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DESIGN BOARDS AS AN ALIGNMENT TOOL FOR CROSS-DISCIPLINARITY IN ENGINEERING

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ABSTRACT
Design boards are communication and ideation tools used by designers in a design process to create shared understanding and creativity either mutually or between designer and client. There are many opinions about how to create Design boards the right way. Therefore, relevant literature will be reviewed with focus on the different types of Design boards, their relation to each other, their content and the basic guidelines of creating them.
At the engineering education in industrial design at Aalborg University Design boards are often used in the project work to align and establish creativity. Even though this is an engineering education and many of the students eventually end up working within the engineering sector, there has been found no examples of practical use of Design boards within this sector. Therefore, a pilot study has been set up in an engineering company to test if Design boards can be used as alignment tools between different departments.
In the reviewed literature three fundamental ground structures of creating Design boards have been discovered. Likewise, an illustration has been created to structure the Design boards in relation to each other and in relation to a design process. In the pilot study it is indicated that there is a higher agreement between the sale/administration department and the development department compared to the before mentioned departments and the workshop. Furthermore, consideration on how Design boards are being taught to the students at Industrial design at Aalborg University will be pointed out and discussed throughout this paper.

Keywords: Mood boards, Design boards, Inspiration boards, visual communication, cross-disciplinarily, Alignment, Likert scale, product development, Design education.

1 INTRODUCTION

Design boards can be used in many parts of a development process as a tool to transmit a certain mind-set, vision or idea between different stakeholders [2, 5, 9, 10, 11]. It is a communication and idea development tool often used within the design sector to establish a common language when sharing views whether it is mutual or with clients [2, 5]. All this combined, makes it a perfect tool to establish a shared understanding and alignment, meaning that everybody involved has the same understanding of the design task and agrees on the procedure.
The basic knowledge used for this paper has been achieved through 5 years of study at the engineering education in industrial design at Aalborg University. At this education Design boards are used to achieve creativity, shared understanding, and alignment in teamwork. The education has an interdisciplinary approach to industrial design, with focus on both the technical and aesthetic details of product development. Due to this placement, in the crossover area between design and engineering, many of the students consider themselves as either technical minded or aesthetical minded, [4] which occasionally will lead to miscommunication. The use of Design boards is one of the first tools taught to the students simply because it is a simple and straightforward tool. It is introduced during the first semesters, after which it is up to each student to expand their knowledge, about Design boards, on their own. There are many opinions about how to create Design boards. At this education it is taught to be a tool mostly consisting of images, but it may also include: material samples, colour samples, drawings and physical objects fixed to a big foam board [2, 9, 10]. Likewise, the students are taught briefly about what kind of information that is meant for the various Design boards. The overall approach on how to construct the Design boards, is with different media that look alike and is seen as a whole [1, 2, 9, 11]. In some cases, the media used by the students vary a lot and are arranged in other

ways. Even though many of the students from this particular education, wind up within the engineering sector, there have been found no examples about practical use of Design boards within this sector.
There are a number of other aspects and opinions on how to create Design boards. Therefore, relevant literature has been reviewed with focus on the Design boards' content and relation to each other. This knowledge has been used to create a figure showing various Design boards in relation to a design process. Furthermore, a Style board and one Mood board, has been created to be tested in a pilot study as alignment tools between different departments in a small engineering company [7].
In the reviewed literature, many types of Design boards have been found. The most well-known type of Design board is a Mood board and therefore, the most literature is concerning this particular type of Design board. Likewise, it is noticed that the term Mood board occasionally is used as a common term for Design boards [1, 10]. Subsequent, the common term for the identified boards, including Mood boards, will be Design boards [9].
The pilot study indicates a higher agreement between the sale/administration department and the development department compared to the before mentioned departments and the workshop.
The following sections in this paper are composed as follows: Section 2 presents an overall description of Design boards, a figure with their relation to each other, content in keywords, and how Mood boards can be used as alignment tools. Section 3 addresses the pilot study and presents the approach to the study. Section 4 presents the results from the pilot study. Section 5 presents a discussion and conclusion concerning the different types of Design boards, how they are being taught at the engineering education in industrial design at Aalborg University and the pilot study. Section 6 reflect on future studies.

2 DESIGN BOARDS

2.1 The general aspects of Design boards

Design boards are tools mostly consisting of images, but may also include: material samples, colour samples, drawings and physical objects fixed to a big foam board [2, 9, 10]. There are many views on how Design boards should be structured. A Design board can either be structured as a collection of images each representing something [6, 11], as a collection of images that look alike and is seen as a whole [1, 2, 9, 11] or as a collection of images with one central image supported by the other images [11]. It is mainly a non-verbal tool, meaning that the media should be self-explanatory, but in some cases people add a few keywords on the Design boards in order to point out the focus [9, 11]. This is the case at the engineering education in industrial design at Aalborg University, where some of the students use keywords on their Design boards to point out the focus in a specific image or material sample.
Design boards are technically easy and simple to create; it does not require any knowledge about computers or design software and can therefore be created by anyone. In some cases, Design boards will even be created by the client [9]. As an example, some types of Design boards are used by wedding planers as a tool for the bride to plan the big day. The bride will then collect images and material samples on a Mood/Style boards to align wedding planner and bride [3].
There are many types of Design boards that contribute to the different stages of a design process. Some of the boards contain abstract media and some boards contain literal media. These different Design boards will sometimes be mixed together and therefore it might be hard to distinguish between the different types of Design boards [1].
In the following sub-section, Figure 1 illustrates some of these Design boards. It gives an example of what type of media different Design boards content their relation to each other and their relation to a design process.

2.2 Design board relations and contents.

After reviewing relevant literature, Figure 1 has been prepared as a result of the initial literature studies [1, 2, 10, 11].

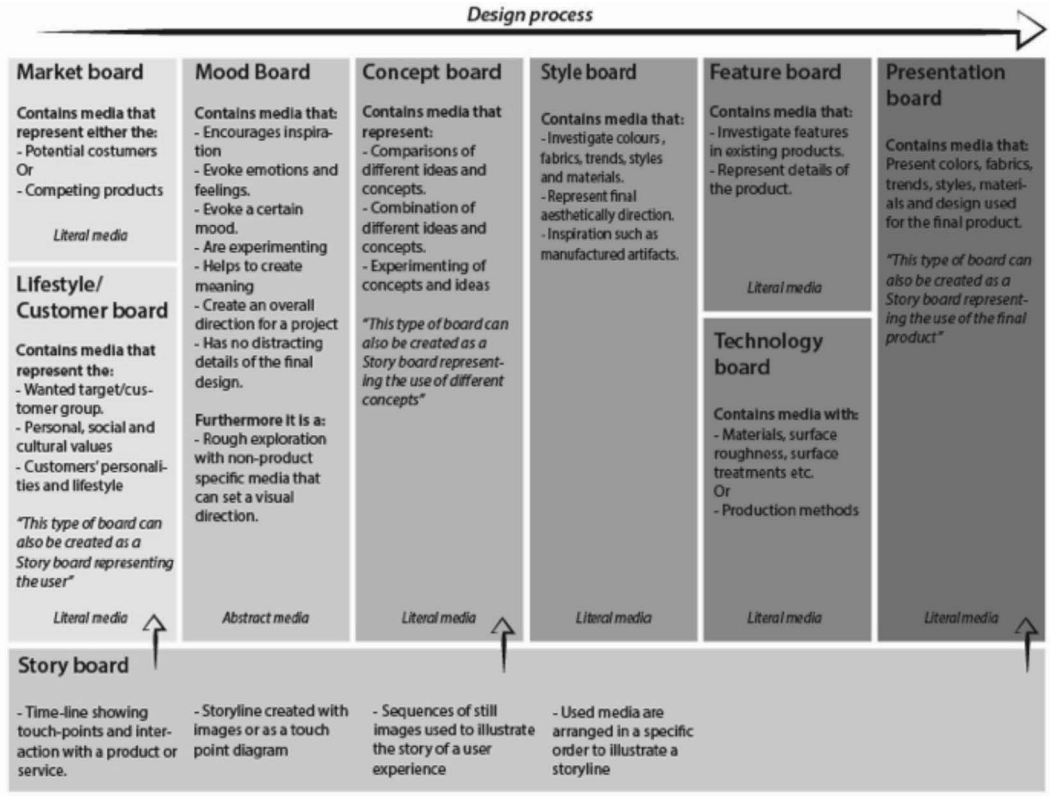

Figure 1. Overview of design boards as a result of the initial literature studies.

2.3 Mood boards as an alignment tools

In a preliminary study, it has been confirmed that Mood boards can be used as alignment tools internally between designers as well as between designer and client. In this study, the author has interviewed both industrial designers and fashion designers [2]. In the aligning process between designer and client, the creation of Mood boards is an ongoing process. They are created in collaboration between designer and client. The client shares undefined and rough ideas for a product or a service. On basis on the subjects discussed, the designer conducts research to define the designer's own understanding of the subjects. This material is presented on Mood boards to align designer and client. At this stage, the Mood boards will function as a non-verbal medium that assists in the transmission of mind-sets and visions. The media used on the Mood boards work as triggers to help express views and ideas. A Mood board, as an alignment tool, can be used with numerous clients, stakeholders and decision-makers [2, 9].

Earlier studies, also suggests that Mood boards can be used to evaluate emotions and is both gender and age neutral [6, 9].

3 THE APPROACH TO STUDY

This pilot study is inspired by a study conducted by Yusuke Yamani, Jason S McCarley, and Deana McDonagh [6]. In their study, they compare the perception of images on a Mood board between two age groups. The participants are 12 young adults with an average age of 19.8 years and 12 elderlies with an average age of 74.8 years. The focus is whether the perception of Mood boards is age-neutral or not. The participants are asked to evaluate the images on the Mood boards individually.

In this pilot study, 20 participants from the same small Danish engineering company [7] was asked to individually evaluate two Design boards by expressing their state of agreement to 21 statements on a Likert scale from 1 to 5 [8]. (1. Strongly disagree, 2. Disagree, 3. Neither agrees nor disagree, 4. Agree, 5. Strongly agree.) The statements are presented in Figure 3.

The participants were from three different departments: nine participants from the sales/administration department, seven participants from the development department and six participants from the workshop. The order in which the Design boards were viewed was: Board 1, Board 2.

An Industrial design student studying at master-level at Aalborg University has created one Style board presented in Figure 2 (to the left) and one Mood board presented in Figure 2 (to the right). Both

Design boards are created as a collection of images that look alike and are meant to be seen as a whole. Afterwards, the data is analysed with the departments of the participants in focus, to investigate whether the departments has the same perception of the Design boards. The tests were conducted in the participants' own offices where they were asked to answer the statements on their own computer shown in Figure 3. The Design boards used in this pilot study contained 12 images, each image had the following dimensions 90*90mm. Each Design board was printed on A3 paper and glued to the cardboard.

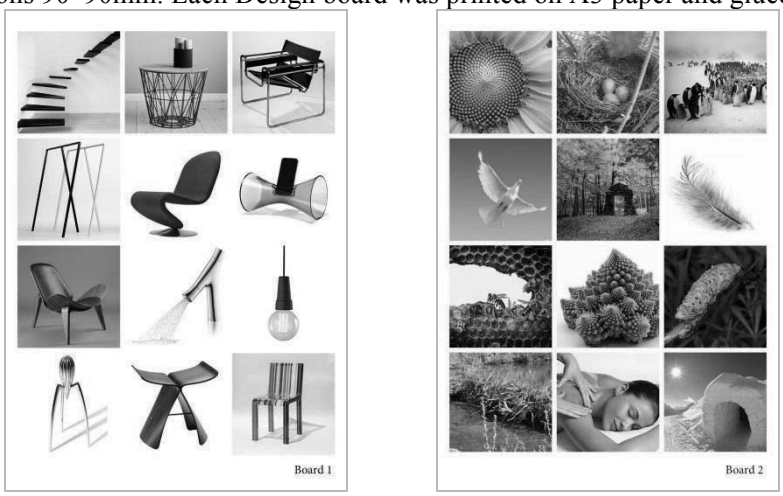

Figure 2. The Design boards used in the pilot study.

1.	The pictures make you feel happy	12.	The images reveal masculinity
2.	The pictures make you feel sad	13.	The images reveal safety
3.	The images reveal quality	14.	The pictures are inviting
4.	The images reveal poor quality	15.	The pictures seem repelling
5.	The images reveal order	16.	The pictures seem familiar
6.	The images reveal disorder	17.	The pictures seem unfamiliar
7.	The images reveal strength	18.	The pictures seem minimalistic
8.	The images reveal weakness	19.	The pictures seem modernistic
9.	The images seem natural	20.	The pictures seem old-fashioned
10.	The images seem unnatural	21.	The pictures seem clinical
11.	The images reveal femininity		

Figure 3. The statements used for this pilot study.

4 RESULTS FROM THE PILOT STUDY

To evaluate the data from the pilot study, the answers given for each Design board, is divided between the three departments. For each statement, the mean value and the standard deviation are calculated. This will indicate the factor of agreement internally in each department and the agreement between the departments.

The data collected with the Style board is illustrated in Figure 4 and the data collected with the Mood board is illustrated in Figure 5. The y-axis represents the factor of agreement, the x-axis represents the answers given from each department and the error bars represent the variation in the answers given. This applies to both Figure 4 and Figure 5.

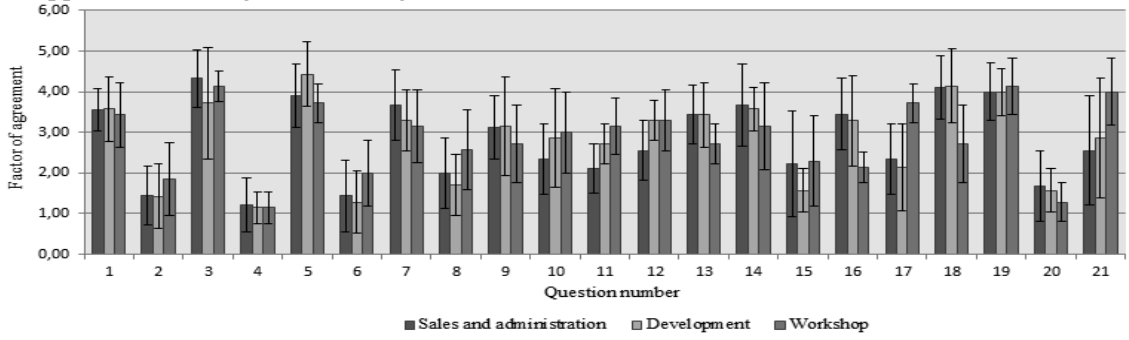

Figure 4. Data collected with the Style board.

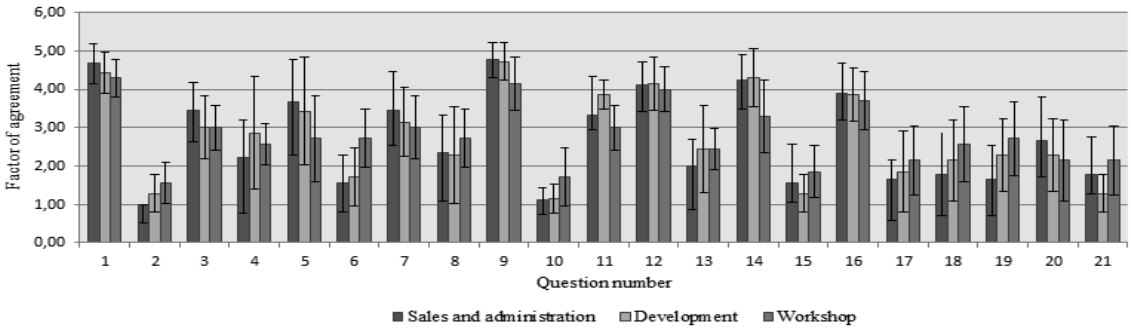

Figure 5. Data collected with the Mood board.

5 DISCUSSION AND CONCLUSION

5.1 Design boards

Some general aspects on how to create Design boards have been found. The fundamental element used on Design boards are images and it is mainly considered a non-verbal tool. Three ground structures for Design boards has been identified. A Design board will either contain a collection of images each representing something [6, 11], a collection of images that look alike and is seen as a whole [1, 2, 9, 11] or a collection of images with one central image supported by the other images [11]. There are many types of Design boards. The Design boards that have been identified in the literature reviewed for this paper are presented in Figure 1. This illustration/tool can be used to select the right type of Design board in relation to the stage in the design process. When the type of Design board has been selected one of the three ground structures needs to be selected. Furthermore, the user also has to decide whether the Design board should only contain images or other media and if keywords should be used on the Design board. If these ground rules have not been settled, it could be compared to playing a board game where the players are playing with different sets of rules.

5.2 Design boards at educational level

At the engineering education in industrial design at Aalborg University, learning about Design boards is an ongoing process throughout the education. The students are taught about the main themes and information meant to be communicated through the different Design boards. The students are only weakly taught about the basic principles of how to structure the media on the Design boards. Therefore, the students might not be aware of what ground structure they are using. This means that when Design boards are placed on a wall to be discussed the students might have different views of the content value and focus. Furthermore, some students use keywords on the Design boards and some do not. This will also affect the content value and focus. Therefore, the guidelines pointed out in the previous sub-section could be of great use for the students, but this will need further investigation.

5.3 Mood boards as an alignment tool

Firstly, the internal perception of the Design boards within the departments has been found by calculating the standard deviation for each statement. The author has afterwards used the following as a guideline: If the standard deviation is 1 or above 1, the disagreement is significantly high for the given statement. Secondly, the mean value given by each department for each statement has been found. The mean values have been compared and the following guideline has been set. If the difference between the mean values is 1 or above 1, there is a significantly high disagreement between the departments. The internal perception of the Design boards in the departments has been found. There are no patterns that indicate a higher internal perception of the Design boards in one of the departments compared to the other. The reason for this could very well be the low amount of participants. A difference between the mean values has been found significantly higher for the following statements: Board 1: 16, 17, 18 and 21, Board 2: 6 and 4. All the disagreements found are between the workshop and the other two departments. This suggests that the highest alignment and shared understanding is found between the sales/administration department and the development department when using Design boards. During this pilot study, it was pointed out by a few participants that some of the statements could be understood in various ways. Therefore, a review of the statements is needed for further work. In this pilot study, the participants have evaluated the Design boards

individually, but usually when using Design boards at the education in industrial design at Aalborg university, they will be evaluated by more people at the same time. This means that instead of calculating a mean value for each department, the participants could in cooperation state answers given for the department. The reason for not letting the departments evaluate each Design board together in this pilot study was to investigate the level of internal alignment within the departments.
In this pilot study, only two types of Design boards have been tested; a Mood board and a Style board. Therefore, it is difficult to state if all types of Design boards can be used as alignment tools.

6 FUTURE WORK

For future work, other types of Design boards could be investigated with the same focus as in this paper. The figure presenting an overview of different Design boards could be tested in an educational context and a more detailed investigation of how the students at Aalborg university are using Design boards in their work could be done.

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