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# INCLUDING SKETCHING IN DESIGN IDEA GENERATION MEETINGS

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## 1. Introduction

Idea generation techniques, like brainstorming, are commonly applied by designers for generating ideas. In the existing body of these idea generation techniques, the primary mode of expressing ideas is in written language. Usually, brief descriptions of ideas are listed on a flipchart. In contrast, when involved in unstructured design meetings, designers tend to make extensive use of sketching when generating design ideas. Design researchers have often connected this activity of sketching to creativity in design (for a review, see Purcell & Gero, 1998}.

As both sketching and idea generation techniques are regarded to be tools for stimulating creativity in design, perhaps combining them can provide an even better tool. The objective of this study is to explore whether various ways of introducing sketching into the brainstorming technique do actually enhance the brainstorming process within a product design context.

## 2. Experiment design

This exploratory study consisted of a series of four experimental creative problem-solving meetings. The meetings were held in the same location and guided by the researcher, who is an experienced creative problem solving facilitator. Each meeting consisted of four designers. These were fourth or fifth year product design students who were involved in a course in facilitating creative problem solving meetings. The meetings were recorded on videotapes, which were then transcribed into protocols. Following creative problem solving methodology, ideas were recorded on flipcharts that were then posted on the wall.

For two of the techniques, the designers sketched their own ideas. For this purpose, each designer had been assigned a specific marker color and a set of pre-numbered sheets of paper. These sheets were pasted onto the flipcharts by the facilitator to make them available to the group. After each meeting the process was discussed with the designers.

For this experiment we opted for using the same design task as used by Dorst [1997}. The designers were asked to generate ideas for a new litter disposal system for a new Dutch railway carriage. To make this assignment suitable for application in creative problem solving meetings, we limited the amount of background information available to the group members and streamlined the assignment itself into a brief problem statement: "How to make a new litter disposal system for Dutch railway trains?"

In the meetings, graphic alternatives to the brainstorming technique were introduced. The effects of these variations on the amount and types of linking between ideas were explored. Brief descriptions of the applied tools are provided below:

- *Brainstorming with graphic facilitator.* A graphic facilitator captures the problem solving process in pictures rather than in words, thus providing a 'collective graphic memory' for the designers [McKim, 1972}. The graphic facilitator usually works in cooperation with a process

facilitator. Graphic facilitation is mostly used in organizational change and problem mediation [Ball, 1998}. Application in a creative problem solving context is less common. The graphic facilitator technique can be considered the most literal graphic variation made. The only difference between regular brainstorming and the graphic facilitator technique is that the facilitator makes notations of ideas in sketches instead of written words.

- *Visual brainstorming.* This is an adaptation of the Brainstorming with Post-its tool, in which the participants speak their ideas out loud, and write their ideas down on separate post-it notes in a concise and legible manner. During visual brainstorming, rather than writing them down, the designers make sketches of their ideas on A5 size sheets of paper (or jumbo-sized post-it notes}. When ideas are captured, the designers give the sheets to the facilitator who then pastes them on a flipchart. Visual brainstorming is the closest possible adaptation to the brainstorming technique in which the participants themselves sketch their ideas.
- *Brainstorming with sketches added.* Instead of requiring sketches, here ideas are generated following the regular brainstorming principles. The facilitator writes down ideas on a flip-chart, but the designers are invited to also sketch their ideas on their A5 size sheets, in order to help illustrate and enrich the written ideas. The objective of this technique is to allow for better access to the group's remote memory types
- *Regular brainstorming [Osborn, 1953}.* The divergent step consists entirely of idea generation in words. Group members speak their ideas out loud and the facilitator writes down the ideas on the flip chart.

The idea generation techniques vary both in the person who did the recording: participants, facilitator or both, and in the applied medium of recording: Sketches, written language, or a combination of both. The principal comparisons to be done are between traditional brainstorming and the two fully graphic variations, 'graphic facilitator' and 'visual brainstorming'. The 'brainstorming with added sketches' technique was developed based on the experiences with the fully graphic techniques. It will be of interest to compare this technique to both regular brainstorming and the graphic techniques.

## 3. Method of analysis

The main reason for organising a group meeting is for the group members to interact in their problem solving efforts. This makes the 'building on each other's ideas' guideline for divergent thinking [Osborn, 1953} especially relevant to this research project. Investigating the ways in which the participants build on each other's ideas provides direct process clues regarding the functioning of the techniques applied. Linkography [Goldschmidt, 1996} is a research approach which specifically addresses the ways in which designers build on each other's input. We have adapted this method for application in our research of creative problem solving meetings. In this paper we cannot go into detail regarding the linkography method. For a more elaborate description of the research method used we refer to earlier work [e.g. Van der Lugt 2001}. Here we will limit ourselves to a brief description.

In linkography for each idea direct connections or 'links' with all earlier ideas are determined by gathering and evaluating evidence of such connections. Once the link systems of the meetings are finalised, link indices are calculated. The link indices provide insight into the general characteristics of the meeting process, regardless of the specific qualities of the separate meetings, like the number of participants or the number of ideas generated. The following indices were developed and used:

- The *link density* is an indicator of the integratedness of the process. A high link density indicates that ideas have many connections with earlier ideas.
- The *self-link index* is the ratio of links that the participants make with their own earlier ideas, in relation to the total number of links made. Together with the link density, the self-link index indicates to what extent the 'building on each other's ideas' guideline is met.
- The *link-type indices (Supplementary, Modification, and Tangential)* indicate the nature of the connections that are made, based on a categorization of the nature of ideas provided by Gryskiewicz [1980]. Tangential links indicate wild leaps into a different direction, modification links indicate direct variations and supplementary links indicate small alterations.

The researcher constructed the link matrices for the three experimental meetings and the control group meeting. For each of the meetings, the relative link indicators were calculated (see table 1).

As this study is purely exploratory in nature, it is useful to include the experiences of the participants when analyzing the functioning of the various graphic variations. The remarks made by the designers provide a rudimentary kind of triangulation that can help strengthen the inferences made through analyzing the link matrices. Interesting issues in the group discussion were identified according to the following procedure. First, the videotapes of the group discussions were transcribed and fragments containing single topics were identified. Each fragment was then provided with a label describing the subject matter of the fragment.

## 4. Discussion of results

**Table 1. Results**

|  | Graphic facilitator | Visual brainstorming | Brainstorming with added sketches | Control group: Regular brainstorming |
|---|---|---|---|---|
| Number of ideas | 33 | 17 | 50 | 46 |
| Number of links | 26 | 14 | 50 | 45 |
| Number of self links | 6 | 5 | 10 | 12 |
| Link Density | 0,79 | 0,82 | 1,00 | 0,98 |
| Self-Link Index | 0,23 | 0,36 | 0,20 | 0,27 |
| Link Type Index: |  |  |  |  |
| S (Supplenentary) | 0,19 | 0,29 | 0,14 | 0,18 |
| M (Modification) | 0,35 | 0,50 | 0,30 | 0,38 |
| T (Tangential) | 0,46 | 0,21 | 0,56 | 0,44 |

Below, the results of each graphic technique are related to the results of the regular brainstorming technique. We also include remarks made by the designers during the group discussion after the meeting, regarding the functioning of the graphic technique applied.

### 4.1 Graphic facilitator

The graphic facilitator technique shares some of the basic characteristics of the regular brainstorming technique. For both techniques, the linking in the link matrix appears to be scattered throughout the matrix. The link type indices of the two meetings are similar, with comparable proportions of supplementary, modification, and tangential linking. The self-link indices of the two techniques are both according to what could be expected in a 'full' group process, which for a group of four members is expected to be around or below the value of 0.25. However, both the number of ideas generated and the link density are substantially lower for the graphic facilitator, compared to regular brainstorming.

In the group discussion an issue came up, related to the graphic facilitator requiring relatively long to make sketches. The first issue dealt with the participants feeling that their flow of ideas was blocked, because they had to wait until the graphic facilitator finished a sketch of an idea. Designer F mentioned: *"I felt it very clearly in the beginning ... this takes too much time, writing is faster."* And designer T made similar remarks: *"I felt it a bit of a struggle…you could not directly shed your ideas. And I also think that things were said that did not end up being drawn ... I was really waiting until [the graphic facilitator] finished drawing and only then could one say new things."*

The second issue also dealt with the fact that it takes longer to make a notation of an idea by means of sketching, in compared to writing. The participants found that, when someone proposed an idea, instead of directly writing down the idea, they would first search the earlier ideas, to check if the idea had come up before. Designer E suggested that this blocked the idea generation process, by introducing some kind of idea screening in the divergent phase: *" I thought it was a nuisance that I was terribly tempted to not let whatever was there [on the flipchart] come up again"*.

A different topic that came up in the group discussion was the need for the graphic facilitator to interpret ideas, in order to be able to represent them by means of sketches. The designers saw this interpretation both negatively and positively. For instance, designer F said, *"…my fingers really started itching .. because I did not intend it [the idea] that way at all."* Designer E thought the

interpretations of the graphic facilitator were conducive to creativity, because they open up new directions: *"I did like the fact that if you go to your own idea, I mean this idea of mine turns into Mr. Clean (see figure 1) ... I mean, that is an entirely different leap, because you have a visual association yourself, you translate that, and it is translated back into a picture again... Then you get other things."*



**Figure 1. The graphic facilitator made this representation of the following remark made by designer F: "I think that you feel very good if you are in a clean space … that is happiness or something"**

Using a graphic facilitator does not appear to help the process. If anything, it obstructs the process. The number of ideas generated is much lower than for brainstorming. The link density is also lower, which means that this technique fails to comply to both the 'strive for quantity' and the 'make connections' guideline.

In the discussion, the graphic facilitator -who, like the participants, was an advanced product design student, but who was a talented sketcher as well- suggested removing the blocking of the process due to the waiting time, while maintaining the graphic representations. He proposed writing ideas down as in regular brainstorming, but to also have someone sketch some of the interesting ideas. That way, the flow of ideas would not be hampered, while visual stimulation through idea sketches would still be provided. The graphic facilitator mentioned: "I know that drawings can work, someone for instance started to generate ideas which involved the feelers of a snail (see figure 2) … And I do not know that if it [the notation on the flipchart] would just say 'snail' that you would also get to that… So maybe it would work to have someone write down ideas like a regular facilitator and that to have someone else drawing pictures…".  This remark lead to the 'brainstorming with added sketches' technique applied, which involved both written language and sketching.



**Figure 2. The graphic facilitator's drawing of designer E's idea of a 'snail 's shell'. The idea relates to carrying your stuff (including your trash) with you**

## 4.2 Visual brainstorming

During the visual brainstorming technique, in which the participants were asked to sketch their ideas before sharing them, the number of ideas generated was extremely low, only 17. The link density is relatively low as well, comparable to the link density found in the graphic facilitator technique. The

self-link index is particularly high, which indicates that the idea generation process has a more individual orientation. Combined, this means that for the visual brainstorming technique also, the 'strive for quantity' and the 'making connections' guidelines are less well met, compared to the regular brainstorming meeting. In addition to this, the tangential link type index is especially low and the supplementary link type index is especially high, which suggests that the idea generation process is more based on small improvements and direct associations, rather than making wild leaps to explore novel directions.

In the group discussion three issues surfaced. The first one dealt with the individual focus of the technique. For instance, designer D mentions: *"Yes, you are very focused on your own drawing... It has been a much more individually oriented meeting, compared to the meetings that we had during the course in creative problem solving".* The second issue related to the designers running out of ideas prematurely. Designer D, again, mentions: *"Your flow of ideas dries out quicker...when you are allowed to shout out your ideas then you have ten options, and if you have to draw then you have three and then you do not know anymore."* The third issue related to the fact that the designers were not able to make novel connections, or wild leaps. Designer A mentions, *"I felt that we were very fixated on the picture in the left upper corner [picture provided on one of the flipcharts, consisting of a sketch in perspective of the lay-out of the seats in the train]...Only after someone suggested that it [the litter] could also be picked up by someone who walks, I all of a sudden thought, well, there is also the conductor..."*

The designers had difficulties in breaking loose from the notion that the litter disposal system should be an element of the seat set-up that could be interchanged with the existing trash bins.

The participants feeling drained after few ideas, combined with both the low link density and the high level of supplementary-type linking in this early idea generation step, suggest that in this meeting, what Goel [1995 calls 'premature crystallization' took place. The designers had problems breaking away from the solution direction of the early ideas generated. Finally, the focus of the participants on their own sketching appeared to disrupt the flow in the brainstorming process.

## 4.3 Brainstorming with added sketches

As both visual techniques appeared to be sub-optimal, we tried out a technique that was meant to allow for a continuous flow of ideas, as in regular brainstorming, but that also included sketches. The underlying assumption was that including sketches could improve the accessibility of the earlier ideas. In the brainstorming with added sketches technique, the participants verbalized their ideas. The facilitator wrote these ideas on a flip chart, as in regular brainstorming. However, the participants were also invited to make sketches of their ideas, if they felt that this would add to their ideas. These sketches were pasted next to the written notation of the ideas on the flip chart.

For the brainstorming with added sketches technique, the number of ideas generated and the link density are comparable to the regular brainstorming technique. The Self-Link Index is especially low, which signifies that the participants make many connections with each other's ideas. The tangential link type index is especially high in meeting C, which means that there is a high level of 'wild leap' type connections made.

The structure of the links in the link matrix shows that most of the links are made close to the diagonal of the matrix, which means that mostly immediate connections are being made. This may be due to the fact that during brainstorming with added sketches, the sketched ideas are brought to the attention of the designers twice. Once by means of a verbal expression and the facilitator writing down the idea, and then again by the designer giving the sketch to the facilitator, which is often accompanied by some further verbal explanation of the idea. This probably directs the focus of the meeting towards the last few ideas mentioned, instead of the group members exploring the full range of earlier ideas as a source for making new connections.

In the group discussion, most remarks regarding this technique were related to the individual focus of sketching. The designers felt that they stepped out of the group process to make a sketch, and when they re-entered the group process it had proceeded, so that the sketched idea sort of lagged behind. Designer M mentioned: *"I noticed that sketching is always slower than talking. When you are talking and then you are sketching and then you are further than..."* Designer I concurs: *"Yes, that is difficult too, when you are sill working on for instance [idea] number two and then we are all of a sudden five*

*ideas ahead"*. Designer L gives special attention to the fact that when sketching, the designers disconnect from the group process: *"Yes, you just miss something when you are sketching"*.

The link indicators for the technique appear favorable, even though the designers had some critical remarks about this technique in the group discussion. However, the technique was primarily intended to enhance building on earlier ideas by providing better access to these earlier ideas. The opposite occurred; most of the linking took place with the last few ideas mentioned.

## 5. Final remarks

In the experimental meetings we explored various ways of including sketching in the brainstorming technique. Taking away the written words used for recording ideas in regular brainstorming and replacing them with sketches, either made by the facilitator, or by the participants, appears to interrupt the brainstorming process. Adding sketching to the brainstorming technique, while maintaining the writing down of ideas by the facilitator does not appear to interrupt the process, but it does substantially alter the linking process.

This research project was initiated with the notion that designers use both brainstorming and sketching to stimulate their creativity, and that combining the two may provide an even better tool for stimulating creativity. Contrary to this assumption, the results of this exploratory experiment suggest that merely replacing the written recording by sketching appears to deteriorate the idea generation process. The processes of idea sketching and of divergent thinking as promoted by brainstorming appear too different to superimpose them. Graphic tools for idea generation need to allow for the qualities of the idea sketching process. This means that there needs to be place for, among other things, an inquisitive type of reflection during idea generation, which Schön & Wiggins [1992 call a *"reflective conversation with the drawing surface"*.

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