter describes a number of initial results of the author's PhD study entitled: 'A guide for preparing and facilitating multidisciplinary, collocated design meetings as a means for building design improvement'. This study consists of the following research tasks: studying what a systematic approach to a design meeting means; studying how a design meeting can be prepared and managed; developing working methods that create and share knowledge and developing a design guide.

The design process for a design meeting will be modelled as a collection of related preparatory and design activities, executed by managers, facilitators and designers with the aid of design tools and management plans. The model is based on existing insights and theories of cognitive processes such as perception (verbal, visual and tactile), communication, (creative) thinking, (experiential) learning and (interdisciplinary) collaboration.

This study is part of the Strategic Design research programme process cluster of the Knowledge Center for Building and Systems (KCBS), a joint project conducted by the Netherlands Organisation for Applied Scientific Research (TNO) and Eindhoven University of Technology (TU/e). The center's mission is to improve insight into the underlying principles of integral design processes to decrease investment risks and ensure the sustainability of buildings.

2. Problem

Research shows a growing tendency among customers and end users to expect better fulfilment of their requirements. This means that stakeholders in the building industry are being confronted by custom work in joint project forms and the search for comprehensive solutions to problems. The various specialists will have to work together synergistically to produce an effective response. (AWT 2000; ARTB 2000)

A case study of design sessions showed that designers were more interested in co-ordinating and planning tasks than creating and sharing knowledge (Van Gassel 2002; 2004). In the initial phase of the design process, a lot of aspects had to be considered due to wastage and loss of value during the life cycle of a building project (Rutten and Trum 2000).

Researchers believe that designers who work together effectively produce more knowledge and share more tacit knowledge, and that it is necessary to organise and manage the design process (Friedl 2001). The literature contained indications that working methods that involve different specialist designers who want to learn from one another and practise their new-found knowledge lead to innovative concepts (Quanjel 2003).

3. Research questions

The aim of the PhD study and the problem described in the last paragraphs is a reason to develop a specific working method as a means to helping designers to create and share more knowledge during a design session. The design of this method is based on a survey study of the subjects: collaboration during face-to-face design sessions, knowledge creation and sharing and working methods. A short description will be given in paragraphs four and five.

Paragraph six contains a description of the working method, which is referred to as the Handstorm method. This method was developed by testing it in six design sessions. To gain insight into how the method works, we formulated two research questions.

1. Do the designers get to work with this method?
2. Is the method well designed?

The experiences of the tests are discussed in paragraph ten and conclusions for further research are drawn in paragraph eleven.

4. Collaborative design

One of the first issues in developing a method for collaborative design is to convey an understanding of what the term *collaboration* means. Kvan (2000) distinguishes between the terms collaboration and co-operation. He notes that *co-operation* relates to working together for mutual benefit, while *collaboration* relates to working together to achieve shared goals. The main distinction between the two forms of working together, according to Kvan, is the creative aspect of collaboration (Van Gassel et al 2004).

Participants in collaborative design sessions in a multi-disciplinary team will make their own design thinking transparent and are able to listen with interest and respect to one another. They are willing to learn from one another and realise that this is the only way a good and integrated design result can be achieved. The organisation of the design process is crucial here and had to be organised effectively.

5. Design session and working methods

A design session is a prepared activity executed by a group of designers to work on the design task with the help of a facilitator and design tools. The designers sit at a table or work together remotely. ICT tools are required for the latter situation.

In 'The creative workshop method' Emmitt (2004) distinguishes five types of workshops:

1. (partnering) building effective relationships: teambuilding, common goals, ethics in co-operation, roles and partnering agreement
2. vision: basic product values, knowledge and experience, whole life approach
3. realism: fulfilling project values, design alternatives, project economy
4. criticism: presentation of conceptual design, value reflection
5. design planning: production information, delivery, value engineering
6. planning for execution: process plan to map the various production activities

The research will focus on the 'vision' type of workshop, where the designers sit at a table. This type of workshop required a shared understanding between the designers of the product and process. In his comment on the 'vision' workshop Christoffersen (2004) mentioned the following aspects: frame and process, dreams and visions, value debacle, value base and evaluation of the 'building effective relationships' workshop.

By harnessing people's creativity, Sanders en William (2001) identified several forms of human behaviour: Say (say, think), Do (do, use) and Make (know, feel, dream).
Each level of knowledge (explicit, observable, tacit and latent) requires a carefully chosen technique (interviews, observations and generative sessions, Sleeswijk Visser et al. 2004)
Figure 1 shows the relationships between what people are expressing, what kind of knowledge and what techniques are preferable.

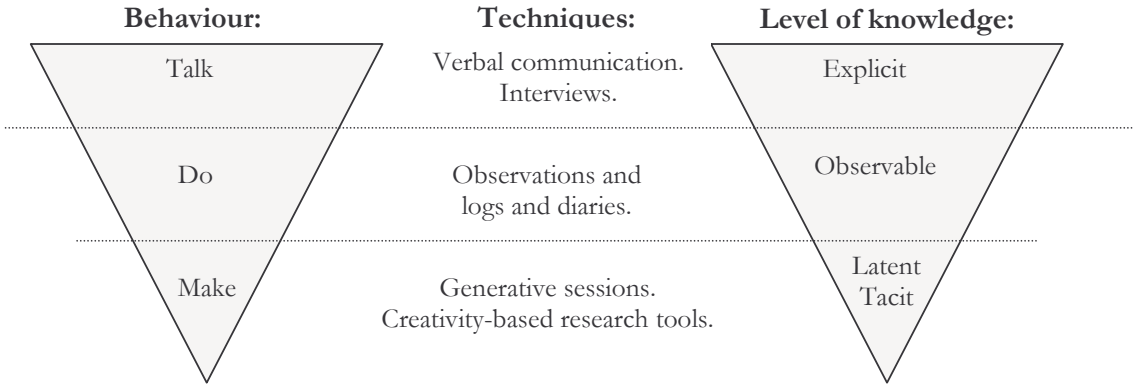

Figure 1 **Different levels of knowledge of experience are accessed by different techniques (adopted from Sanders en William (2001) and Sleeswijk Visser et al. (2004))**

Sanders writes: '*The creativity-based research tools enable creative expression by giving people ambiguous visual stimuli to work with. Being ambiguous, these stimuli can be interpreted in different ways, and can activate different memories and feelings in different people. The visual nature liberates people's creativity from the boundaries of what they can state in words. Together, the ambiguity and the visual nature of these tools allow people much more room for creativity, both in expressing their current experiences and ideas and in generating new ideas*'.

Creativity techniques make tacit knowledge of designers explicit. Root-Bernstein et al. (1999) used a trans-disciplinary view to define creativity: *'Creative thinking in all fields occurs preferably before logic or linguistics come into play, manifesting itself through emotions, intuitions, images and bodily feelings. The resulting ideas can be translated into one or more formal systems of communication such as words, equations, pictures, music or dance only after they are sufficiently developed in their prelogical forms'.*

To express the latent and tacit knowledge of the designers, creative thinking with the aid of creative techniques is useful for a vision-based session. The purpose of a 'vision' design session is to reach an agreement between the different designers about the process and product. This means that the designers create and share knowledge. In educational terms, they learn from one another. A generative or creative technique to help achieve this purpose should be a philosophy called 'serious play'. Serious play is a serious activity to create innovative ideas. Schrage (1999) describes the essentials of serious play as follows: '*Serious play is about improvising with the unanticipated in ways that create new value. Any tools, technologies, techniques or toys that let people improve how they play seriously with uncertainty are guaranteed to improve the quality of innovation. The ability to align those improvements cost-effectively with the needs of customers, clients, and markets dramatically boosts the odds for competitive success'.* John Varney (2005) gives a special meaning to Serious Play, SERIOUS

refers to the left brain (logical, analytical, fragmentary, mechanical, efficient) and PLAY to the right brain (imagination, pattern-forming and recognising, holistic, organic, effective).

Papert (1999) says, '*Constructionism is the idea that knowledge is something you build in your head. Constructionism reminds us that the best way to do that is to build something tangible – outside your head – that is personally meaningful. Further that knowledge is best constructed in a social context where the participants make something sharable'*.

In his inaugural lecture Martens (2005) says that people use two complementary means for communicating ideas, opinions and interactions. *Descriptions* for spoken and written languages and *depictions* for gestures, drawing a picture, images and sketches. The last means is helpful for forming opinions and ideas, where the opinion is not determined by externally agreed interpretation. In our view, it does not stop by drawing pictures, but constructing objects is also a helpful means. It is probably a matter of tactile intelligence or tactile thinking as a counterpart to conceptual thinking.

A long time ago, Donald Schön (1992) told us that '*Design knowledge is knowing-in-action'*. Constructing with materials helps the designer express the knowledge that he cannot say.

The above insights into how to design in a group show us what is important in the development of a working method:

- to use the rational and tacit knowledge of the designers
- to use the left and right brain alternately
- to be willing to learn from one another
- to construct together an object as a reflection of doing and seeing
- to tell stories about the constructed object and
- to give a (metaphoric) significance to the object

6. The Handstorm method

The points summed up in the previous paragraph are the basics for further development. The Handstorm method is part of a design session plan with the following steps:

1. to imagine oneself in the problem, to get a feel for the problem
2. to formulate the design task
3. to generate new visions by constructing a metaphoric object
4. to formulate an answer to the design task

Step three, the construction phase, comprises the following activities:

- to construct a metaphoric object with special materials *together*
- to explain what you are doing and to give meaning to the objects
- to listen to the meaning of the other designers
- to present the meaning of the object to one another
- to describe the meanings

The activities 'constructing an object and telling a story about it' are an attempt to inspire and stimulate the designers to work in a rational and emotional way. The opportunity to get innovative and share solutions should be greater. (Bijl 2002)

In step four, the designers had to translate the meaning of the constructed object into an answer to the design question; the imagination will transfer into reality. We call this step the resociating phase.

In this method, the designers first combine to construct an object with specific materials. We have chosen to construct objects because it is an activity that the designers can do together, at the same time, on one object. We experimented with three kinds of materials:

- materials with a very specific meaning, such as puppets, cars, trees and animals
- voluminous and meaningful material normally used in architectural prototypes
- materials from the GEOMAG construction system, consisting of short and long magnetic rods, steel spheres and plates. (www.geomag.com)

7. Testing the method

Tests have been carried out on the Handstorm method in order to check whether it works. We describe the last design session in more detail. In this session, five students of our faculty participated as designers and a lecturer facilitated it.

The facilitator explained the problem: the reception area in the faculty building had the following problems: bad climate, the view of the entrance is bad, too much draught, little privacy for the receptionist, not enough storage room/storage space. By asking for more details on the problems, the students got more of a feeling about it.

In this session, we chose the 'Key Words Technique' for defining and refining the problem in question. In this technique, the basic structure of the question is: 'in what way might *somebody* do *something* with/to/for/about *something*?' (Daupert 2004). In a writing brainstorming session, alternative words were generated for somebody, something and something. This led to a number of possible questions (see Figure 2).

Figure 2 **Formulation of the design task.**

After structuring and discussing these questions, a design task was formulated as follows: *Design an ergonomic reception area for the receptionist.* With the help of the GEOMAG materials, the students combined to construct an object that represented a metaphoric solution to the design task (see Figure 3). One of the students presented the object to the other students and the facilitator. During this presentation, the students also took notes of some interesting ideas (see Figure 4). In the last part of the session, the students described the requirements for a reception area which will not have the problems described above.

Figure 3 **Constructing a metaphoric object together.**

Figure 4 **Presentation of the constructed object and noting the ideas.**

8. Method for answering the research questions

The following method is used to answer the research questions. Every session is documented by keeping a diary, gathering the design questions, describing the materials and design results and taking pictures of the designed metaphoric objects. To understand opinion of the students, we let them fill in a questionnaire with the following questions after each session:

- Did they like to design in a group?
- Is it easy and attractive to construct an object?
- Did designing in a group give more results?
- Did the students learn from one another?
- Is it easy to formulate an answer to the design task?
- Are the designers satisfied with the result?
- Did it take a lot of energy to participate in the session?

We made a video of the constructing and resociating phase of the last session.

9. Answers to research questions

About 50 students participated in five sessions. They all filled in the questionnaire. See Table 1 for the results.

Table 1 **Results of the questionnaire**

Question - Statement	**N**	**Scores on a scale of 1 to 5. Scores in %**					**Average**
		1	2	3	4	5	
Did you like designing in a group?	48	0	1	1	15	31	4.6
		0	2	2	31	65	
Did you find it easy to construct the object?	25	0	0	9	10	6	3.9
		0	0	36	40	24	
Did it appeal to you?	14	1	0	3	5	5	3.9
		7	0	21	36	36	
Designing in a group gives more results.	48	5	5	11	12	15	3.6
		10	10	23	25	31	
Did you learn from one another?	28	0	3	6	7	12	4
		0	11	21	25	43	
Developing an answer to the design task was difficult.	29	2	13	5	8	1	2.8
		7	45	17	28	3	
Were you satisfied with the design result?	48	5	12	12	9	10	3.1
		5	12	12	9	10	
Did you have the energy to concentrate during the session?	30	2	2	3	12	11	3.9
		7	7	10	40	37	

By observing the constructed objects during the design sessions, we also came to the conclusion that materials with too much meaning did not generate many innovative ideas during the session. The video observation showed that ideas generated during construction were not mentioned in the resocation phase, and the students did not have the energy to formulate concrete answers to the design task.

10. Discussion

The students were interested in participating in this kind of design meeting: they like it, find it easy and attractive and they learn from one another. 'Developing an answer to the design task was difficult' is a question that scored 2.8, the lowest of all. The students were also not really satisfied with the design results, which scored 3.1.

Observations told us that a lot of ideas were generated during the construction of the metaphoric object, but during the resociation process, not many of these ideas were transferred to an answer to the design task. An idea, which should improve this resociating process in coming sessions, is to record the construction phase on video and show it to the designers to capture the ideas that were discussed and probably get more results.

All the students enjoyed designing in a group. Most of them found it attractive to construct an object, but it was not easy to present the object and to formulate answers to the design task. The group did not really feel satisfied about the results.

11. Conclusions

The two research questions for these experiments were: will the designers work with this method and is the method well designed?
The method used in the observed sessions works to a certain extent. To get the designers more involved in the resociating process, the activities for step three should now be as follows, where the first four activities will be recorded on video.

- to combine to construct a metaphoric object with special materials
- to explain what you are doing and to give a meaning to the objects
- to listen to the opinion of the other designers
- to present the meaning of the object to one another
- to *watch the video* and then describe the meanings

The method will work better if the materials have no meaning, the materials from the GEOMAG construction system are suitable and will stimulate metaphoric meanings.

The coming research will entail providing answers to the following questions: does the answer to the design question give enough content to start the next step in the design process (fulfilling project values, design alternatives and project economy, the Realism workshop according to Emmitt)? and how to measure the extent to which the designers create and share more knowledge with this method in comparison to a traditional working method such as brain-writing, for example.

12. References

ARTB, (2000). *Quick Scan, Bouwprocesinnovatie.*

AWT, *Bouwen op kennis*, (2000). Rapportage verkenningscommissie Bouw AWT.

Bijl, Jolande, (2002) *Vertellen werkt.Pearson Education.*

Christoffersen, Anders Kirk, (2004). *Presentation workshop Lean Construction.* Danish Technical Institute, Kobenhagen.

Daupert, D. The Osborn-Parnes, (2004). *Creative Problem Solving Process manual.* www.ideastream.com

Emmitt, Stephen, Dag Sander, Anders Kirk Christoffersen, (2004). *Implementing value through lean design management.* Proceeding IGLC2004, Kobenhagen.
www.iglc2004.dk

Friedl, Gebhart, (2001). *Modelering van het ontwerpproces, een proceschereografie.* ADMS publicatie 15, TU/e.

Gassel, Frans, van, (2002). *Experiences with the design and production of an Industrial, Flexible and Demountable (IFD) Building System*, ISARC 2002, p 167-172, NIST SP 989, Washington, USA..

Gassel, F.J.M., van, (2004). *Research results of the Industrial, Flexible and Demountable Building System project, IFD Today*, Research report Technische Universiteit Eindhoven.

Van Gassel, F.J.M., J.P. van Leeuwen and A.F.H.J. den Otter (2004) *Experiences with a Course on Collaborative Design on Distance*. Proceedings ISARC2004, Jeju Island, Korea. Editors: Moon-Young Cho, Sang-Rok Oh and Young-Jo Cho.

Kvan, T. (2000). Collaborative design: what is it? *Automation in Construction*, **9**(4) 400-415.

Martens, Jean-Bernard, (2005) *Visual interaction: between vision and actio*n. Inaugural lecture at the Technische Universiteit Eindhoven.

Papert, S., (1990). *A critique of technocentrism in thinking about the school of the future*. MIT Epistemology and Learning Memo No. 2 Cambridge Massachusetts Institute of Technology Media Laboratory.

Quanjel, E. (2003). *Eindrapportage Onderzoek Integraal Ontwerpen*.

Rutten, P.G.S and H.M.G.J. Trum, (2000). *On the Innovation of Buildings*. Technische Universiteit Eindhoven.

Root-Bernstein, R. and Root-Bernstein, M., (1999). *Sparks of Genius: the 13 Thinking Tools of the world's Most Creative people.* (Houghton-Mifflin, New York).

Sanders, E.B.-N, C.T. William, (2001). *Harnessing People's Creativity: Ideation and Expression through Visual Communication. In Focus Groups: Supporting Effective Product development*. Langford J. and MCDonagh - Philip D. (Eds) Taylor and Francis.

Schrage, Michael, (1999). *Serious Play: how the world's best companies simulate to innovate*., Harvard Business School Press.

Schön, Donald, Designing as reflective Conversation with the Materials of a Design Situation. *Research in Engineering Design* (1992) 3:131-147.

Sleeswijk Visser, Froukje, Pieter Jan Stappers, Remko van der Lugt, Elizabeth B.-N. Sanders. (2004). *Context mapping: a hands-on introduction*, TU Delft. Handout Workshop.

Varney, John. Strategy Is Serious Play in *Business Executive*. Spring 2005.