

E-xplore

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Project: Design For Creatives

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Contents

| | |
|---|----|
| 1. Introduction | 4 |
| 2. Objective | 6 |
| 3. Design | 7 |
| 3.1. Exploration and generation | 8 |
| 3.1.1 Storyply | 8 |
| 3.1.2 B3.2 Collaboration | 10 |
| 3.2. Conceptualization and Design | 12 |
| 3.2.1. 1 st iteration and student collective | 13 |
| 3.2.2. 2 nd iteration, diverging and converging | 14 |
| 3.2.3. 3 rd iteration, user interaction and user rewards | 16 |
| 4. Technology | 20 |
| 4.1.. Iterations | 21 |
| 4.1.1. 1 st iteration | 21 |
| 4.1.1.2. 2nd Iteration | 22 |
| 4.1.1.3. 3rd Iteration | 25 |
| 4.2. Current Problems and Solutions | 26 |
| 5. Future Plans | 28 |
| 5.1 Input | 28 |
| 5.2 Processing data | 29 |
| 5.3 User experience | 29 |
| 6. Reflection | 30 |
| 7. References | 32 |



1. Introduction

In my final bachelor semester at Industrial Design I did a project in the squad “Design for Creatives” (DfC). After an extensive exploration phase I decided to focus on Designers working together regularly in close proximity; co-located design in short.

The title of this project is E-xplore and it was made for and in the Concept Lab, a living lab of the modern design studio under construction in the Industrial Design department. Even though the client for this project is Concept Lab, the project is optimized to create possibilities and inspiration for any designer, while continuing to work in their own individually preferred way.

E-xplore is a system based on the notion that designers are visual thinkers, but barely have access to visual inspiration while invested in a brainstorm. The E-xplore platform allows creatives to interact with the internet as if it's a team member by digitally augmenting their brainstorm method. The system surprises and challenges users in the earliest stages of conceptualizing. The system remembers which images evoked a reaction, to eventually present the user with an overview of their creative process.

E-xplore is made for co-located designers and functions as follows. Designers choose their preferred method and, when working on a physical surface such as paper or a whiteboard, simply point a video projector onto their work surface and then run the E-xplore program. When working on a digital medium, such as a tablet or smartboard, the system only has to be started up right on the medium itself.

The creatives choose a point in their brainstorm where it makes sense to receive extra inspiration with their drawings and writing. Immediately the system presents them with a number of related images to where the exploration currently is and places them in between the current sketches and ideas of the designers. Users can choose to dismiss or elaborate on these images to receive images better tailored to them, while the system keeps track of their process, allowing designers to go back

and change their mind any time. It also allows users to see in real time where the process of an idea is taking them, avoiding miscommunication by two designers being unable to communicate an undeveloped concept.

When users are satisfied with the brainstorm they can tell the system to wrap up, after which E-xplore leaves the designers with an overview of inspiration users have approved and shown interest in. The designers can look back onto this moodboard any time and see how they arrived at a specific idea, what path they took and possible alternatives they might still like to explore at a later time.

By giving designers a way to connect with a source of inspiration within a brainstorm, this project aims to enrich the ideation and conceptualization process of creatives, while also showing the extend of current development around an explored idea. Seeing inspiration and sometimes surprising alternatives can help users let go of their initial ideas about a subject. It can also help them communicate with other designers by taking the system into a specific direction. This promotes a truly free and unencumbered ideation, exploration, conceptualization or idea development in general.



2. Objective

Design for Creatives is a project that is about the design process and being able to use modern technology to enhance it. It works within a relatively concise user group, namely designers. In the case of this project the focus, after the initial exploration phase, was on co-located designers.

With the goal to enhance working together in a group in closed proximity being pretty open it was important to choose a part of the design process to focus on. After some rough sketches and open exploration some opportunities were identified in the exploration process. The process is cumbersome and does not allow for interaction with inspiration, making it a highly inefficient process considering the amounts

of time a team might have to return to the drawing board after information is discovered after, for example, a brainstorm.

The direction the project took called for some design principles to be applied to it. The design could not be obtrusive, it needs to be simple in use and execution, it should allow people to discover functionality and it should provide new possibilities without taking any others away. Quickly making it apparent that a digital, cloud based, platform would give a maximum number of designers the freedom to interact with the system. This made the main challenge of this project interacting with a computer without breaking the delicate workflow of an exploration.



3. Design

This chapter described how this project went from a project description to an idea to a concept to some iterations to a working prototypes to an experimental system called E-xploavre. It is specifically about the idea and concept development, how the project was realized and problems and solutions related to this will be elaborated in the next project 4.0 Technology.

3.1. Exploration and generation

3.1.1 Storyply

The idea generation phase started off with a weeklong Storyply (formerly known as Storify) session¹ In collaboration with Sebastiaan Krijnen and Marieke Wijngaard. Storyply is a storytelling tool to help teams discuss and build user experiences and design for these situations.

The Storyply session was based within the DfC project description and focussed on co-located designers. The specific identified problem was working together in after hours. If a job has to be finished outside of the regular working hours or a team member is absent it can be hard to communicate and work together. A team member may, for example, aim to work in the train but be unable to due to a bad network connection. Or a team member may forget to sync their files in a tool like Dropbox or Google Drive, causing team members to work past eachother instead of together.

The scenario devised focussed specifically on two designers agreeing when leaving for home in the evening to work on a presentation individually, the presentation is for an important client the next morning. One of the designers does so until late at night because he is concerned about not being able to work in the train, the other one decides to work on the train the morning before. However the second designer finds that he isn't able to sync the presentation files in the train, causing him to have to work without any of the updates the other designer made. This results in both designers having different ideas about the presentation, ultimately resulting in a disappointing performance.

This was the scenario which had to be solved with a design. After a brainstorm with many ideas we started converging towards one device, called Freeze. Freeze is a device that houses the same numbers of USB sticks as there are designers working together in a company. At the end of a workday the Freeze module saves all files on the USB sticks, which workers can then take home or on their commute. This system ensures that all workers have the same files to work with and encourages them to make clear arrangements on what each of them does, without relying on a sometimes unreliable internet or intranet.

More information and a demonstration of Freeze can be found in this video.

<https://youtu.be/TmeQ-ry5xOs>

¹ Atasoy, Berke, and Jean-Bernard Martens. "STORIFY: a tool to assist design teams in envisioning and discussing user experience." CHI'11 Extended Abstracts on Human Factors in Computing Systems. ACM, 2011.



Exploring non co-located interactions



Mockup for the Freeze Module used in the video

3.1.2 B3.2 Collaboration

After finishing the Storyply session another diverging phase was entered. Together with Mariëlle van Leuken new directions of the project were considered. The Storyply session peaked an interest in communicating within a design process, as communicating ideas can be extremely hard, especially when not fully developed yet. Adding a visual aggregate to this communication can greatly enhance this process¹. Especially since designers tend to be visual thinkers and surround themselves with visual material² as inspiration it makes sense to increase their access to this, especially in a phase where ideas are incomplete and communication hard.

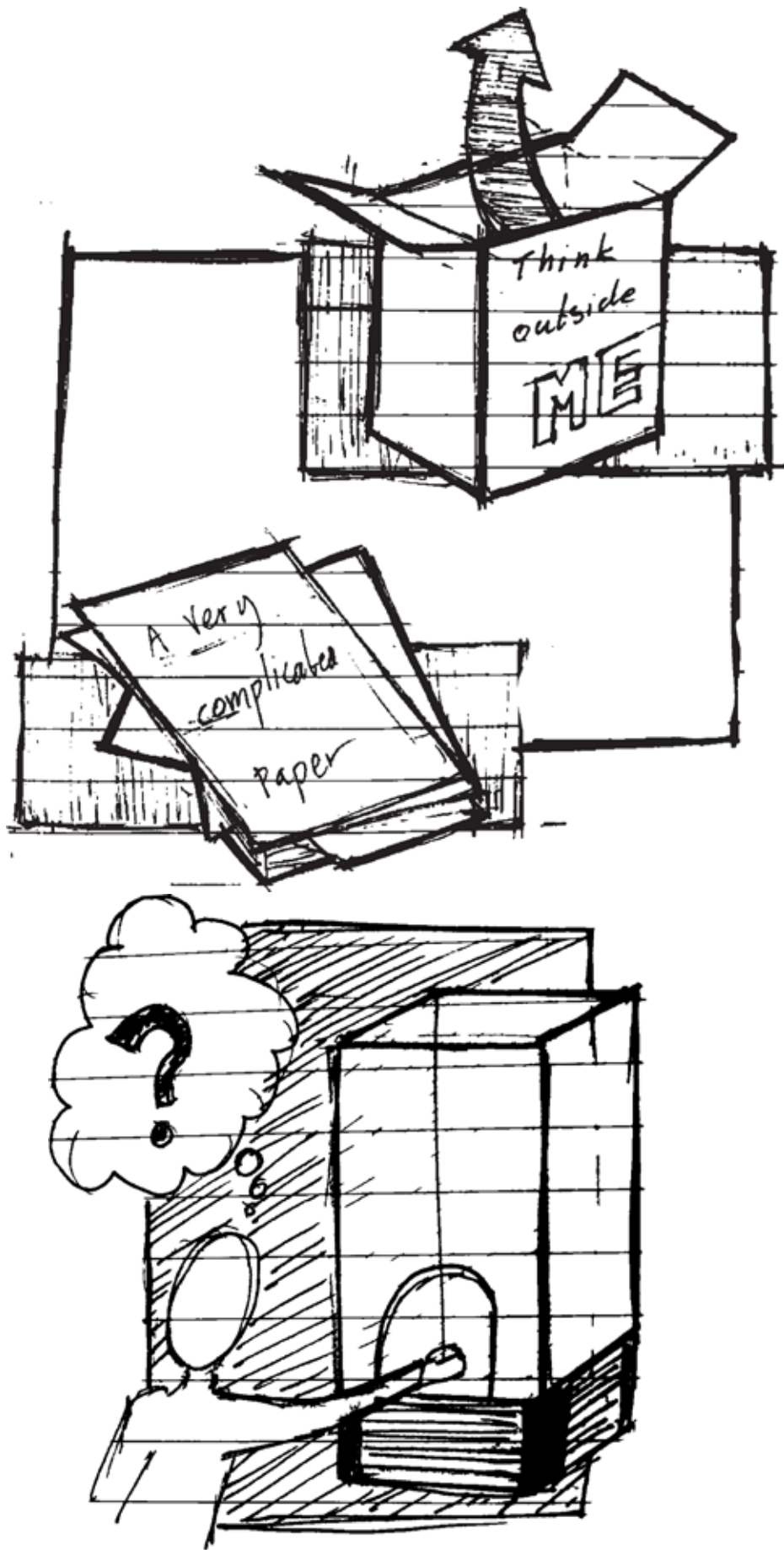
The focus became to provide visual inspiration to designers, to both increase the quantity of ideas and the quality of visual communication between designers. The biggest, most voluminous, source of inspiration nowadays is the internet. But as many designers who have brainstormed together know, during a brainstorm you can't have distractions such as open laptops or people looking at their phones during a brainstorm.

As you can imagine, excluding the internet or a digital component at all in a brainstorm can limit creativity. Designers are unable to look around in an enormous world of inspiration and may regret this afterwards, or find similar projects after already having committed to a concept, resulting in frustration and wasted time.

So the mission becomes to make a type of inspiration machine that links the digital world that has so much inspiration and the physical world without distraction that allows designers to work in their own preferred way. To achieve this it is important for the design to support a designer's individual way of brainstorming so it is not cumbersome to use in a process, but an actual asset.

¹ Spindeler, Brigitte, and Bernd Wollring. "Communicating ideas about space and shape." Mathematical Understanding 5-11: A Practical Guide to Creative Communication in Maths (2007): 28.

² Keller, Adriaan Ianus. For Inspiration Only; Designer interaction with informal collections of visual material. TU Delft, Delft University of Technology, 2005.



Some of the earliest sketches

3.2. Conceptualization and Design

To make an inspiration machine as described in the last chapter, the gap between current brainstorming techniques and current inspiration sources had to be identified.

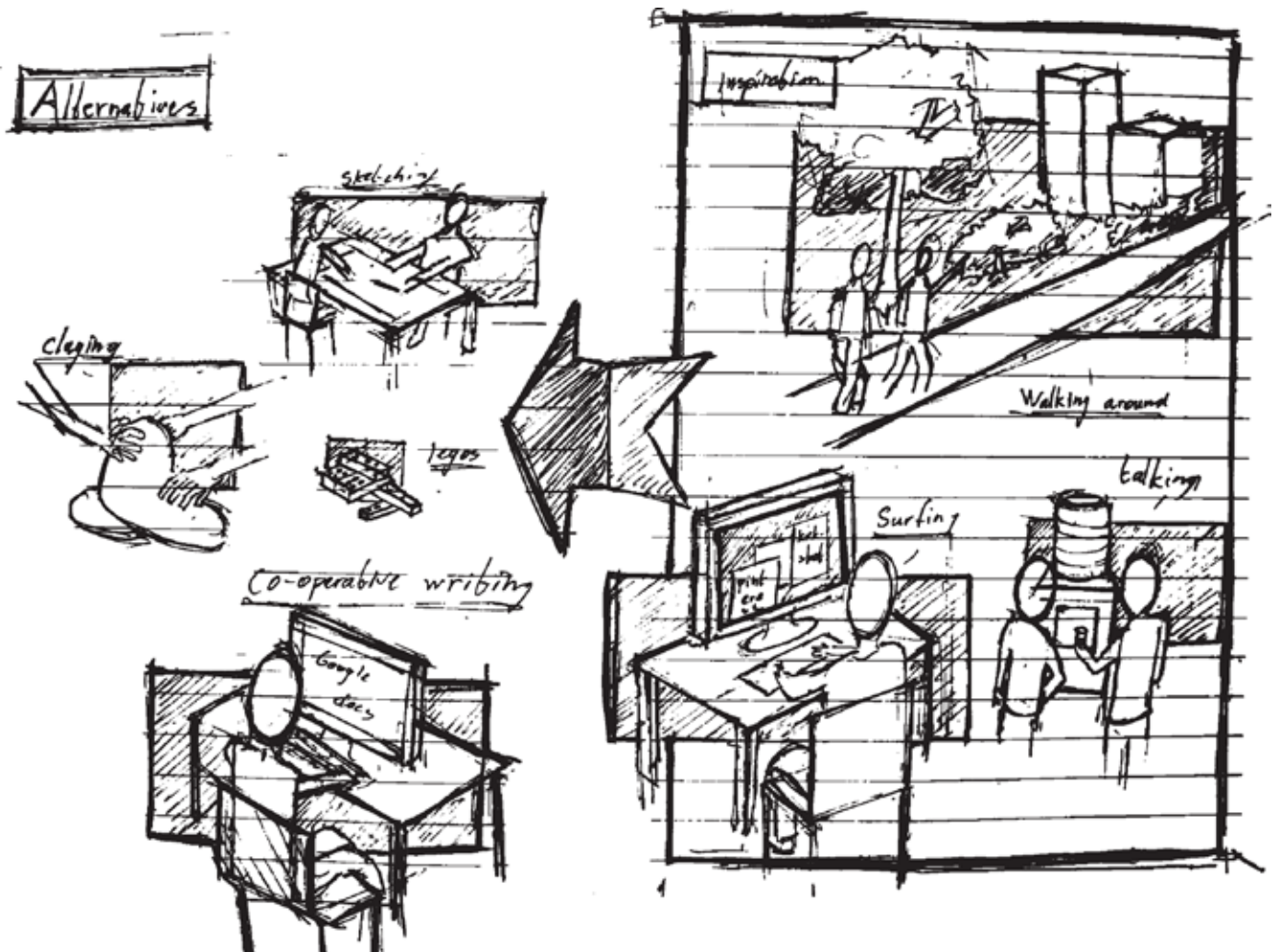
Some co-operative brainstorming techniques include:

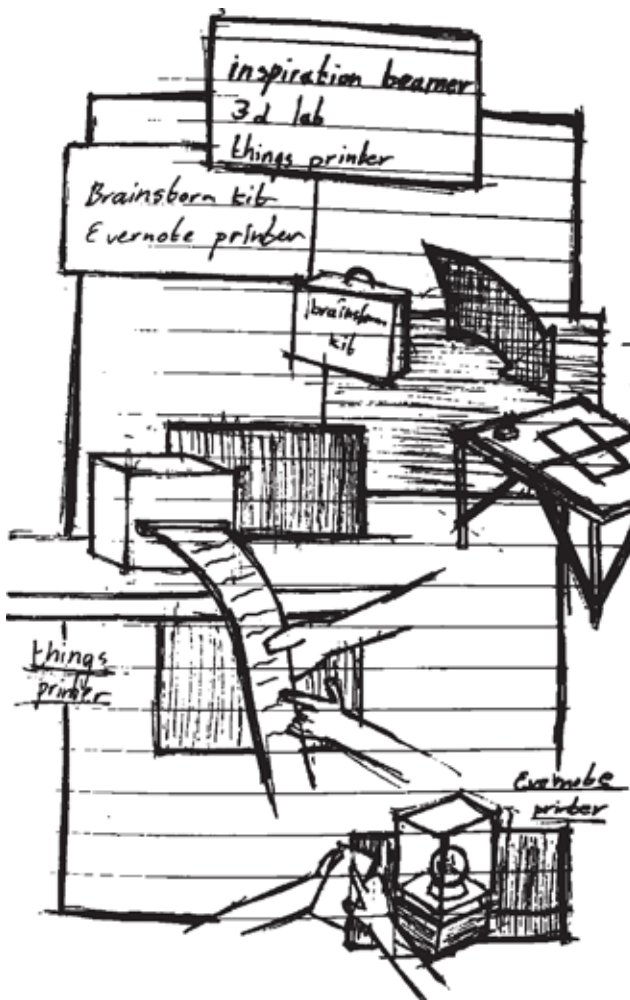
- Sketching together
(2d visual communication)
- Claying or moulding
(3d visual communication)
- Cooperative writing on Google Drive, Dropbox, etc.

Examples of inspiration sources include:

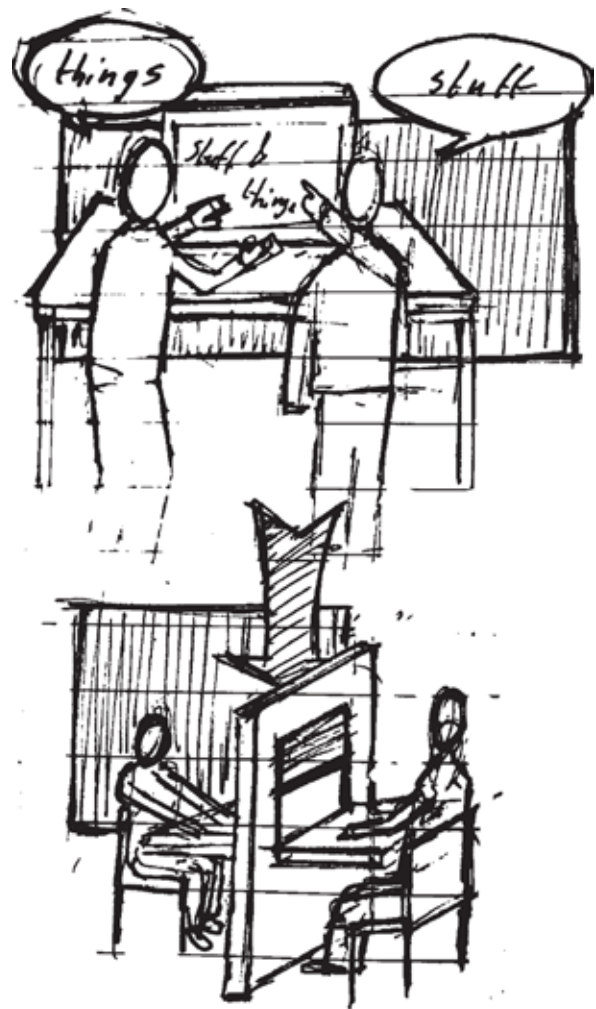
- Walking around outside
- Talking with others
- Surfing the internet

These elements right now are not connected, as a brainstorm usually requires you to stay in a single place, talk to no one else but the people at the table during the brainstorm and doesn't allow you to look at any type of screen while coming up with ideas. With this in mind the iteration process was started.





3.2.1. 1st iteration and student collective



With design principles and criteria defined it was time to spar with some ideas together with other students. To do this we started a student collective together to meet every week with as many students within the project as possible. Especially in the early phases of the project this proved very useful, every Friday we talked about how the week went, what plans we have for the next and if we reached last week's plans. This provided a weekly moment to reflect, as well as a moment to look forward.

The group allowed for concept development and feedback from fellow designers in the earliest stages of conceptu-

alization. Meeting regularly helped the initial idea develop steadily into a concept that could be built in the coming weeks, to be tested on other users.

What quickly became apparent is that the project would have to become a digital system. Most proposed ideas that included a physical component seemed to become cumbersome relatively quickly. More importantly however, an object that a group of people need to interact with together requires them to drastically have to change their current way of cooperating. The current, intuitive way of cooperating simply isn't broken, but can be enhanced.

After exploring and eliminating some initial ways to develop the concept it was decided to use the internet as biggest source of inspiration in the project and use this to enhance a traditional brainstorm. A brainstorm with two people at a table on paper was chosen as the main scenario.

By adding a video projector above a table with two people brainstorming on it is possible to display images alongside sketches being made. This proved to speak to the imagination of other students and the student collective and building the initial concept was started.

3.2.2. 2nd iteration, diverging and converging

While images being projected alongside sketches was very entertaining and already provoked some creativity in quick tests with fellow students, it was important for the project to be able to work in two ways: diverging and converging. When displaying images based on where an exploration is heading the vision tended to become narrower and more focussed, for example: from a sitting object, to a stool, to a wooden stool to a wooden stool with leather cushion, etc.

Making a diverging system would have to be language based, whether it is typing, handwriting recognition or speech

recognition, a database to link words to related ones could be a great way to expand the exploration of a designer. Luckily there is already some research in using language databases to find related words, synonyms etc¹².

WordNet is a good fit for this purpose, there is a lot of support and example projects to learn from and it is a relatively complete lexical database for the English language.

The system is now able to work in a diverging and a converging way, both able to provoke the user or help a user to make decision. For example: a chair can lead to an armchair, then a couch, then a couch with a chaise longue to a bed, etc.

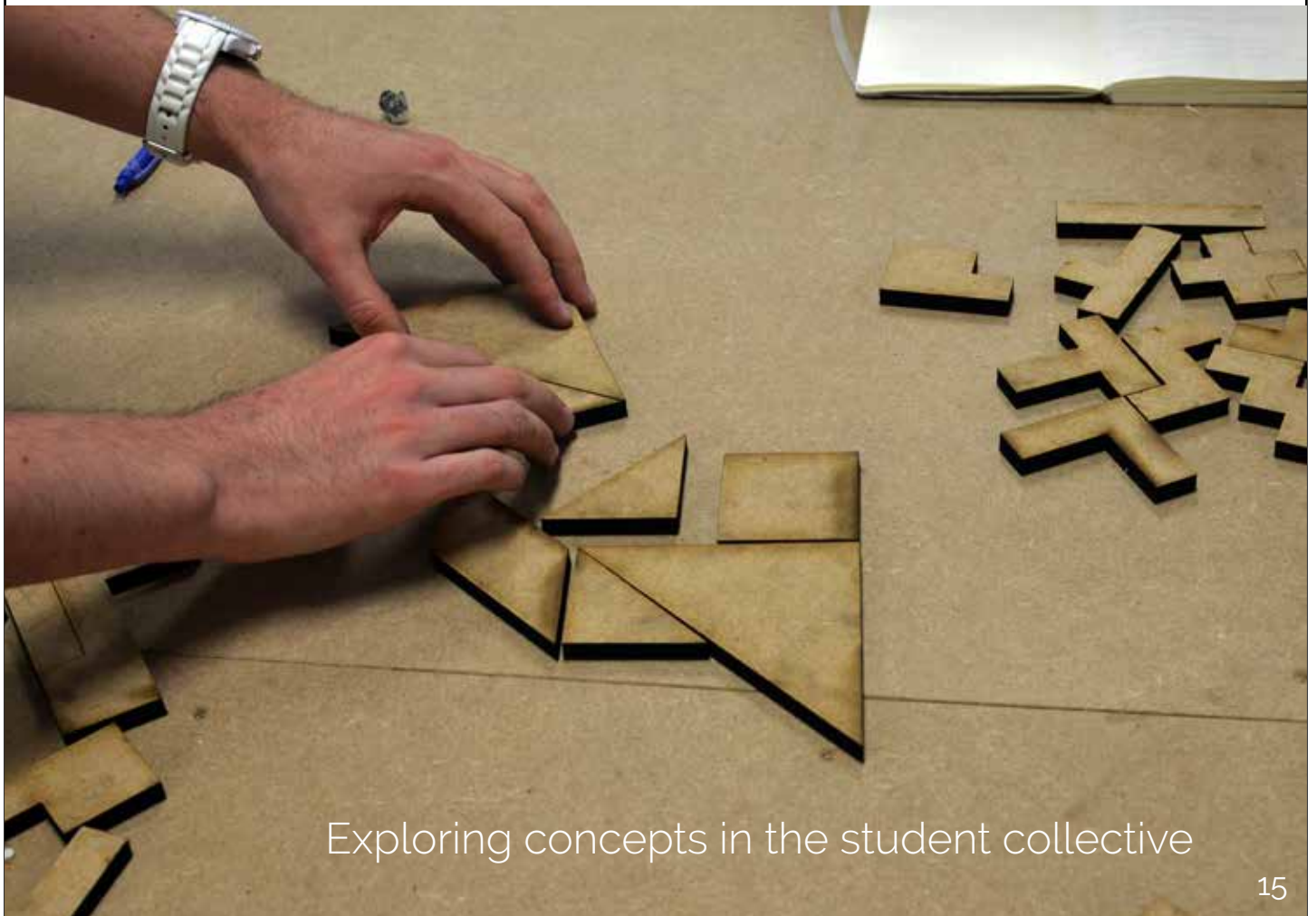
A provoking factor in the system gives a relatively high novelty factor and seduced fellow students to push the limits of the system and see where synonyms take them. Showing visuals instead of words caused users to think less about how the system works specifically, but more about where the system is taking them and how their input influences the output together with the system.

1 (Fellbaum, Christiane. WordNet. Blackwell Publishing Ltd, 1998.

2 Tosa, Naoko, Seigow Matsuoka, and Ryohei Nakatsu. "Computing Inspiration: i. plot." New Frontiers for Entertainment Computing. Springer US, 2008. 117-127



Early Prototypes in the student collective



Exploring concepts in the student collective

3.2.3. 3rd iteration, user interaction and user rewards

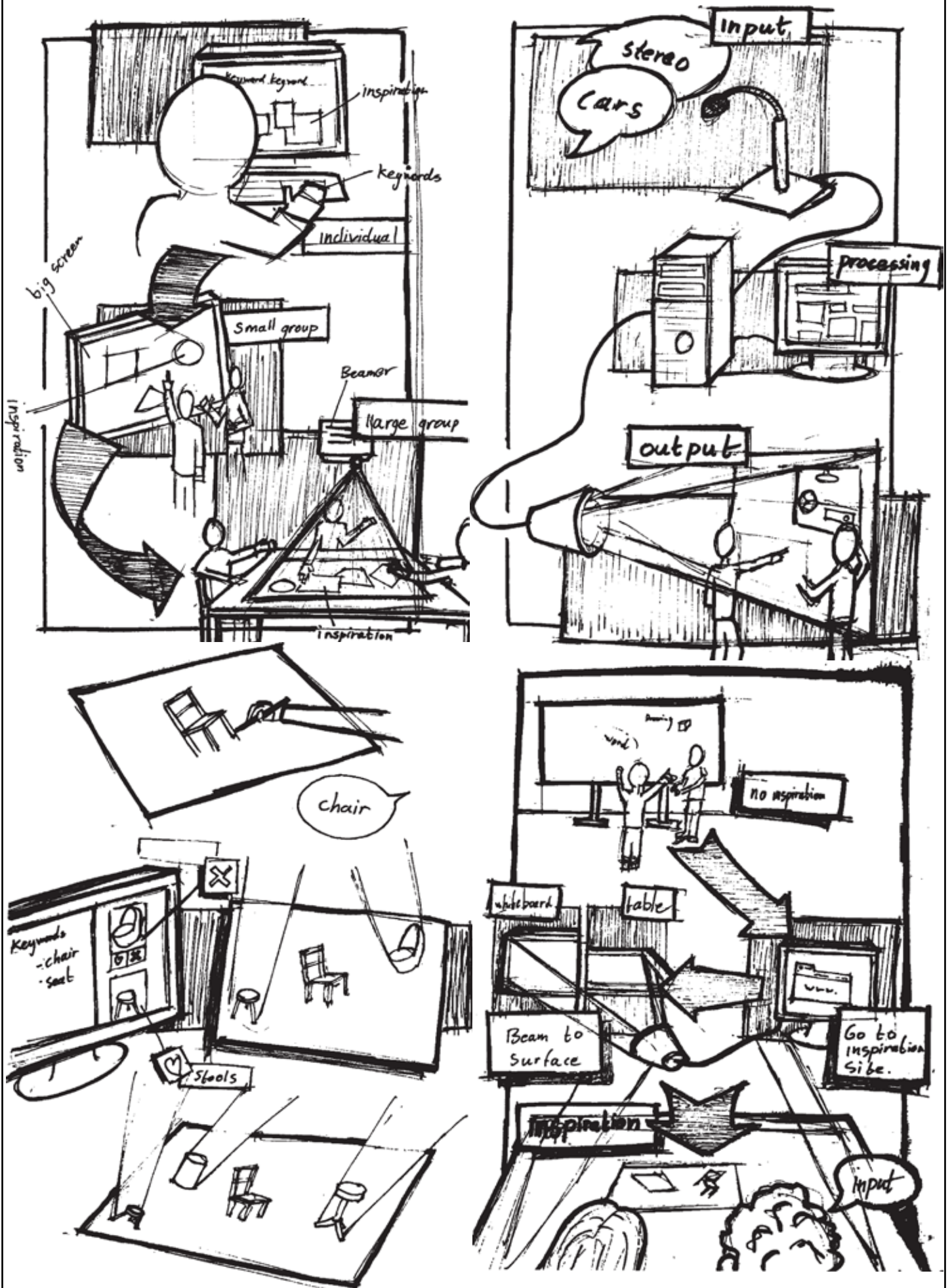
What wasn't clear in the second iteration is where the system had its place in a design process. Yes, it makes sense to use it in a brainstorm, but where does the system stop and the next phase begin? More importantly, what can a user take with him or her after using it? Besides this, the user interaction needed to be more engaging, at this point the system relied on relatively small buttons and some preliminary knowledge about using it to really know what is happening. It's essential for the system to be instinctive to use and discoverable, so a user can feel a real connection with the system and be interested in using it to enhance a brainstorm.

Instead of having to input every time a new set of images is needed the images were made clickable. Clicking a specific image results in expanded results on that specific image. A more button was added above all results that searches for related images to the one clicked on. Next to this it remains possible to manually input new information, so users can go into a new direction if they want. Or if users see a specific detail in an image that the system does not directly have a button for.

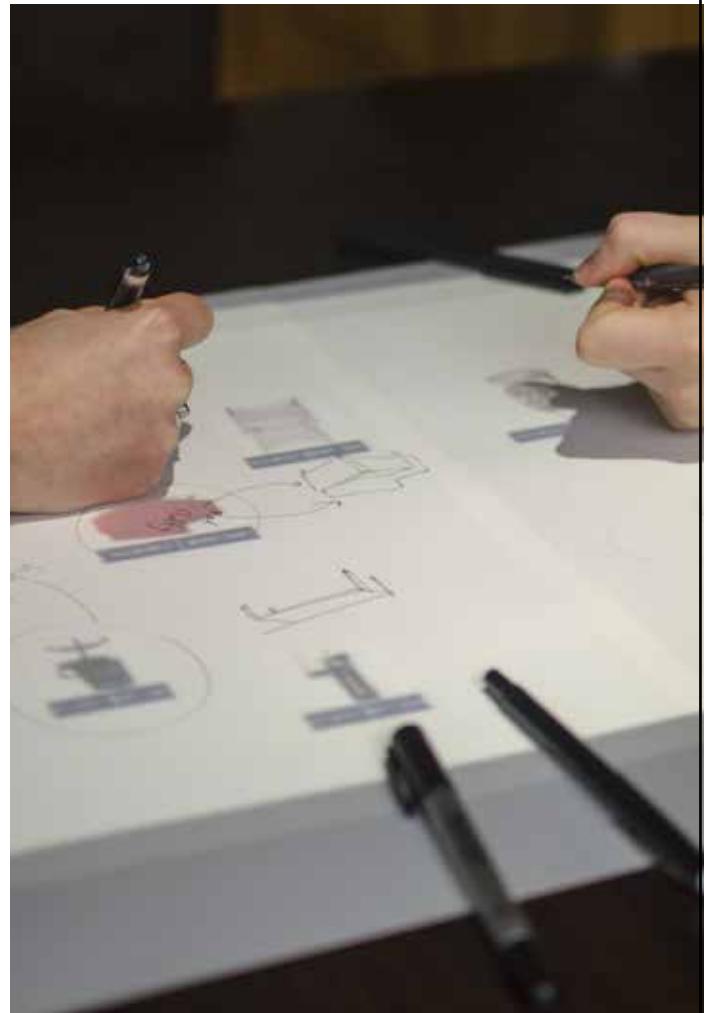
The system keeps track of all user searches and at first showed the path users take from the initial search to wherever they go. In a second screen users were able to see their progress

live. However this didn't seem to have much positive effect because of the non-visual nature of it. It also subtracted attention away from the exploration itself. Instead of a list of words a list of images was added, one the user does not have complete control over to make it more of a moodboard, showing the progress of a thought process to capture phases, revelations and idea development.

To avoid too much focus from being transferred from the brainstorm itself to the system developing a moodboard the decision was made to show the moodboard at the end of the exploration. When a user is satisfied or wants to stop the current path of thought he or she is able to push the "end" button which stops the program and shows a set of images that the user has shown interest into. Besides the development and ideas a user gets out of a brainstorm like any other brainstorm, the user also leaves the system with an overview of inspiration and idea progression.



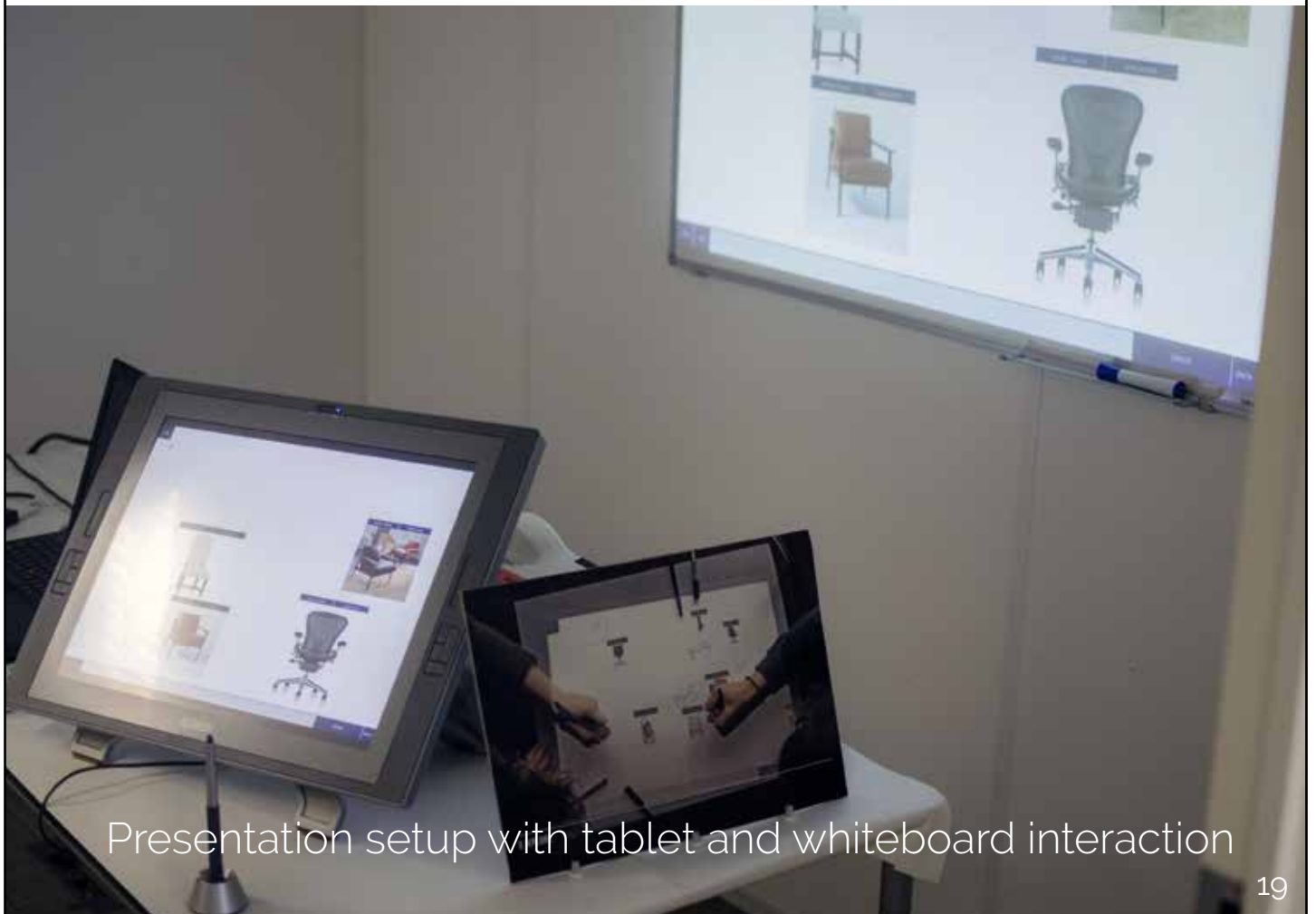
Sketches for the third iteration



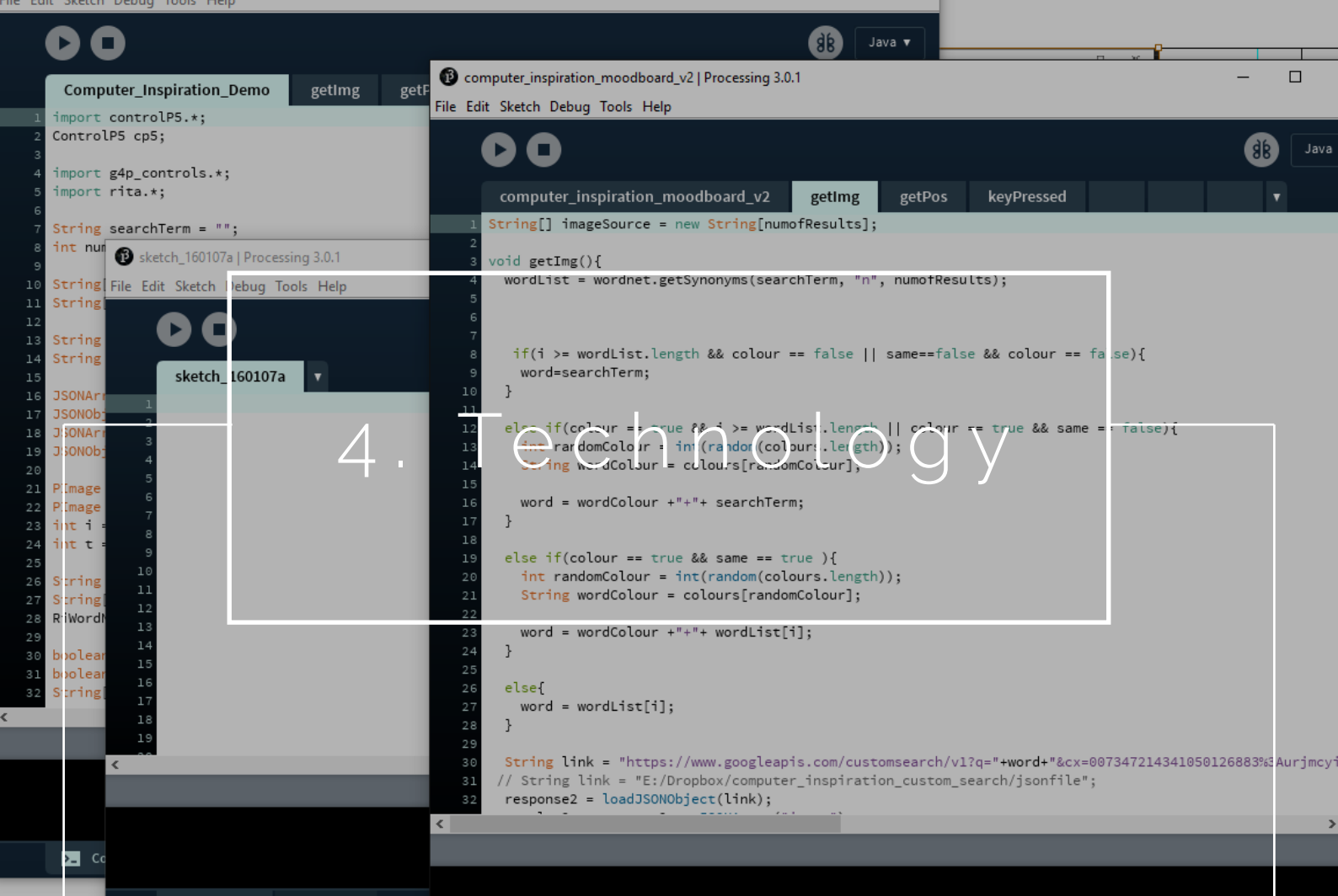
E-xplore being used with a suspended video projector



E-xplore being used on a Wacom Cintiq 21UX



Presentation setup with tablet and whiteboard interaction



This chapter is about the technology that went into making the E-xplore system. The full code can be found in the appendix.

4.1.. Iterations

4.1.1. 1st iteration

For the first iteration of the system the plan was to simply display images based on manual input. There were however some criteria I had to adhere to.

- Images could not be too big, around 400px by 400px
- Images preferably have a white background
- Have a flexible amount of images displayed
- Images have to be sourced from a large search engine such as Bing or Google to optimize the scope of possibilities
- It needs to be a dedicated program that I can build on for future iterations
- The input had to be visible

First and foremost, a platform had to be chosen to work with. Processing¹ seemed a perfect fit for this project. Processing is a programming language and IDE that makes experimenting with software easy. It was chosen as base for the system because of its enormous support, relative ease of use, direct java app and webapp export and library database. From this point on the project was entirely written in Processing 3.0 and Processing 3.0.1 when it was released late October.

Processing is able to import images from the internet without problems using the loadImage() function to read image files from the internet (in this case jpg files), PImage() to store it and image() to finally display it. Getting images to not overlap is a little more complicated, a function was made that stores the positions of each image in two arrays and checks if placing the next image will overlap with the last one. If no images overlap the image is placed, if they do however, a new position is chosen until the new image does not overlap with any of the current ones. Other than some Processing basics this was what was needed to display the images.

The next step was finding an API to retrieve images from the internet based on search terms. The (now defunct) Google AJAX API² provided the most comprehensive JSON to import and read in processing and didn't require an app id or any type of account with unlimited requests, perfect for this application. After functioning for a number of weeks the support for the Google AJAX API was dropped, which forced a big rewrite of the code to work with the Google Custom Search API. The Custom Search API has limited requests, requires an account and app ID, but it does have more options than the AJAX API and still provides comprehensive JSON for the system to work with.

¹ <https://processing.org/>

² <https://ajax.googleapis.com/ajax/services/search/images>

Starting off with Youssef Faltas' `getGoogleImagesSearchResults` sketch³ a function was written to retrieve images from the Google AJAX API. This later was rewritten to the aforementioned Custom Search API.

The system now is able to take input and show any number of images positioned randomly around the screen but never overlapping unless forced to by their own size or the screens resolution.

4.1.1.2. 2nd Iteration

The second iteration revolved around the system being able to provide diverging information. It was decided to base this on WordNet, while it is one of the most widely used and well documented lexical database. As luck would have it this project wasn't the first Processing based project interested in using WordNet in it and there was a library called RiTa^{4 5}. RiTa makes the link between WordNet and Processing. It provides many ways to find words related to an input one, it can find synonyms, words that rhyme, antonyms, anagrams and more.

3 <http://www.openprocessing.org/sketch/132752>

4 Howe, D. C. (2015). RiTa [Computer software]. Retrieved from <http://rednoise.org/rita>

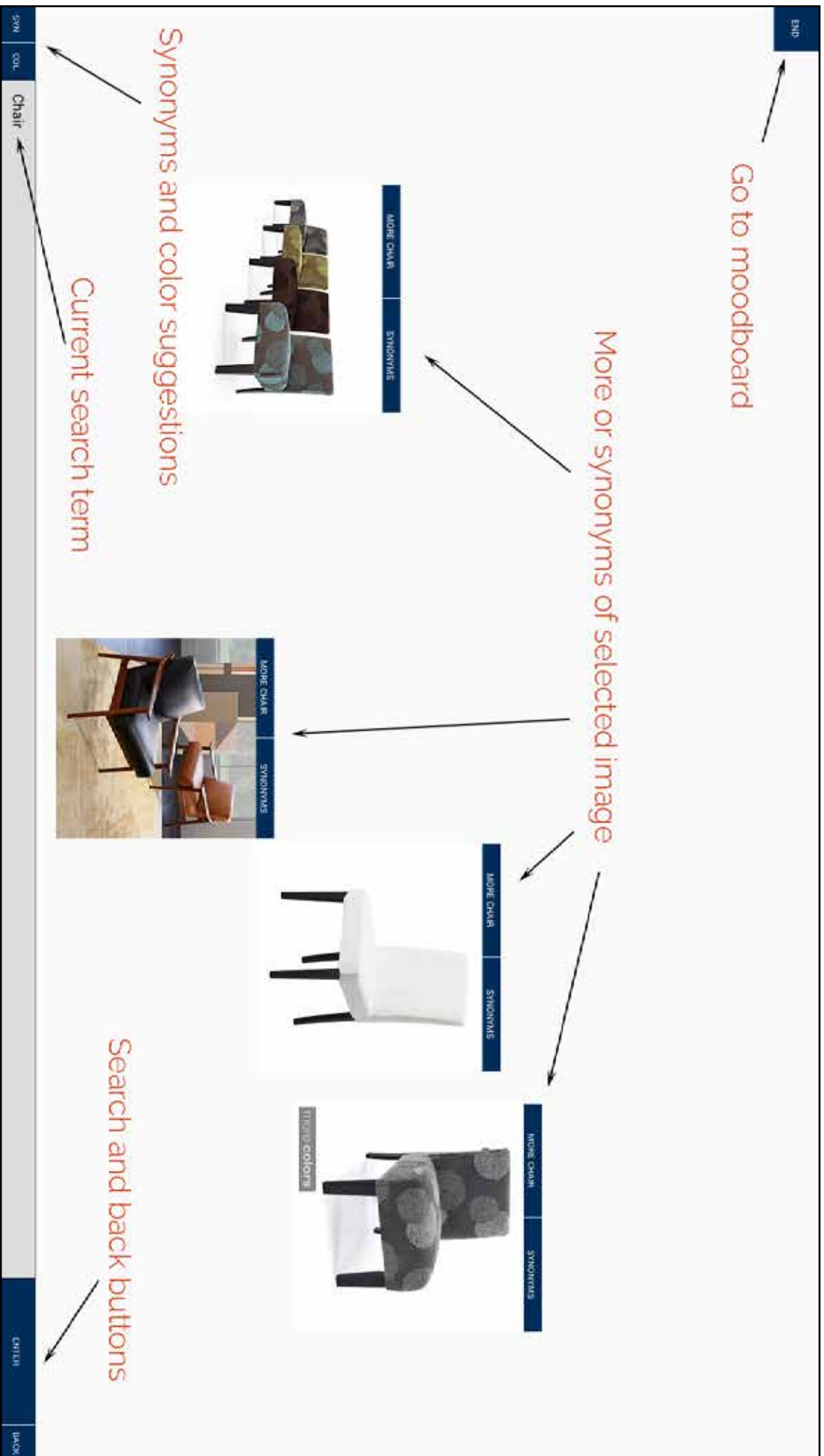
5 Howe, D.C. 2009. RiTa: creativity support for computational literature. In Proceedings of the seventh ACM conference on Creativity and cognition (C&C '09). ACM, New York, NY, USA, 205-210. DOI=<http://dx.doi.org/10.1145/1640233.1640265>

RiTa allowed a function to be added to the system that searches for synonyms in selected words that can then be fed into the image search function. By saving images with the search terms that lead to generating them, this process can be repeated over and over; from chair, to armchair, to chaise, to couch, to bed, etc.

To display the search terms users have used in real time there needed to be a second screen in the processing sketch. To achieve this the G4P library for Processing⁶ was used. G4P allows extra windows to be created, this allowed a second screen in processing to show the search process in real time. A back button was added to navigate backwards through the previous search terms, to avoid "wrong turns" being included in the final result of an exploration.

For now it was decided to not focus on the input too much. Making speech or handwriting recognition would require extra hardware for the system to work (microphone, camera), while it was essential for the system to work on as many platforms as possible with the minimum amount of hardware, to support all designers in their explorations. For now all input is either done by a dedicated person listening in on the brainstorm, choosing certain words that the team seems to show interest in. Or by someone participating in the brainstorm, simultaneously typing in related search terms.

6 <http://www.lagers.org.uk/g4p/>





4.1.1.3. 3rd Iteration

The third and final iteration mainly focussed on usability and user experience. To make buttons more unified in style and legibility the ControlP5 library¹ was used.

Above each image that results from a typed in text search a set of buttons is added. On the left there is a “More” button that searches for more of the same images (clicking “More” on a chair shows more chairs), clicking the image itself does the same. On the right a “Synonyms” button, which searches for synonyms when clicked (clicking “Synonyms” above a chair shows stools, couches etc.).

¹ <http://www.sojamo.de/libraries/controlP5/>

To make the moodboard at the end of an exploration as described in chapter 3.2.3 a `StringList` array is added that saves all first results of typed in searches and all images that are clicked to provide either synonyms or more of the same results. When the user decides to end the exploration, the `StringList` is filtered to exclude defect images or duplicates and all images are shown side by side in rows in a new window generated with G4P.

The ability to make drawings on tablet platforms was also added as a substitute to drawing on paper.

4.2. Current Problems and Solutions

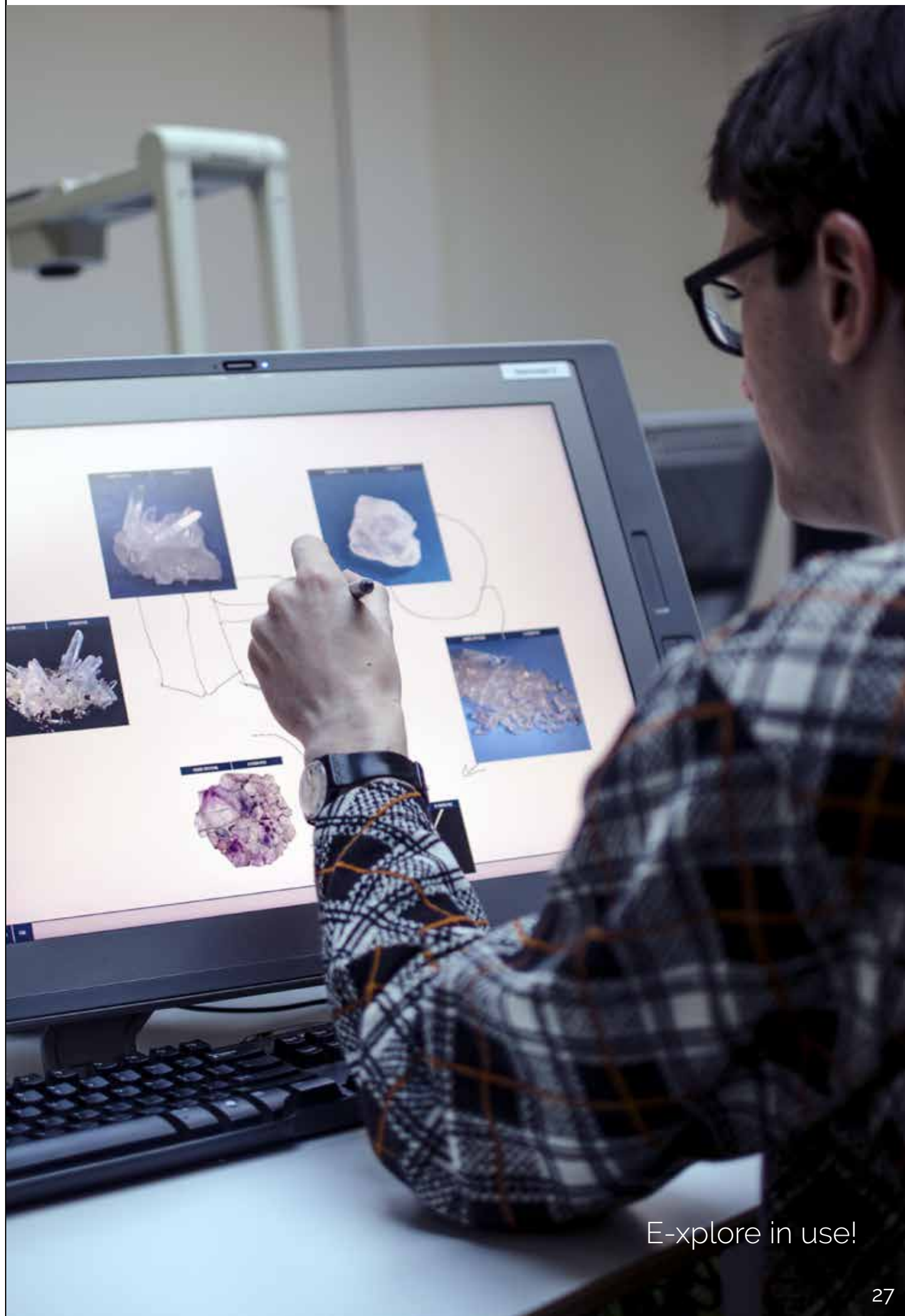
At the time of writing the 3rd iteration is the latest version of E-xplore, and even though it has proven to be functional and fun to use there are improvements to be made in the next version to make it more useful and powerful in an exploration.

The most immediate change to be made is a simpler easier to explore User Interface. Right now there are some buttons that might confuse the user causing some functions to tend to be overlooked. The program could benefit from a short introduction or explanation when first using it.

Another change is cycling the search results, right now every time a user searches "chair" he is shown the same sequence of chairs each time. Instead of this the system should show a wider selection of chairs.

When interacting with an image the image should not disappear. In the 3rd iteration clicking, for example, "synonyms" above a chair, causes the interacted with chair to disappear and only synonyms to show, which might lead a user to forget how they got to the current set of images.

The system should be able to construct the moodboard in real time on a second screen if the user chooses to do this. When creating the moodboard in real-time the user should also be able to dismiss certain images, to gain more control over the design process.



E-xplore in use!

5. Future Plans

E-xplore is a functional interactive platform and concept but it still needs to go through some steps before it can be introduced to the world with its full potential.

E-xplore needs more diverse input and processing methods, even though writing recognition and speech recognition will require extra hardware, having them as option could increase the value of the entire project by making the interaction with it more intuitive.

5.1 Input

E-xplore could be enhanced by elaborating on the input methods it has.

Right now it initially uses typed in text followed up by clicks on the field the images show up on. This raises a number of limitations across platforms. Brainstorms on a physical platform for example require the users to still use a mouse or digital pen to interact with images on the screen and moreover: a keyboard to input user ideas. Eliminating this hardware makes the system even less cumbersome to use, but is also pushing the limit of a good interaction. The two most immediate alternatives to typing in the input are: handwriting recognition and speech recognition. Both of these have their own problems and strengths.

Handwriting recognition is very hard to reliably do on a physical medium, be-

cause the direction of the strokes can't be tracked like a computer can in real time. A camera also has to be added to the system which considerably lowers the convenience of using the system. Especially with the dynamic nature of writing in a brainstorm, making it relatively illegible, it might be better to either forgo handwriting recognition, or only implement it on digital platforms only.

Speech recognition also requires hardware, but microphones are present more of the time and are cheaper than cameras. Moreover, if E-xplore is run from a laptop, the internal microphone most laptops have can be used. This makes speech recognition a pretty likely next step to be implemented into the system. There are multiple ways for processing to work with speech recognition either by library¹ or another google API and websocketP5² in conjunction.

5.2 Processing data

At this moment the development of images relies on users inputting the trend into the system. If, for example, a user sees a leather chair and a couch they want to combine, the user itself will have to input "leather couch". It would however be very interesting to have the system identify images that a user shows interest in and make parallels it-

¹ Florian Schulz, Speech To Text Library [Computer software] <http://stt.getflourish.com/>

² Jens Alexander Ewald, websocketP5 [Computer software]

self. This might not be as far-fetched as it sounds as some of the biggest companies in the world are currently competing to create the best image recognition algorithms that can learn what humans see in an image³.

Implementing accurate image recognition like this could make E-xplore into even more of an autonomous thinking team member, and less like a system designers need to put effort in to use.

5.3 User experience

Enhancing the quality of user interaction with the E-xplore system is something that definitely has to be done, but also something that has to be discovered. There are some changes that can already be made to the interaction, like including drawings into the moodboard, keeping track of a live moodboard while being able to pick and choose images of interest and dismiss ones that aren't. Most of these are already described in chapter 3 and 4.

However a more immediate next step would be to bring E-xplore into a professional environment. Working together with students is already interesting and valuable, but putting the system into a real life professional situation would really give insight into what it needs to be a very professionally and eventually economically viable product.

³ He, Kaiming, et al. "Deep Residual Learning for Image Recognition." arXiv preprint arXiv:1512.03385 (2015).



6. Reflection

This is a reflection on my Final Bachelor Project and related activities, I will be referencing my PDP for this semester which can be found in the appendix attached to this report. Following the reflection guidelines I have chosen to write this reflection based on the 2014/2015 competence framework as I'm most familiar with it.

I'd like to thank Jean-Bernard Martens and Jan Rouvroye for coaching me this semester and Robin Dohmen and Pieter-Jan Pieters at OWOW for giving me the chance to be an actual designer.

When receiving the project description and finishing the initial exploratory phases leading to the idea that made this project I realized that first and foremost: this concept could never become a physical object. This put me in a tough spot, I loved the idea as computer for team members, but could not find a way to make a physical system out of it without it being arbitrary. In the end I naïvely added to my PDP that I wanted to make physical prototypes for this project.

Quickly it became painfully clear that all iterations would have to be done digitally to catch any type of feedback that I could use in improving the system. So I decided to develop the competencies related to this problem in different ways. This gave me the chance to go all out on the digital aspects of this project, which was convenient as some more advanced programming was a big goal in my PDP. I got to put a lot of focus on the digital part of Integrating Technology, researching it (D&RP), had to Model the system out several times to build it efficiently (D&MM) and tested the system out at with other design students and outsiders at every possible opportunity. I had a very big volume of feedback from my target group to work with as tests were very easy to set up (just need a laptop) and my target group was all around me (designers and students).

Very important next to running a good project was addressing my EC verdict of last semester. This was a challenge at first as individual coach meetings are

few and far apart in the new system. However when I suggested to Sebastian to start regularly meeting it wasn't long before we were doing weekly student collective meetings in which I was able to look back on my week and get into a routine of not only reflecting what happened, but also making planning for the future. Not only was this a great way to tackle my condition, it was also valuable for the Teamwork and Communication competencies.

To develop competencies that could not get as much attention this semester I strategically picked two electives that balanced my development out; Exploratory Sketching for Ideas and Concepts, Form and Senses and Communication. Designing Tangible Business Models for Teamwork, Business Processes, Social Cultural awareness and User Focus.

This semester I got the chance to develop all across the board inside the study, but also outside it. My internship company OWOW asked me to continue working with them on websites allowing me to work with clients all over the Netherlands every week, a great way to work on professional skills. I am also continuing work on my internship project there: the Data Orchestra. Which allows me to work on a physical system like I wanted and push my knowledge in electronics and hardware. The Data Orchestra has been to the DDW, TEDx Amsterdam and is going to the Milano design week this April! This way I get a taste of the design world out there outside of the TU/e.

7. References

Storyply:

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A woman with a ponytail is seen from behind, sitting at a dark wooden desk. She is looking at a laptop screen. On the desk, there are several papers, a yellow cup, and a small bowl of fruit. A large window in the background shows a view of trees with autumn foliage. The text "2016 BasB.nl" is overlaid on the bottom half of the image.

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