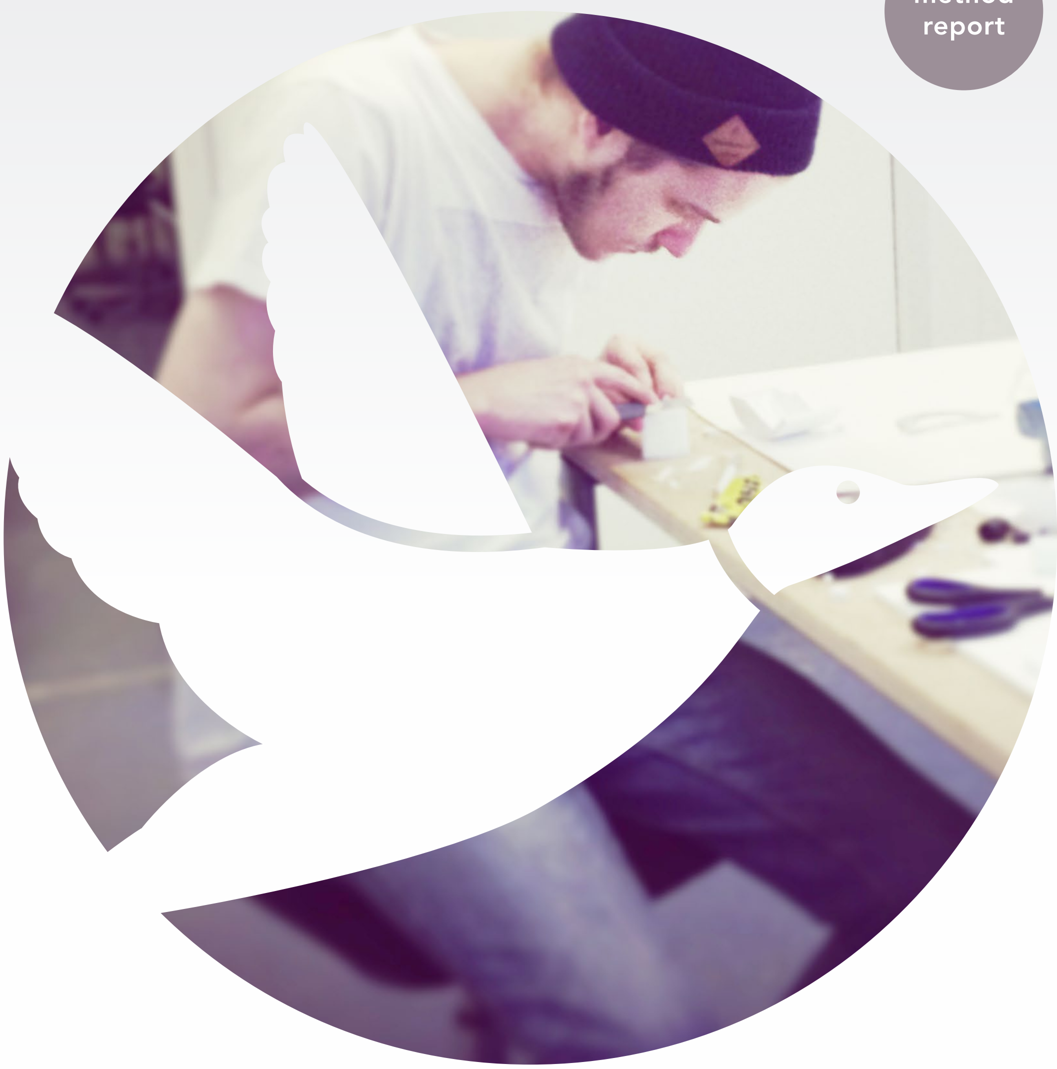
DUCK CHAIR

By Nordic Easy Chair 2013

method
report



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INTRODUCTION

This report will discuss the methods used in the project period. Each method is explained using the following three steps:

Objective

Explanation of why this method is carried out and what the expected outcome is.

Tools/Execution

A description of the tools used and the way the method is executed.

Reflection

A reflection on the method, what was learned compared to what was expected and what could have improved the use of the method.

Each method will be referenced to the Process report, where the use of the method are referenced by page and/or illustration number.

CONTENTS

PROCESS DIAGRAM

Align (P. 8, Ill. 8)

Half way into the project period the design team decides to make a process overview scheme to make sure the next steps in the process were made in plenum. This overview also defines the different chapters that are to be found in the process report.

Objective

The goal with this method is to create a total overview of the process. It is difficult to determine where in the process the group actually is and how much work is still ahead. Its important that everyone in the design team has the same overview of the process and which elements that are connected. This is expected to create an overview of and easily establish a coherence in the choices taken in the process.

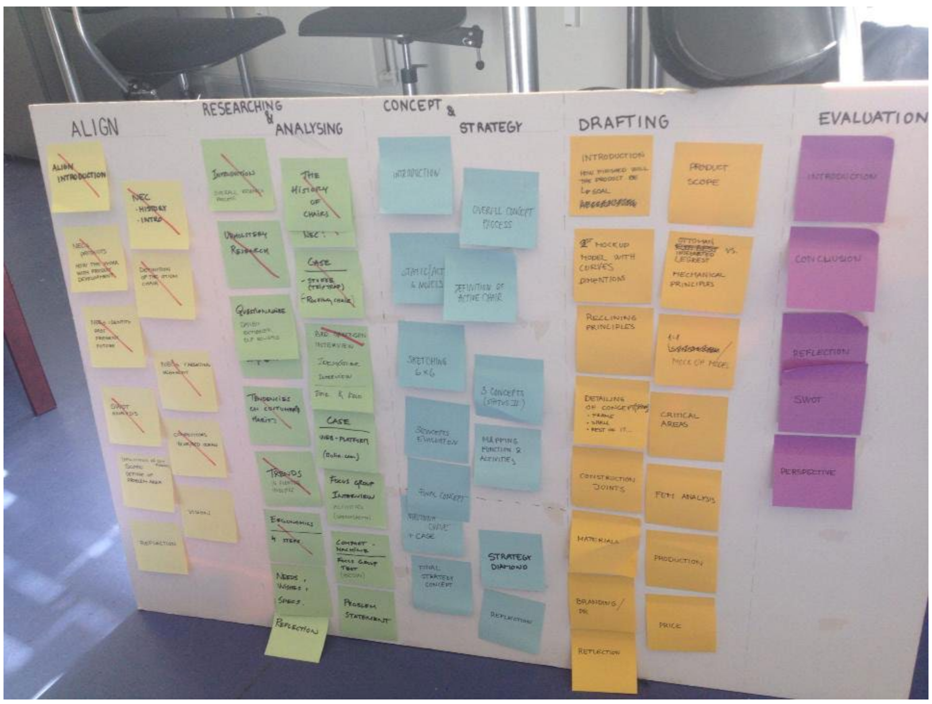
Tools/Execution

The different phases of the project are written on a board. All the areas that have already been researched or are intended in the future work are written down on post-its. The design team then decided in which order the different areas/chapters will be executed. During the process some of the chapters are re-arranged, if the design team believes there is a better fit in a different place.

Reflection

Prior to making the process diagram the design team had used a Gannt Diagram [Appendix 2 Gannt revideret. CD], however it was realized that this was not a beneficial time management tool for the design team. It was revised once or twice a week and not used actively. Instead the team needed a physical presence of the design process and work, where there was possibility for changes in the schedule.

The method is a great way to create an overview over the process. From the point it was created, the design team established a better overview of the design process. It is the primary management tool and is edited several times during the end of the project period to suit to the parallel changes in the design process. It also became the leading tool in organizing of the documentation of the project, so each member can see which tasks are in process and which are done.



Ill. 5
The design process is organized on a board in the studio.

SWOT CURRENT

Align (P. 23)

A SWOT analysis is created to map Nordic Easy Chair's current business.

Objective

This method is used to map where Nordic Easy Chair is now and which strengths and weaknesses they have, while considering the opportunities and threats. It is expected that the design team will map the mutual understanding of the company, based on the presentation from the meetings held in Aars, and by the findings at Stockholm Furniture Fair.

Tools/Execution

During meetings at Nordic Easy Chair, at Stockholm Furniture Fair and through desktop research information have been gathered on Nordic Easy Chair and their market position. This information is condensed in the SWOT format to map how and where their current business can be refined or improved.

Reflection

The method was a fast tool to map the information, that the team had gathered since the start of the project. It is beneficial as it made the design team take a step back and reconsider the findings in the *Align phase* and conclude on Nordic Easy Chair's position.

SWOT FUTURE

Evaluation (P. xx)

A SWOT analysis is created to map the new strategy and concept.

Objective

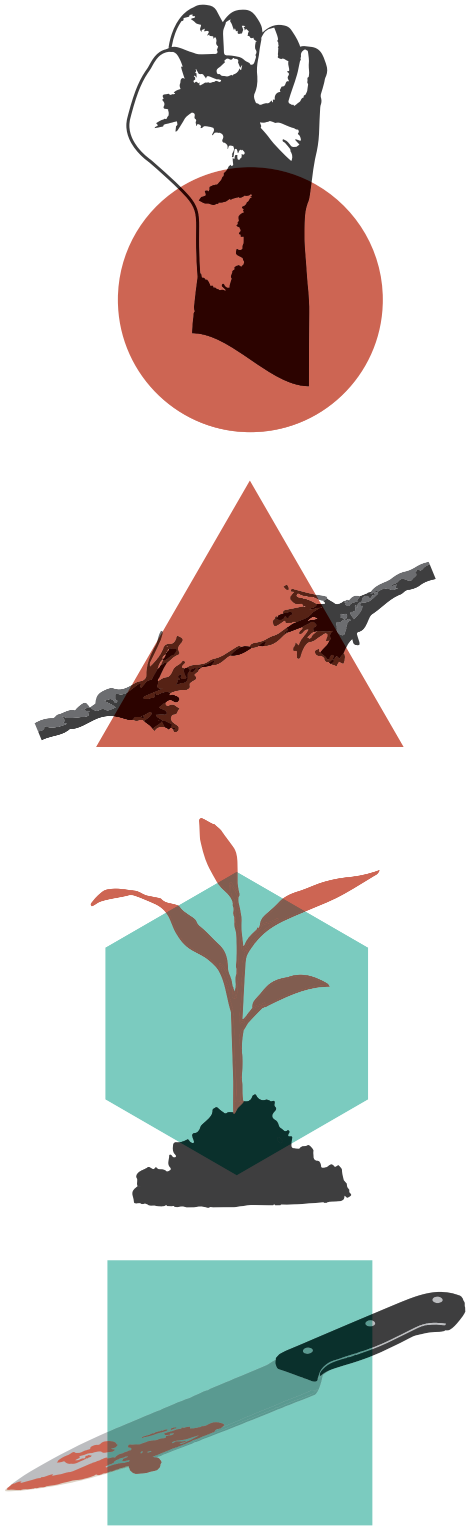
In order to understand the new strategy's weaknesses a SWOT was made on the brand that would consist the Duck chair.

Tools/Execution

The final concept and strategy is being mapped in plenum and put into the SWOT.

Reflection

This was used as a tool to understand what the benefits and weaknesses of the concept and strategy are.



Ill. 7
The SWOT analysis is illustrated by the four icons above representing the four aspects of the analysis.

STOCKHOLM FURNITURE FAIR 2013

Align (P. 15-17, 24-26), Research & Analysing (P. 48-51)

To kick-start the master thesis the design team visits Stockholm Furniture Fair 2013 to observe what Nordic Easy Chair's competitors are showcasing and what the future trends are.

Objective

The goal of the trip is to collect information about Nordic Easy Chairs competitors and find out, which trends could be followed in the furniture industry. The intention of visiting a design fair in the beginning of the project period is to gather inspiration, and to see what the competitors are doing and what should not be done. Furthermore a material research is intended to find out, which new materials can be used in the development.

Tools/Execution

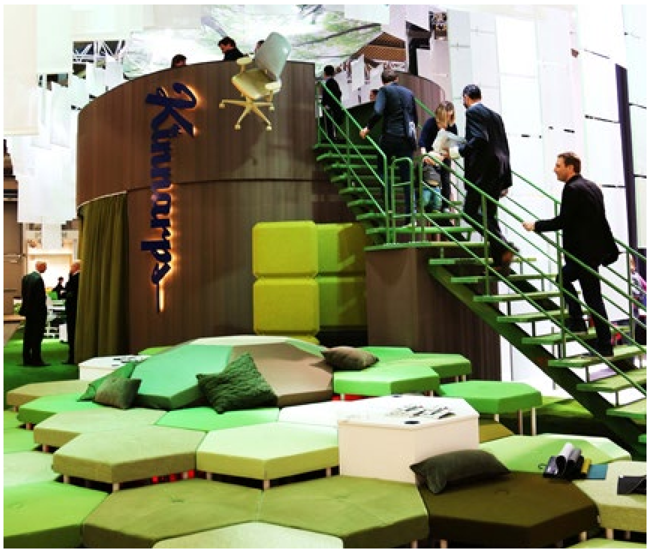
The visit at the fair is over two days. The first day, the design team visits the exhibition stand of Nordic Easy Chair to analyse how they showcase themselves in a trade fair. Furthermore different competitors are visited to analyse the market and to see how a company differentiates themselves from competitors. The second day each team member has a task. These are: research new materials, analyse competitors and new trend. Each member is to collect material on the task and to note or sketch any inspiration.

Reflection

The visit at Stockholm Furniture Fair 2013 gave the design team a great start of the master thesis with a lot of inspiration. The visit meant that the recliner market was mapped faster and more detailed, because the design team knew which companies, that are primary and secondary competitors, based on the field research. Visiting the fair gave the design team a mutual set of references within the competitors and also among the other exhibiting companies, that has been useful throughout the project period. If the Stockholm Furniture Fair had not been visited, the design team would need to spend much time identifying the competitors and what their focus were.

It was found difficult to define trends because of the number of showcasing companies. However trends are afterwards studied in the trade magazine MIX, which showed the future tendencies in the product and furniture industry. The design team could therefore connect this research with the observations at the fair.

Ill. 7 a-e
Pictures from the Stockholm Furniture Fair 2013.
The companies created different universes in their stands.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QUESTIONNAIRE

Research & Analysing (P. 42-44)

The questionnaire is created to obtain knowledge on the purchase frequency and preferences of the segment.

Objective

The questionnaire is created to obtain empiric data on the segment's purchasing criteria, frequency and preferences. The goal is to understand, which criteria they rate the highest when they are buying furniture, and also to find out, which style of chair that they find appealing. This information will be mapped using the lifestyle map from H. Vejlgaaard. This is used to see if new information or design criteria can be established on the results of this survey.

It is used as the first contact with the segment as the team has limited pre-understanding of the segment.

Tools/Execution

The questionnaire is divided into four parts.

First part	Personal information.
Second part	Determines the frequency of replacing furniture.
Third part	Identifies the buying criteria for the new furniture.
Fourth part	Establish the preferred products from an existing range of furniture and the segmentation model.

The questionnaires are handed out at three different furniture stores in Aalborg. This is done to receive responses from people who are looking to buy new furniture, and have made decisions in part two or part three of the questionnaire.

The three stores are:
Gades bolighus that are an existing retailer of NEC and targets an older segment. Idémøbler that has more contemporary furniture and ULF bolighus that carries high-end furniture by i.e. Republic of Fritz Hansen.

The three stores were visited by one member of the design team for two hours on a Wednesday afternoon. The team approached any customers, that was perceived as being in the age group of the segment. They filled in a paper questionnaire and returned it.

Reflection

Having the questionnaire on paper meant that the results were more time consuming to register and extract. Using a website (e.g. Survey monkey) would mean it would be faster to process the data and the results would already be online. Using a survey in store, meant that the design team reach the customers in the store, that were already browsing for furniture.

The last question in the questionnaire was asked to position the segment in Vejlgaard's lifestyle map. The lamps each represent one of the nine sections in the map (Trendy is not chosen as it is a variable factor). The lamps were chosen to be representative of the segment, however the value that the members place in the product, could easily be perceived differently by the reader. This may be the reason why the "simple" lamp received the majority of the votes, as it was easier to relate to than the other extremes, such as bohemian.

It was expected that new and precise information could be extracted from the survey, however the results did not give vital new information. The results need to be cross referenced to find usable data.

Using a focus group later in the design process providing more open-ended questions, would qualify the information that was returned.

VISIT TO BRDR. SØRENSEN

Research & Analysing (P. 45)

Furniture store Brdr. Sørensen is visited to test a variety of quality furniture to find out, which chair feels comfortable and why.

Objective

The goal is to find one or several pieces of furniture that feels comfortable in the height angles, upholstery and use this for the future development of the product that is designed.

Tools/Execution

The method is executed by testing all chairs, sofas and recliners in the store. When a product felt comfortable or uncomfortable it was noted why. All members of the design team tried the comfortable chairs and discussed, if it was pleasant to all members.

Reflection

Five chairs that were defined as comfortable to all members of the design team were noted and the dimensions, angles and upholstery were noted. Surprisingly the team found that a rocking function was pleasant for all members and that it created a soothing experience. Testing the furniture gave guidelines to the angles and heights and widths of chairs.

Secondly the visit provided an insight in the finish of quality furniture that were more high-end than the market that was aimed for the project. It gave the design team a unified reference point of the comfort of the chairs, where the feeling of different chairs could easily be articulated.

Ill. 11.a-c
The design team testing the furniture in the Brdr. Sørensen store. The chairs are (l-r) Wing Chair by Hans J. Wegner, Spokeback Sofa by Børge Mogensen and the Hunting Chair by Hans J. Wegner.

FOCUS GROUP

Researching & Analysing (P. 52-55, 60-61, 63) Drafting (108)

A focus group is established early in the process because the design team find it essential that the chair suits the segment's use of a chair and also their lifestyle. The focus group is established as a selection of 50-65 year old in design team's circle of acquaintances and peripheral acquaintances. The focus group consists of eight people.

Objective

The focus group is established to get insights into the user segment's lifestyle, habits, furniture choices and ergonomics. The team has used the focus group in selected areas of the process depending on the expected outcome of method. The entire focus group is used for the questionnaire, four were used in the discussion panel and two were selected for specific tests.

Tools/Execution

Questionnaire

A questionnaire is sent out to all members to map the use of their spare time activities and the use of their furniture. The questionnaire is used to get an understanding of their daily life. At the same time they were asked to return a picture of them sitting in their furniture, to understand how their living room setting is and how they were sitting in it .

Testing of ergonomics

Two members of different heights are asked to test the mock up model to see if the dimensions of the seat suit both members.

Discussion

The paper "New product development by eliciting user experience and aspirations" explains that a focus group meeting is lead by a facilitator, which guides the team through discussions or exercises. The meeting, is a discussion that is carried out between the members, rather than a set of individual questions for each person. The output is qualitative and will be a personal output, that cannot be seen as a result of the entire population. [Bruseberg and McDonagh-Philip, 2001, 436]

Four members of the focus group were invited for a discussion at the studio in Aalborg. The meeting was divided into 2 sections. The first was an open ended discussion where the four members were asked about their use and cost of furniture. The second half is a session where they are testing the Sorø chair and the mock-up model.

Testing of chairs

Two members visited a furniture store with a design team member and tested a variety of recliner chairs.

FSA

Two members agreed to test different types of upholstery. This method is thoroughly describes in the method report (P. 20).

Reflection

Choosing acquaintances, means that it was quick to set up the focus group, and they were willing to participate in the research.

The focus group started as eight for the questionnaire, where it was halfed to four in the discussion session. The reason only four participated in the discussion was due to the availability of the members. The discussion was facilitated by the team members. A list of questions were prepared for the discussion, however more open-ended questions could have been prepared, to get a deeper insight into the choices of the focus group. There was a warm up phase in the first part of the discussion, where the answers were brief and with less interaction between the members. After approximately 10minutes the members started to have discussions, which gave better and more detailed answers. For future use of a focus group it can be recommended to have a warm up session to loosen up the atmosphere.

Bruseberg and McDonagh (2001) says that the focus group output cannot be used to make general observations, and a series of similar workshops may be set up to understand if there are common findings [Bruseberg and McDonagh-Philip, 2001, 444]. The findings in the testing of the Sorø chair provided the foundation for decisions later in the process. This was a small research foundations, however the design team did not have the time to carry out several focus group interviews. Arranging the interview and analysing the data is a time consuming process, that can only be carried out once to follow the time table.

ETHNOGRAPHIC FIELD RESEARCH

Research & Analysing (P. 54-55)

Different ethnographic field research methods are used during interviews with i.e. The focus group and upholsterer Jette Andersen, A-Polstring.

Objective

Ethnographic field research methods are used to get a pre-understanding or understanding of a new field of research. The design team uses this method where the intended output is received from the interviewee, while the person is explaining or showing how they act in a situation. Using these methods will give structure to the interviews and the design team will get closer to understanding the behaviour of the interviewee.

Tools/Execution

The ethnographer can be describe as "going native" in the understanding people or cultures, however in a design process with short amount of time this type of research cannot be fulfilled. Instead the design team can make "quick and dirty" versions. The methods do not have to be made in a specific order but can be modified to the situation. [Sperschneider and Bagger, 1994]

Five methods from the ethnographic field research from interview of the user to "Apprenticeship", which is the ethnographers "going native":

Situated interview	The user or interviewee is asked different, specific questions.
Simulated use	If an action is not done frequently, the design team can ask the user or interviewed to show how it can be done in a simulated setting.
Acting out	The user or interviewed guide the interviewer through the normal procedure.
Shadowing	The design team will follow the user or interviewee to understand the normal procedure. The shadowing method rarely has prepared questions and the method can include mock-ups.
Apprenticeship	The design team follows the user's or interviewee's footsteps and do some of the procedure themselves to understand how they can be done and improved.

This method is used during the meeting with upholsterer, Jette Andersen, who showed the design team how to upholsterer a chair. The method, "acting out", was used to get a pre-understanding on upholstery and the craftsmanship. Pictures where taken and questions where asked.

The visit by focus group participants is a combination of "situated interview" and "simulated use". The situated interview was carried out as a discussion in the design team's studio, and the simulated use was done to understand, how they interacts with a recline chair. A video is made to afterwards analyse how they actually use the chair.

The design team also visits Idémøbler with two members of the focus group where the method "shadowing" is used to understand their experiences of Nordic Easy Chair's and their competitor's chairs. This visit is documented by photos and questions are asked during the interview.

Reflection

The use of the methods controlled the process and the intended output.

Using the method with the focus group, has created unexpected results, which the design team were able to use in the design process. I.e. Exiting the chair after using a leg rest. It has also been a great tool to get pre-understanding about upholstery, where the design team had little knowledge.

[Sperschneider W. and Bagger K., 2003 Ethnographic Fieldwork Under Industrial Constraints: Toward Design in-Context. International Journal of Human-Computer Interaction, 15 (1), pp. 41-50.]

DESIGN THROUGH MODELLING

Concept & Strategy (P. 70-71, 74-77)

Throughout the project, the design team has been building scale models (1:10, 1:6) to examine form or function.

Objective

The models have been build to test new forms, verify technical principles during the development of the product.

Tools/Execution

During the early stages of concept development modelling has been used as accompany a sketching process. In "Active Passive" the design team would start a sketching session, where selected sketches are chosen to be built in model. The first sets of models consist of cardboard, foam board and foam. These are built in a smaller scale to primarily test functional or conceptual principles.

The second set of models (Bird concepts) are build using polymorphic thermoplastics, textile and the previous materials. They are built in a 1:6 scale to suit the proportions of a model for figure drawing.

Reflection

Accompanying the sketching with model making in the beginning of the design phase, was a great way to start dimensioning and testing the effect of variations of form and size in for instance the base or thickness of cushions. The scale on the first models were 1:10, which meant that the models were small. This was done to test functional principles.

The 1:6 models allowed for more detailing and form-giving. The textile helped illustrate the upholstery type that was chosen for each concept. Using polymorphic thermoplastic meant completely different opportunities in the forming of the models, which led to the exploration of the thin shells for the chair. Not having this material would mean that the design team was limited to the possibilities of cardboard, which may have taken the design in a less curved direction.

Ill. 14.a-c
Three models from the 1:6 modelling workshow.

6X6 WORDS IDEATION

Concept & Strategy (P. 72-73)

This is a method to create furniture concepts that are based on a mix of function and aesthetics.

Objective

Ahead of the ideation, 12 words are found based on function and aesthetics. The functional parameters are based on which activities the focus group carry out in their furniture and the aesthetic parameters are based on trend analysis and aesthetic preferences. The goal of the method is to create new ideas based on functional and aesthetic parameters.

Tools/Execution

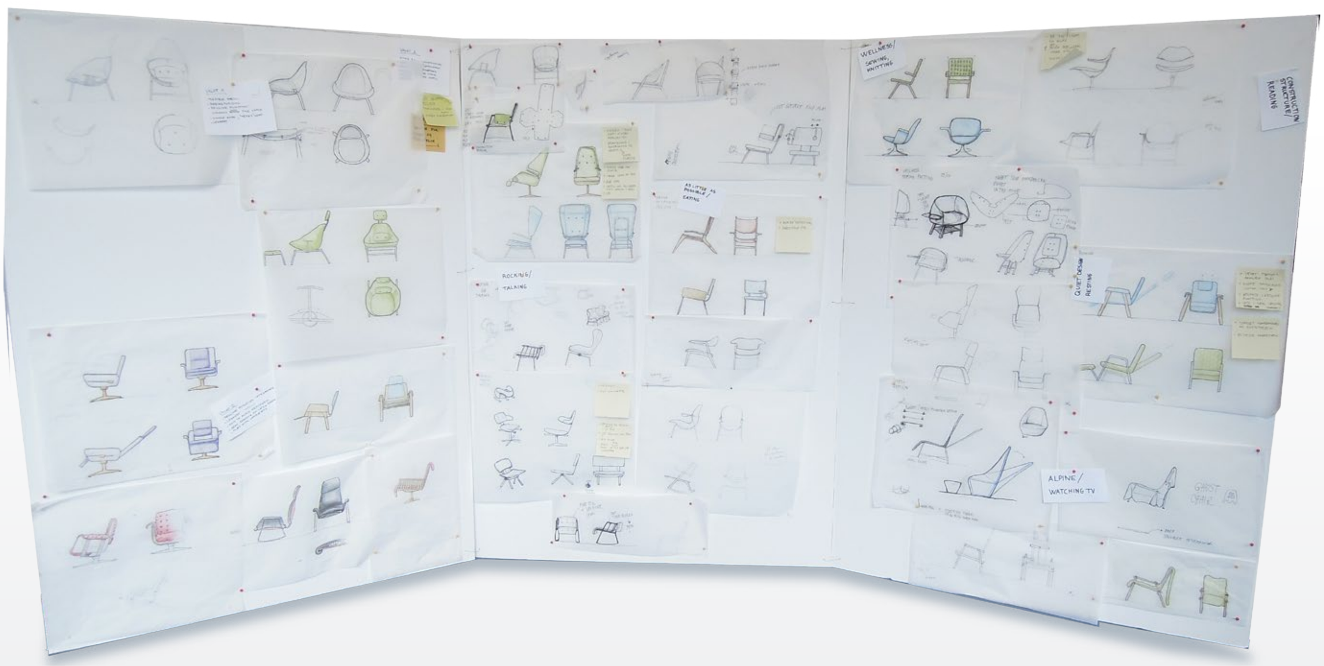
The words are written on a piece of paper and two words are chosen at random from both list. The design team spends a pre-decided amount of time (15 minutes) on each ideation round where the outcome is expected to be concepts based on the juxtaposition of the two words. Afterwards the team members give critic on the concepts and a new ideation round takes place.

Reflection

The outcome of the ideation method was several different ideas based on specific parameters. The concepts were inspired by the sketches from the other team members, where it was possible to see an inspiration from previous sketches. At the same time it allowed the team members to design a chair with a single purpose. I.e. a minimalistic chair for eating.

These sketches form the basis for three concepts, that the design team would explore.

This is a great method for future use because it creates some ideas that may not have been thought of, if those exact parameters were not combined. However the ideation process also has peak levels, which means that in some ideation rounds there are fewer concepts than others. For future ideation this could be divided into two sessions during a day, or there could be fewer rounds to increase the speed of the method.



Ill. 15
The sketches pinned to 3 A0 boards for an overview.

COMPANY MEETINGS

Concept & Strategy (P. 78)

Prior to the project period, and during the project period, the design team has held several meetings with the collaboration partner, Nordic Easy Chair. Multiple meetings are arranged at the NEC domicile in Aars where both CEO Ole Kjærsgaard and sales manager Torben Thodsen Petersen are present. A final meeting with Torben is arranged at the design team's studio in Aalborg.

Objective

Nordic Easy Chair is the collaboration partner and also the design team's client. Their knowledge regarding the market, competitors and strategy is important to the design team in the beginning of the project period, as it gives an insight into a market that the design team has little pre-understanding of. Later in the project period their knowledge of production is utilized in the *Drafting*. Their role as a client means that they are kept up to date on important steps in the project, to avoid that the end result does not match their expectations. The meetings allowed the design team to present the progress while obtaining relevant information for the further process.

Tools/Execution

Meeting 1 - 03/12/2012

This meeting is held before the start of the project. During this meeting Nordic Easy Chair presents their company to the design team and the design team explains their expectations to this collaboration. The meeting includes a tour around the assembly line and an introduction to the company's and values.

Meeting 2 - 03/01/2013

The possible directions for the project are presented during this meeting. Nordic Easy Chair explains that they are open to any direction of the project and suggest several directions, even non-recliner furniture.

Meeting 3 - 27/02/2013

This meeting is the first presentation of the project's process and includes initiating research on users, trends and a vision of a new type of recliner chair. This presentation leads to a discussion on how to create more attractive resting chairs, that obtains a status as design classics. The company and design team established a common vision of a new recline chair, that has references to design classics.

Meeting 4 - 02/04/2013

Three concepts are presented, that answers to the research that was carried out in between Meeting 3 and Meeting 4. The three concepts are discussed and Nordic Easy Chair presents their opinion on the development of the collaboration and also the three concepts. They bring up the novelty value of the chosen concept as being specifically interesting. User experience and production are were discussed. Based on these factors Nordic Easy Chair pointed towards the concept they saw the most potential in, and suggested that it was combined with features from the two other concepts.

Meeting 5 - 02/05/2013

Torben is invited to the studio in Aalborg to see the development of the project. The detailing of the chair is explained. During this meeting the base of the chair and the legs are discussed. He points out that the production costs may be higher for some of the bases and gives the name of some of their sub-suppliers.

Reflection

During the process there were new aspects, where Nordic Easy Chair could contribute with information and guidance. The meetings have been important benchmarks in the design team's calendar as they provided a deadline where presentation material needed to be ready for. Meetings were necessary for the company to follow the progress while it gave an opportunity for the project to align to their expectations.

The company has been extremely open to the design team and it has always been possible to arrange meetings, reach them or collect information. They have entered this collaboration with a eagerness, that has made it easy for the design team to gather information, and discuss the process and development.

STATUS SEMINAR 1

The status seminar is a possibility to present and discuss the project to fellow students and faculty staff. It is on the 4/3/2013 and it is arranged by the semester coordinator.

Objective

The objective with the first status seminar is to present the progress of the process. At this point the *Align* is over and the process in the *Researching & Analysing*. Selected work that has been carried out so far is presented. The team has established a focus group by this point, and expected outcome is to discuss how the focus group can best be utilized.

Tools/Execution

The presentation from the Nordic Easy Chair "Meeting 3" a few days prior is presented along with the feedback from the company.

Reflection

The presentation was a short introduction to the company and the competitors. It showed the trend analysis and the questionnaire research. This was a lot of new information to outsiders, which caused for some follow up questions. The following status seminar needs to be more targeted towards the audience, to get the full benefit of the status seminar.

The feed back was constructive and encouraged the design team to use the focus group more actively in the project as the segment easily available.

STATUS SEMINAR 2

Concept & Strategy (P. 78)

The second status seminar is on the 4/4/2013 and has a similar set up as the first.

Objective

During this status seminar the design team presents the three concepts. The presentation is made from initial research and findings, and elements from the Nordic Easy Chair "Meeting 4" presentation a few days prior. This seminar is expected to give feedback on the concepts and progress so far.

Tools/Execution

The work is presented to the audience. The scale models have been brought to discuss the form and possible combinations. At this point the design team has already chosen the Duck concept, but feedback is requested on all concepts.

Reflection

The tree concepts were discussed with a primary focus on the Duck concept. The audience found this the most interesting and suggested different ways that this chair could be developed.

The decision to choose the Duck concept as the basis for future work was supported by the fact that it was the one that the audience had an opinion on, and suggested ways for further development.

STRATEGY DIAMOND

Concept & Strategy (P. 82 -84)

The strategy diamond is used as a tool to understand, how the chair can be part of a new strategy for Nordic Easy Chair.

Objective

The objective is to understand how the Duck concept ties in with Nordic Easy Chair's strategy and if there is a business potential for NEC in the product. It is used as a tool that will structure the areas, that needs to be addressed and considered when developing the business proposal for the company.

Tools/Execution

The strategy diamond is illustrated on page 83 in the process report. It is divided into five sub-categories, where each is described in the article "Are you sure you have a strategy?" [Hambrick and Fredrickson, 2005]. The strategy diamond is brought into play late in the process, as a tool to define if there is a strategy behind the Duck concept. The meetings with Nordic Easy Chair and the research has made the design team discus what the potential strategy can be. When the Strategy Diamond is brought into play, it is used as a mapping tool to make sure, that there is a potential business in it for Nordic Easy Chair.

The design team used the diamond to map the aspects of the potential strategy that had been discussed throughout the design process.

Reflection

The strategy diamond was not used as a driving tool in the design process. Instead the design team had chosen concept development and market research as a driving factor in the project. Illustrated in the Key Performance Indicator p. 10 in the Process report.

This resulted in a design process where the product has been developed with an openness to alternative design proposals. Nordic Easy Chair has welcomed the radically different design proposals for a recline chair and encouraged the development of new types of recliner chairs. Cf. Three concepts.

If the collaboration with Nordic Easy Chair was arranged as a strategic design collaboration, the design team would have needed to align to the Strategy diamond throughout the process, which could result in a different product for a different target group.

This project delivers a proposal to how this new chair can be marketed successfully. It is a proposal where Nordic Easy Chair and Bolia co-brands, which has not been verified as a possible business opportunity by Bolia.

FROM MOCK-UP TO 3D

Drafting (P. 93)

The mock up is carried into 3D modelling software to be able to detail the product more thoroughly, while optimizing the form.

Objective

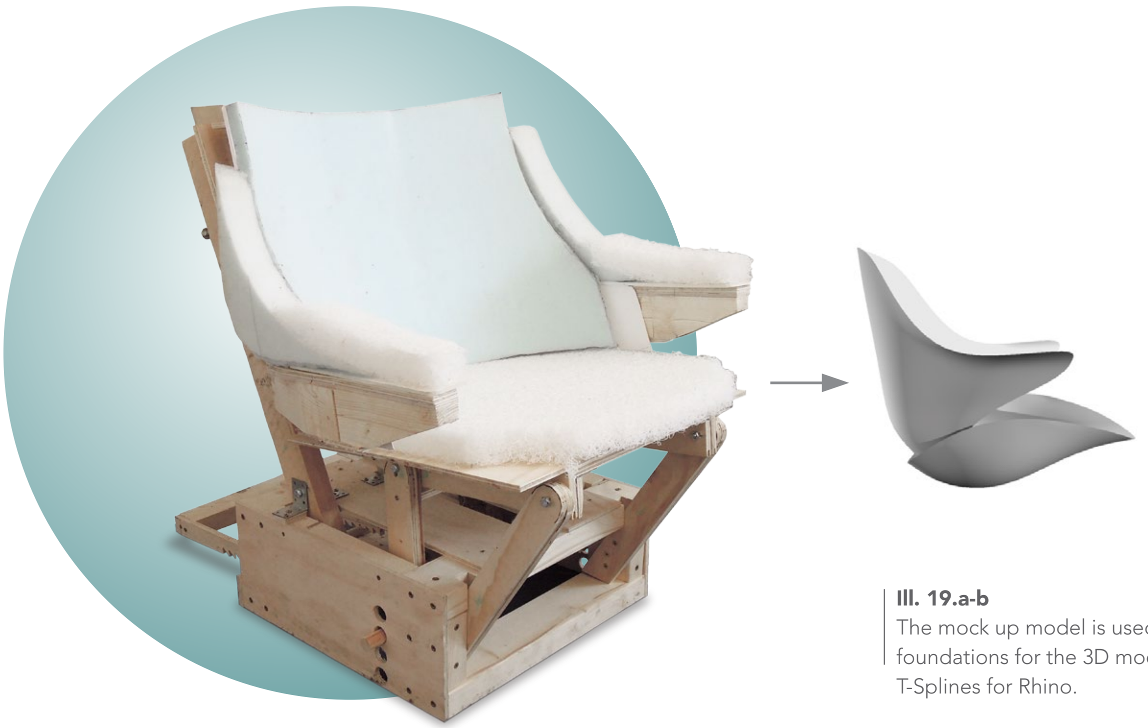
The modelling of the chair is carried into 3D to get a better understanding of the form and how the double curved seat and back meet each other when the chair is reclined. At the same time the overall form and components can be detailed to build the layers gradually that the chair will exist of.

Tools/Execution

The product had double curved surfaces, which means that the team decides that Rhino and the plug-in T-Splines will be the best tool for this. The product is drawn as a 1:10 scale elevation with the new measurements, that were found in the testing of the second mock-up and the focus group meeting. The design is changed in steps, and thus making the chair have the desired lines in the form, while it still has the ergonomic measurements that are found in the mock-up.

Reflection

Using 3D modelling software as a sketching tool allowed for quick changes in the design of the chair. The most important element in this method was to find a desired curvature in the seat and back, that do not clash when reclining the chair. The gap between seat and back was also minimized. T-splines was an efficient way to make changes to the form. The form was built by fix-points instead of SolidWorks' geometry, which turned out to give the shells and cushions a soft look.



Ill. 19.a-b
The mock up model is used as a foundations for the 3D modelling in T-Splines for Rhino.

FORCE SENSITIVE APPLICATION (FSA)

Drafting (P. 108)

Force Sensitive Application (FSA) is used to find the best-suited upholstery for the seat cushion in the chair.

Objective

To create a comfortable seat cushion for the chair, different types of upholstery and combinations have to be examined. This method is used because it gives a quick measure of how the pressure load on the buttocks is equalized on different types of upholstery. The design team have collected information on comfort in upholstery at Brdr. Sørensen, but do not have measurable experience with the materials. Nordic Easy Chair explains what they use in the current recliners, but an FSA is used to find a comfortable upholstery with limited thickness to achieve a lighter expression and room for mechanical components in the back and seat construction of the chair.

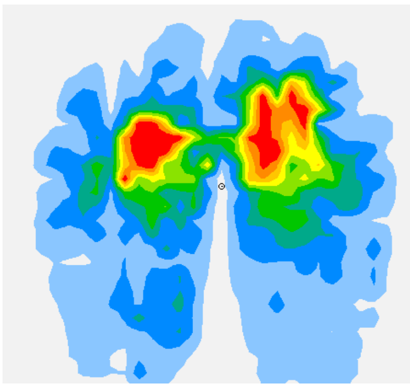
Tools/Execution

A Force Sensitive Application mat and the appertaining FSA software are used in the experiment. [Appendix XX] A small cupboard is used in the experimental setup, as there were no un-upholstered seats in the experiment room. The different foam types are placed one at a time on the cupboard and with the FSA mat on top. From the FSA mat, a wire went into a computer, where a FSA software was showing the output data. Two people from the focus group, Mette N and Børge N and the design team member, Ditte, are the chosen test people due the different body types. Each upholstery material is tested once for 10 seconds by each person. The seated position is recorded and saved. A combination of foam types is tested to see if there are any changes in the pressure load. Each test is executed with a textile cover on the upholstery, to visualize the final sandwich construction as much as possible.

Reflection

After the design team had become acquainted with the FSA measuring tool, it was a fast analysis to make. It gave quick results because the design team used the contour maps as analysis results. However for a more precise result, which is also more time consuming, the data output from each of the sensors in the FSA mat should have been used, as it gave more detailed information of the pressure. During the experiment, one of the test people carried a wallet in the back pocket, which can give a wrong output of the pressure load. The design team expected that the wallet would show a significant high load on the buttock where it was placed however it showed the opposite. However the design team had chosen to use the result regardless, because people tend to carry objects in their back pockets.

The result of the test was used to decide a combination of different upholstery types, density and thickness.



Ill. 20.a-b
The stack of foam types. The output is translated as a topographical image showing the pressure points.

FEM ANALYSIS

Drafting (P. 119, 121)

FEM analysis is used for eliminating any potential construction related weaknesses.

Objective

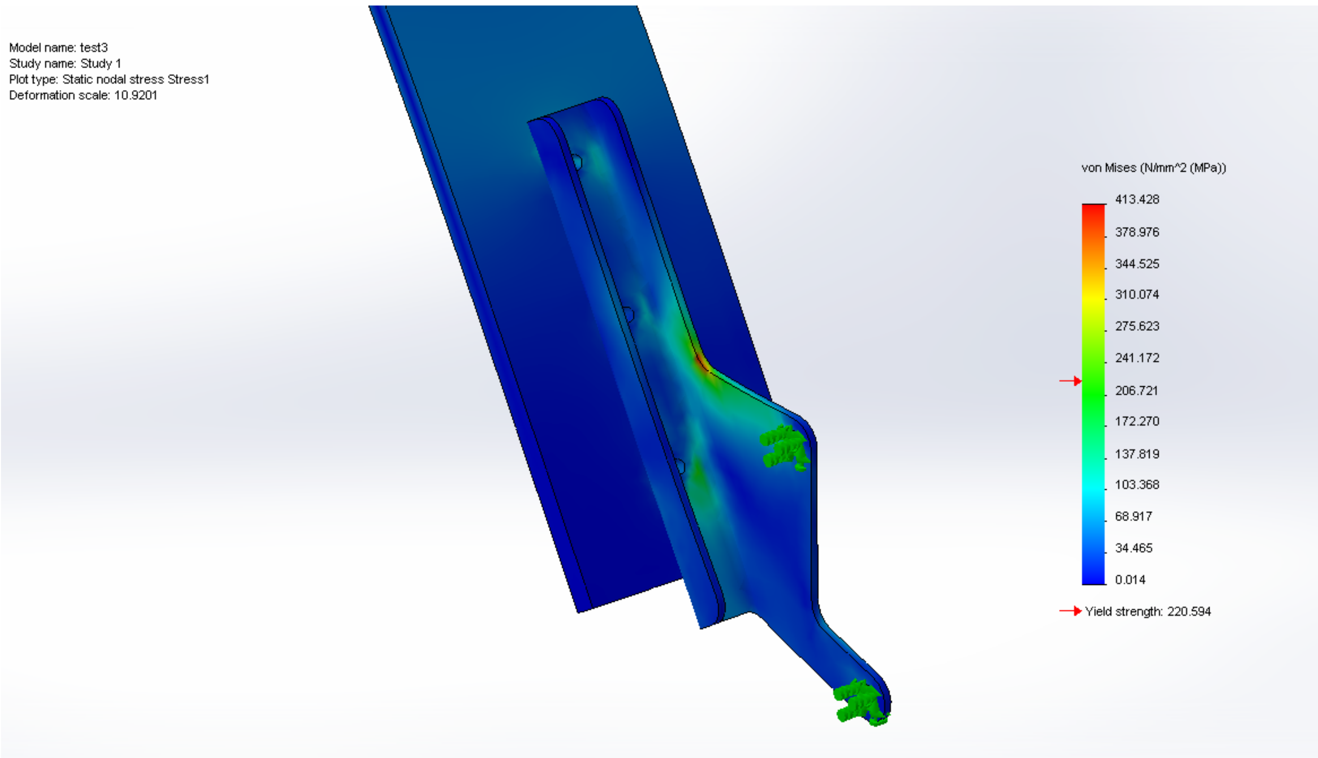
The construction of any product has to handle product use and meet international standards. To insure feasible dimensions and durability, critical areas of the product have to be calculated in connection to the applied stress.

Tools/Execution

To be able to make quick adjustments and changes in the construction and design, a build-in FEM simulator in SolidWorks is used for the calculation. The critical elements that are tested through SolidWorks Simulation are the two types of bases for the chair and the neck rest mechanism rails. These elements are constructed as virtual models in SolidWorks. When material, fixation and loads are defined, the simulation shows where and how much the element is stressed and the displacements.

Reflection

The SolidWorks Simulation was easy to use and it gave information that was more easy to understand than ordinary calculations, as the results were defined on the whole element and not in one spot. The visuals also made it easy and quick to find the exact areas that had to be optimized. For this product, the FEM analysis helped the design team to optimize the product in terms of the desired idiom, lower weight, material use and strength.



Ill. 21
Two versions of the brackets and their FEM analysis.

FINAL REFLECTION

The design team went into the collaboration with Nordic Easy Chair with an expectation of a project, with a focus on furniture design, where the objective was to create a piece of furniture that was to a high level of detailing. Prior to the first meeting with Nordic Easy Chair, the design team had expected to be presented with a pre-defined task; however NEC expressed an interest in not limiting the direction. Not having a pre-defined task meant that the direction became defined by the choices that were based on research. Using another set of methods in the process, may have led the team to have other findings and different decisions in the process and thus creating a completely different product.

The team chose to use several methods to verify important aspects early in the process, such as the angles of the chair and the definition of segment. This often meant that a topic was verified by two sources, making the research verification research. Instead the team could choose to use one source of information, which would have saved time.

Throughout the process, Nordic Easy Chair has been extremely helpful in meetings and with any questions that the team might have, which they also indicated at several meetings as the best result, also was in their interest. Their interest in the collaboration made it crucial for the design team, because it was presented as a realistic project to Nordic Easy Chair, who was the client. This is an aspect that the team will be able to use in the professional lives.