# Untangled

## Upgrading computer literacy

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Design Field:          Interaction design

The Oslo School of Architecture & Design
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# ACKNOWLEDGEMENTS

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# Brief

**In cooperation with "Restarters", a maker community that focuses on repairing electronics, I have designed a concept of a digital platform, "Untangled", as a proposal for their existing service, "Fiksefest" - a social event that provides means for anyone to dive into the art of fixing electronics.**

My diploma is within the field of the interaction design with some elements of service design. The concept, "Untangled", is a website that consists of two parts. One that runs a troubleshooting sequence to find what is malfunctioning on the computer. Which provides with some useful information on necessary steps before the user joins "Fiksefest". Thus, making the whole "fixing journey" more time efficient. And another that consists of a knowledge base that aids the general learning process about computers. I believe that by helping people to learn about computers may in long term contribute to the reduction of the production of E-waste in Norway. Which has been a big problem for several years.

During the diploma I have investigated the state of the art of existing solutions to detect the possibilities and limitations of existing programs. Together with fixers and users, I explored a number of websites and applications that provide some similar functions. The insight from these workshops helped me to see what works and what doesn't for people with little to no computer knowledge*.

Since the very beginning of this project, I have specifically focused on creating a feasible concept for the nearest future. My final proposal can be categorized as a set of best practices, gathered from various solutions that were scattered across the internet. That now are tailored together into one digital platform that aims to be both informative and easy to use for those who seek to fix their computers.
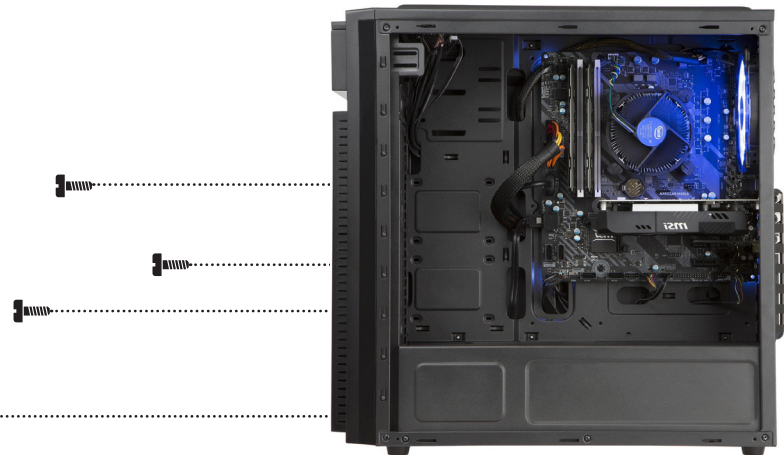
# Personal motivation

I have been a PC enthusiast for as long as I can remember. I built my first computer at the age of 12... Well with my father's help. The experience gained from that process sparked my burning passion for technology.

Since then, I have often been helping others with their PC issues and it always amazed me how mysterious and impressive computers seemed to them. So, I wanted to investigate it further and help others to see and understand the "inner beauty" of their computers.

# Katja Surina

A curious and open-minded representative of Tech-savvy generation with a passion for interaction design and digital solutions.

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## Goal

The aim of this diploma is to lower the threshold of learning about computers and its components for novices . In order to build up knowledge and skills required to fix personal computers. This in long term will contribute to the reduction of E-waste.

## Problem statement

How can a digital service help to reduce E-waste in Norway through helping with fixing of personal computers?

## Contribution

This diploma contributes to a discussion of the problem with E-waste in Norway and represents one of the possible ways to lead people toward the partial solution: through lowering the threshold for upgrading computer literacy*.

*Computer literacy* is many things... In this diploma, I use this term to describe the practical knowledge needed to fix, upgrade or build computers.
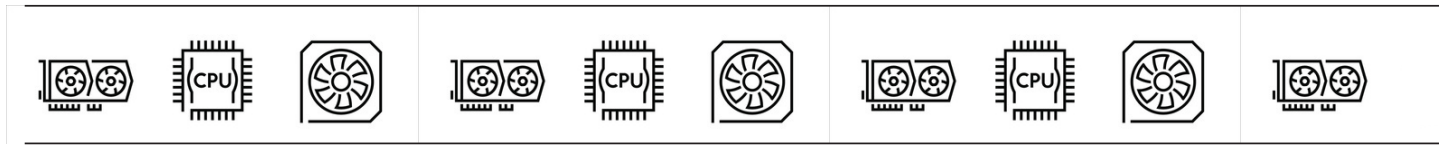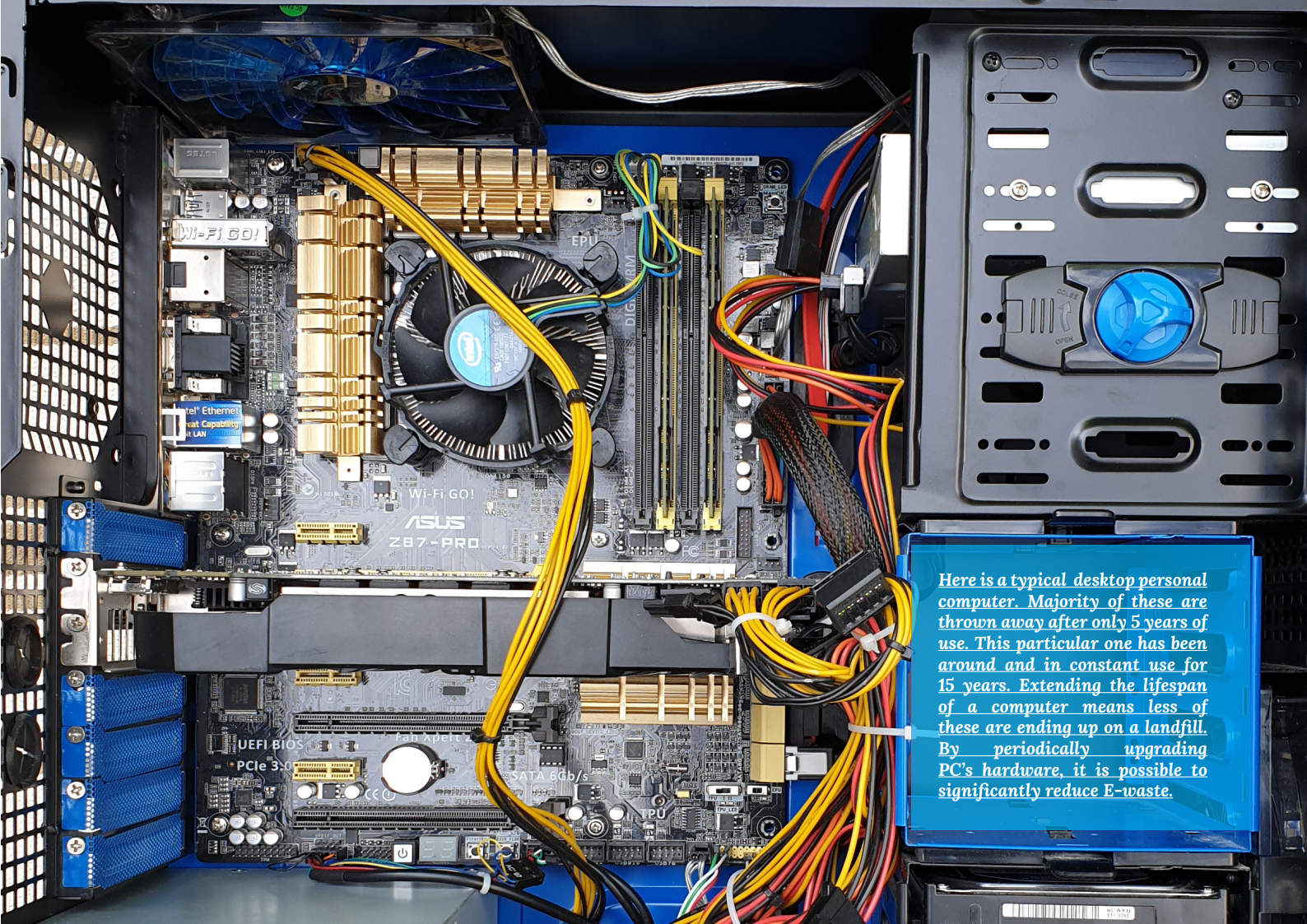
*Here is a typical desktop personal computer. Majority of these are thrown away after only 5 years of use. This particular one has been around and in constant use for 15 years. Extending the lifespan of a computer means less of these are ending up on a landfill. By periodically upgrading PC's hardware, it is possible to significantly reduce E-waste.*

# Approach&Feasibility

From the first day of this diploma I knew I wanted the final delivery be something digital and designed for the nearest future. Therefore, I chose to approach this task by exploring the situation today and reflecting upon the existing solutions together with the people from the chosen user group and the experts in the field. As the project started to take form, I proceeded to create lofi prototypes to map out how the concept should be, while constantly getting feedback from people I design this digital platform for. In order to better communicate the concept, I created scenarios to present examples of the concept in action.

My diploma followed a rather usual path of exploration, Ideation and concept development. This is not the chapters that my rapport is divided into, but an overall structure of the whole process.

## Phase 1

### Research



The first phase of this diploma was exploration of the computer electronics field. What is it one has to know when dealing with computer hardware. And why electronic waste is a growing problem. To answer these questions, I interviewed several people who are the experts in the field of computer electronics.

In order to find in which direction this diploma might go, I have contacted several maker communities. I continued working with "Restarters" and thus focus on helping people to learn to fix their computers. After exploring their core service, "Fiksefest", I mapped its journey out in order to uncover areas of opportunity. By meeting the users and the fixers from "Fiksefest", I outlined the requirements for the further development of the concept.

## Phase 2

### Ideation



During the this phase, I worked closely with the people from my primary target group. The main focus was to explore the state of the art of some usefull websites and programs. Almost all of these websites and programs were mentioned by the fixers in the "Expert interviews".

The insight gathered from the state of the art exploration gave foundation for the further concept development.

I have also conducted a workshop where I tried to explain how hardware works to novices. The total failure of this workshop showed to be usefull in explaining the computer related terms in the next project phase.

**Phase 3**

## Concept development
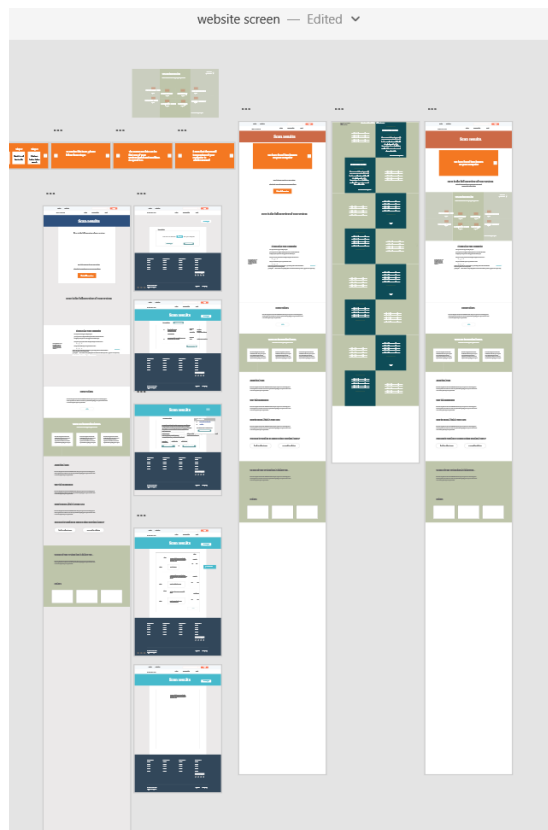


In the delivery phase I worked mainly with lofi prototypes and content structuring. For each version of the website thath was made, I ensured to get some feedback from the users.

I have conducted several workshops during this phase. One together with users, where we explored the structure of the conceptual website. Another, with fiksers, where troubleshooting sequence was established.

After second midterm, I mainly focused on refining the project and writing the rapport.

## REFLECTIONS

Though the phases of this project might seem linear and chronologic, they were hardly so. Some new insights kept appearing, leading to repeatition of the previous steps. But the overall timeline is as it is described here.

In retrospect, I wish I could have started working with a maker community earlier. As it had much influence on the outcome of the project. Also this would have given me more time to actually try the concept out during a "Fiksefest"

**Research**

**1 Interviews** *Experts experience with computing*

**2 Workshop** Building a PC with experts

**3 Establishing contact** Meeting and researching about various maker communities

**4 State of art** *Exploring what is out there of PC related explanations*

5 Midterm 1

**Debriefing**

**6 Field observation** Visiting fixefest and talking to attendants

**Ideation**

**7 Interviews** *Computer literacy of young adults*

**8 Interview** *Understanding Restarters*

**9 Workshop** *Introducing computing to novices*

**10 Interviews** *Needs, wants and motivation of young adults within computing*

**Concept developing**

**11 State of art** *Exploring what is out there of guides, troubleshooting and monitoring*

**12a Iteration** *Trying out existing PC related websites with novices*

**12b Iteration** *Trying out existing PC related websites with experts*

**Outlining rapport**

**13 Feedback** *Concept feedback from Restarters*

**14 Workshop** *Establishing troubleshooting sequence with experts*

Midterm 2

**Concept refining**

**15 Iterations** *Project feedback from novices and experts*

**Filling in rapport**

**Rapport delivery**

JANUARY

FEBRUARY

MARCH

APRIL

MAY

**1 INTERVIEW**

During this serie of interviews I conducted research about what information one should know when one is building, maintaining or fixing a computer.

**2 WORKSHOP**

This workshop gave me insight into the practical part of fixing a computer.

**3 ESTABLISHING CONTACT**

Cooperating with a maker community was one of the chosen methods. In this period of time I contacted and visited several maker communities in Oslo.

**4 State of the art**

With the insight from both interviews and workshops, I was ready to find needed information from the internet and literature.

**5 Midterm**

Midterm 1 was the first milestone and the time to make some decisions. To choose a community and thus the target group.

**6 Field observation**

The final stone in chosing Restarters was the Fiksefest event. Besides the observations of the event I introduced this project to several fixers. Ensuring future concept iteration.

**7 Interviews**

Since the course was set, I interviewed new people from the primary user group.

**8 Interview**

At this time a meeting with Restarters leader was arranged. This was done to better understand needs and wants of Restarters as a community.

**9 Workshop**

In this workshop I tried to teach novices about computer hardware. Sadly, there were less people than expected. But the outcome was clear, There is much confusion around terminology.

**10 interviews**

In order to understand my primary user group better, I held several interviews in order to clarify what the needs are.

**11 State of art**

Next step was to gather existing solutions and prepare them for the workshops with both novices and experts.

**12 Iterations a + b**

This is a series with workshops where websites and programs were presented to the participants and tasks were give to carry in those programs.

**13 Feedback**

Since the concept was rather clear at this stage, it was presented to the leader of restarters. The feedback was positive and encouraging.

**14 Workshop**

Troubleshooting is a big part of my delivery, thus additional correctional workshop was needed. The goal was to correct the question line of the troubleshooting.

**15 Iteration**

The final cooldown to the project delivery was set right after the Midterm 2. This time I used to refine the concept, by gathering as much feedback as possible.

# Exploration
# Part 1

# Establishing the foundation for the Diploma

This part of the exploration focuses mainly on why E-waste is such a problem and why it is important to try to contribute in its reduction. The statistics come mainly from the official articles and websites of the companies and departments working in the field.



# Reflections

It is important to include such data and statistics to backup claims and choices. This data came from the research of the articles, scientific papers and some legal documents.In retrospect I wish I used a little bit less time onthis part and rather do this research in either Pre-diploma or very early in the project. Alternatively, I probably should have arranged several mmeetings with people from this field.
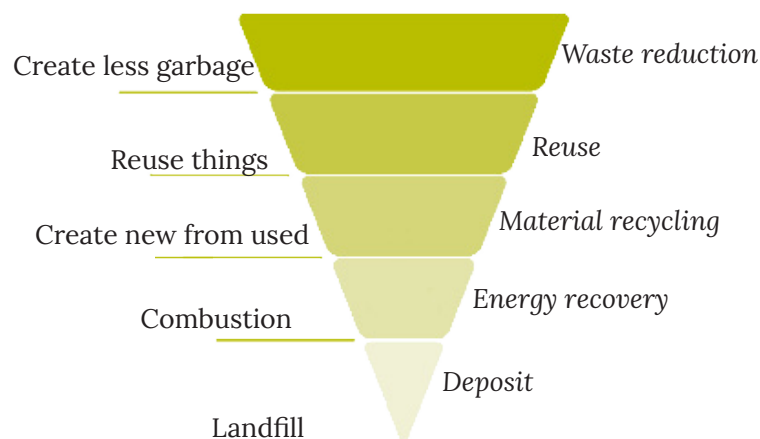
# Exploration

E-waste has been a huge problem in Norway for some time now. In fact, Norway is at the top of the E-waste production chart in the world. Every year it is being registered 150 tons of electrical waste just in Norway.  One third of this are discarded computers and PC peripherals. Sadly, majority of the PC components contain potentially harmful materials. Which make the recycling and disposal processes dangerous to both people and the environment.

A research paper from "Chemistry innovation Knowledge Transfer Network" shows that it is used 43% of all elements from the periodic table to make computers. And out of 28 elements that have limited availability and thus, future risk to supply, 23 are found in computer circuit boards. Therefore, a lot of useful resources go to waste when a computer ends its lifespan in a landfill.

Electronics contain precious metals, such as gold, in high density. Much higher than what can be found in the raw ore. Though, the current trends of making devices thinner and smaller make it less attractive and cost efficient to retrieve these materials. This discourages the recycling of the computer E-waste. Leaving more computers in landfills.

The reparation of computers is also quite discouraged both by the manufacturers and distributors. This happens through the fear of voiding the warranty. Leaving many avoiding to try to repair their PC units themselves. In many computers, especially laptops, the components are soldered together. Making the whole machine obsolete, if just one tiny part breaks. This leaves the owner with a choice of replacing a part for a price that is almost as high as the price for a new computer or simply buy a new computer. According to Norsirk, one of four official E-companies in Norway, around 40% of all E-waste that they receive is still working.

## Endagered elements found in circuitboards

Elements used in computer electronics  51 of  118 (43%)  *107 shown

Limited availability - future risk to supply  23 of 28 (82%)

Rising threat from increased use 3 of 7 (43%)

Serious threat in next 100 years 6 of 9 (67%)

**The World's Worst Electronic Waste Offenders**

E-waste generated per inhabitant in selected countries in 2017 (kg)

| Country | kg |
|---|---|
| Norway | 28.5 |
| United Kingdom | 24.9 |
| Denmark | 24.8 |
| Australia | 23.6 |
| Germany | 22.8 |
| France | 21.3 |
| Spain | 20.1 |
| Canada | 20.0 |
| United States | 19.4 |
| Japan | 16.9 |
| Russia | 9.7 |
| Turkey | 7.9 |
| Brazil | 7.4 |
| China | 5.2 |
| India | 4.9 |

@StatistaCharts   Source: OECD

statista

Norway has very strict regulations about E-waste registration and storage. One of the reasons for that is that when exposed to elements, it can start to leak toxic materials. Such as lead, cadmium or beryllium, which are commonly found in the processors.

All electronic distributors with physical stores, such as Elkjøp, are obliged to take in as much E-waste as they sell. Then the E-waste is sorted and delivered to recycling stations.  There are now three official recycling companies that are authorized in disposal of E-waste (erp, norsirk and renas). 85% falls into cathegory of recycling. The problem in this system is that when it comes to computer E-waste, its size is small enough to be put into the common trash.

Norway will be focusing on the increase of reuse of E-waste. In 2019 Norway got demand from WEEE directive (Waste Electrical and Electronic Equipment Directive) to reduce production of Ewaste through reuse. Last year the statistics show that only 1.5 of E-waste was reused. Some probes from Norsirk show that about 60% of all delivered E-waste was still functional.

There are several steps that are happening to any type of waste. This is illustrated in "the Waste Hierarchy". Norway is very efficient in recycling the materials, but not to reuse or above.



Create less garbage — *Waste reduction*

Reuse things — *Reuse*

Create new from used — *Material recycling*

Combustion — *Energy recovery*

*Deposit*

Landfill

14

# Exploration
# Part 2

# Direction and major choices

this part is where major decisions were taken that shaped the final outcome of the project. After contacting several maker communities, I continued to work with "Restarters". This helped me greatly to identify the user groups and outline the concept as a proposal to be a part of their service. Also in this chapter I discuss the State of the art and the basics of computer literacy.

# Reflections

I think it was a good choice to focus on the state of the art as I did in this project. This gave me foundation  and major insights of what users need from the concept.

**Exploration  part2 |**          CHOICES

My first rather big decicion in this diploma was done when I chose who to work with. I contacted several maker communities that work in different fields. The cooperation was my goal at the start of diploma and one of my methods.

My concept is to reduce ewaste through learning about pc. And this can be done in many ways. By continuing the cooperation with Restarters, I chose repairs as my main direction.

i explored the service that Restarters have and identified some potential areas of improvement
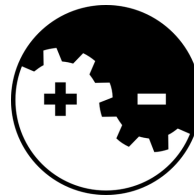


Fellesverkstedet                        Hackeriet

Restarters is a maker community that specialises in electronic repairs.It is a group of highly skilled people who volunteer to helpothers to repair electronic stuff.

The goal of Restarters is to share passion for repairing through actually doing it. Every mounth they arrange an event called Fiksefest, where peopleare welcome with their electronics.

The motto of Restarters is to fix relationship with electronics. The original branch of restarters is situated in London. They are called the Restart project. They also gather data about repairs in order to push politicians into more sustainable ideas, where ALL electronics are repairable.

During my diploma, I had interviews and workshops with both attendands, fixers and their leader Kaja Juul Skarbø. It gave me insights about how communityworks, its limitations and possibilitiesalike.

The biggest opportunity I found was the effectivization of Fiksefest. Fiksefest has a rather low rate on how many devices are repaired due to lack of needed parts.

Also, though they receive about 3-4 computers on each Fiksefest, they have never had a purely computer themed event.



# Kaja Juul Skarbø

"we can fix around 60% but if we would have needed parts, it could be up to 80%"



Restarters had several themed Fiksefests. One of them was all about toys. This day children could come and try to fix some of their broken stuff. So I wondered, why not try a themed Fiksefest for just computers? This has not been done in Norway before.

We are hands-on

We do-it-together

We have fun

We are system-changing

Fiksefest is a social event that is arranged by Restarters. Anyone can attend This event. As long as they bring an electronic device that needs repairing. There are two types of people at fiksefest. It is attendands and fixers. First group vary a lot in age, background and experience. The need for reparation of their electric device is what is common in them. In this project this will be my primary user group. The second group consists of fixers. They are highly skilled people with various background. They help with Fiksefest volunteeraly, with pure motivation to have fun fiksing things and helping others. When one arrives to Fiksefest, their broken electronic device is registered on a board. The name of the attendant, the device and type of malfunction are written down. Then a fixer greets the attendand and offers help with the repairs. It is important to note that in this situation the attendand is actually fixing his/hers electronics self, with a guidance of an expert.

# Target group

Primary – the users

Tinkering with computer electronics is not for everyone, it demands a certain approach and a lot of patience. Though any of us can come in a situation where our computer suddenly fails us. The primary user group, therefore, is the people who really want their computers to work again, but lack knowledge and skill to fix it by themselves. During the interview with the fixers from Fiksefest, it showed that most of the hardware issues appear after the end of computers warranty. Thus, leaving my target user group in a situation with no free support, where they are encouraged to buy a whole new machine and dispose of the old one.

During my early research it has showed that the age has a lot to say.  If the interest for computers did not sparked itself before the age of 3o, it will less likely appear after that. During short interviews, where I tried to ask as many with different backgrounds as possible (around 40 people) if being able to fix and upgrade their pc would be something for them, some of the answers were negative.  When I asked fixers at what age they became interested in Technology and computers, majority answered that the interest appeared at teenage years. Therefore, I assume that the probability for people in the primary target group being between 18 and 25 is very high.


"oh, no,no,no. I have thumbs for my fingers. I rather pay for a ready PC than do it myself!" Konrad, 36
"I never have been interested in computers, I always had someone to fix mine, so no." Ida, 29


Main criterias for primary user group, the Fiksefest attendants:

Probably between 18 and 25

Have a desktop pc that is:

-  outside warranty

- probably with an issue

- two or more years old

Wish to enhance the performance of their computers (or fix the issue)

Curious if computer fixing is for them

Open-minded individuals

Happy to try new things

Paid fixing service is either last resort or out of equation

Secondary - fixers

Fixers at Fiksefest are my secondary user group. They are a group of highly motivated experts in the electronics field with various backgrounds. These people volunteered to help others at Fiksefest with their issues. From the interview with Kaia, the leader of Norwegian Restarters group, it became clear that these people find fixing extremely interesting. They may not be the most extroverted persons, but they just love a hands-on approach and tinkering. Therefore, they would rather help others fixing, than lecturing about it. I personally think that It is important to design a concept that has some benefits for them too.

# Main components

Here is the overview of the main components of a computer. This information is gathered from the expert interview with an Engeneer, Marius Hansen.

A processor – (CPU) is the electronic circuitry within a computer that carries out the instructions of a computer program by performing the basic arithmetic, logic, controlling, and input/output operations specified by the instructions

Processor fan – is an effective cooling of a concentrated heat source such as a processor, CPU.

A graphic card – (GPU, Graphic Processing Unit) s just one of the parts that make a computer work and tick over speedily. Its main responsibility is ensuring content displays and renders on your computer screen or monitor correctly. This includes everything - from the user interface, to applications and webpages and of course high-intensity games.

**MARIUS HANSEN**

Memory- (RAM, Random Access Memory) it is an extremely fast type of computer memory which temporarily stores all the information your PC needs right now and in the near future.

Storage - (HDD, Hard disk drive and SSD Solid State Drive) is part of a unit -- often called a disk drive, hard drive or hard disk drive -- that stores and provides relatively quick access to large amounts of data on an electromagnetically charged surface or set of surfaces.

Motherboard – is the main printed circuit board (PCB) found in general purpose computers and other expandable systems. It holds and allows communication between the hardware.

Power source - (PSU, power Supply Unit) is the piece of hardware that's used to convert the power provided from the outlet into usable power for the many parts inside the computer case.

Case - or cabinet, is the enclosure that contains most of the components of a personal computer

Case cooling - is a set of fans that cool the computer.

I will be focusing on these components in my delivery since they are the main components that are found in every machine.

ALEXIS DIAZ TARE

**Multiple lifespans**

In the early research phase I asked 7 experts about their opinion of the longelivity of the computer components. To back up this biased information I posted same question online where I got many good replies. Judging the methods and sources I think this information is a bit unrelyable. Though It shows a clear tendency, the parts have different lifespans. And they differ by up to several years. Thus If a component fails in a PC within first 3-5 years, the rest of the components are probably fine in most situations. Causing no need to dispose of the whole machine.

year before the owner wish to upgrade

Before hardware actually fails

window when  a new pc is bought

Usual computer

0y ——————— 5y ——————— 10y ——— +++

Processor (CPU)
Graphic card (GPU)

Memory (RAM)
Storage (SSD/HDD)

Motherboard
Power supply unit (PSU)
Case

Case fans
Processor fan
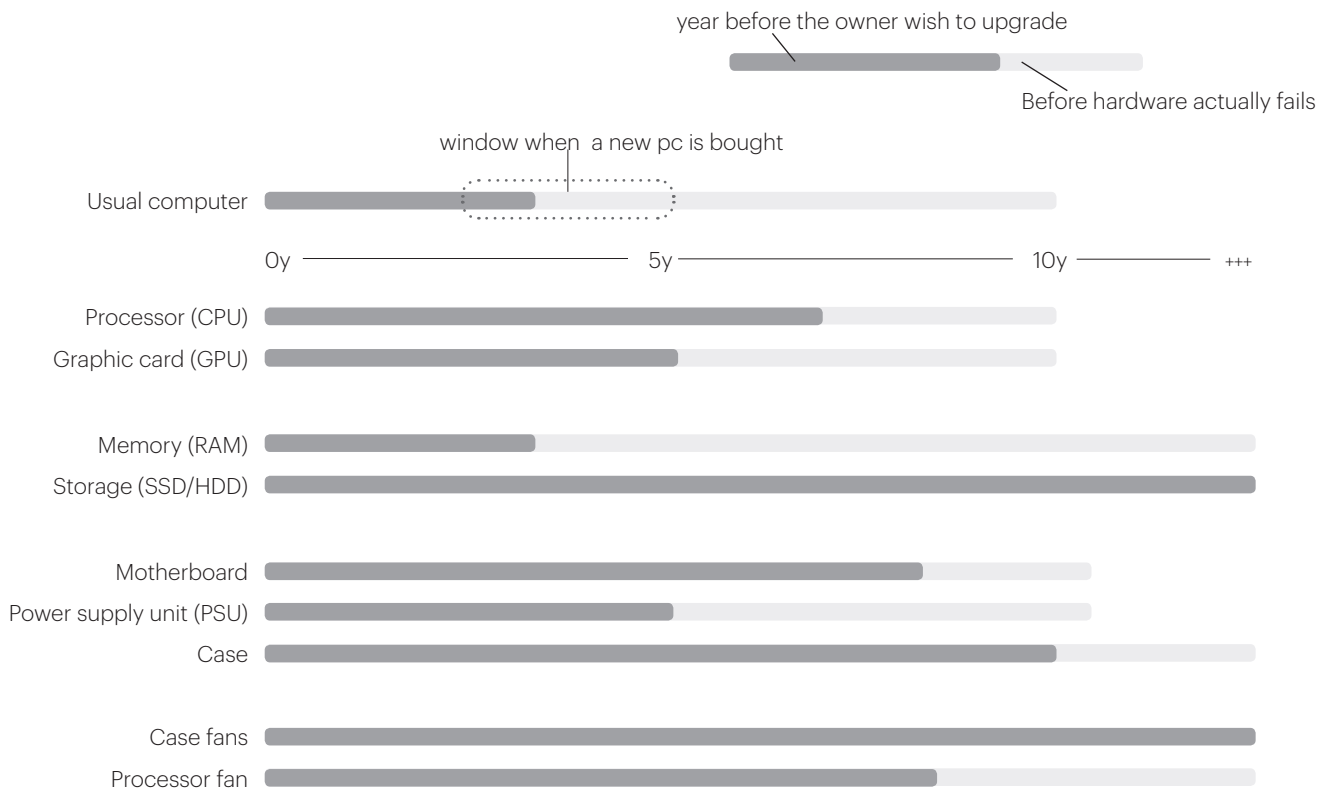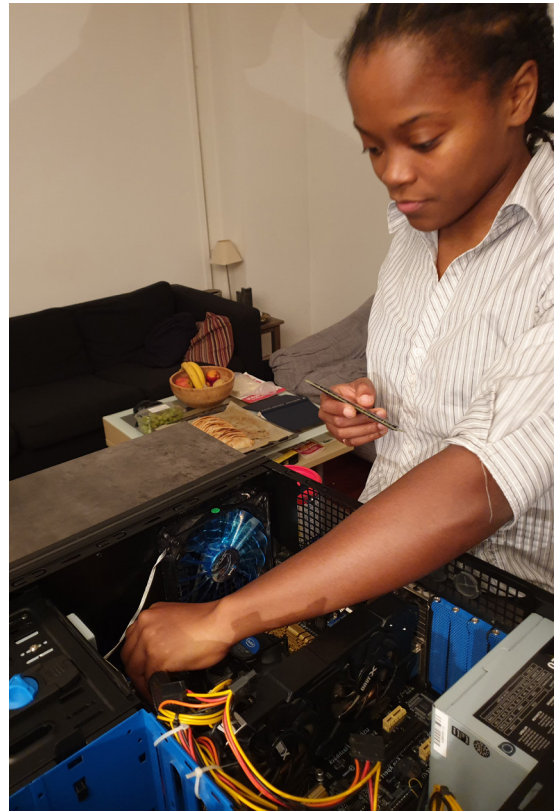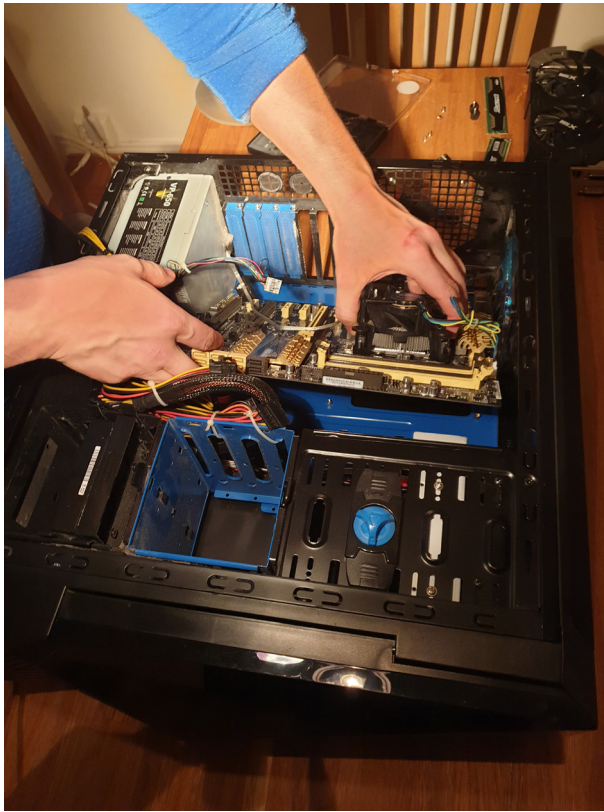
I conducted an workshop where I tried to teach about computer components, but it became clear that it was an information overload. At the end of the day people couldn't distinguish between a RAM (Random Acess Memory) and a Praphic card (GPU). I believe that the amount of information should have been scaled down and terminology explained in every step.

# Requirements

State of the art
One of my main chosen methods was to reuse the best practices from existing relevant programs and websites. These are many. And most of them are free to use. Also many of these are not directed toward novices. Making it hard to understand for people with less computer knowledge.I divided these websites/programs in five groups:

Guides
Guides is one of the forms of information seeked by novices. Together with people from my main user group, we analized and tried out guides from several sources. The goal was to find out what elements should be included and not in guides.
fixit, instructables, wikihow

Monitoring programs
Monitoring is a way to display computer statistics in order to identify problems early. Together with people from the expert group, we seeked out what is possible to measure. Measurements then were sorted in four cathegories.
1. Measurements that are static, that do not change over time. Name of hardware and its characteristics are in this cathegory. This static information is useful when upgrading hardware.
2. Measurements that are dynamic. The current temperature, the usage of components and speed of fans are good to keep an eye on. The changes in this information forecast issues of hardware.
3. Measurements that are important to show to a novice at all time. This include both static and dynamic information. Though, it is showing only part of the whole picture.
4. More advanced measurements that could be of use for a more experienced user. For example Fixer during Fiksefest.
bios, speccy, HWinFo, Asus Rog, MSI, Intel extreme, the open,

Troubleshooting
Troubleshooting is to search for problems in a personal computer. Most of the scanning software does not include the user when scanning for issues. It simply presents the results. Therefore, to seek inspiration, I turned to the websites that do the similair thing, but in a different field.
symptomate- another form for troubleshooting, but not a computer- a person. Though the final diagnosis system did not give any sence for any person that tried it at workshops, the way it gather symptoms is very clear and cute. "I love the way it divided symptoms into areas on a body" **symptomate is a clear inspiration for my troubleshooting process.**

Benchmarking
Benchmarking is a way to gather the information about a computer by stressing it with specific tasks. It both shows the static information about hardware and its current state. It means it shows how well the current hardware performs compared to other hardware of same type. During a workshop with main user group about benchmarking it became clear that these programs are very hard to understand to novices. The terminology used and lack of explanations scares people away from these usefull programs.
programs tested:
passmark, userbenchmark, prime95, 3dmark, pcmark
**For the final deliver I chose userbenchmarks as a way to measure the computer, but the way information will be displayed has to be changed.** Explanation has to be added about each measurement. One of the comments from primary usergroup was: "This website is totally useless to me! I need a guide to understand this."

Other inspiring/usefull website
pcpartpicker, this website contains a good database of hardware.
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I knew that my end result would not be a working prototype, thus testing functions of existing programs and websites gave me enough insight and feedback to measure the understanding improvement and clarity og the content.

Programs that scan computers to detect hardware and its performance are reading same information that can be found in Bios. BIOS (basic input/output system) is the program a personal computer uses to get the computer system started after you turn it on. It also manages data flow between the computer's operating system (Windows) and internal hardware such as the hard disk, graphic card (GPU), Processor (CPU), fans and others. Though unlike BIOS, specialized scanning and monitoring programs show information in cathegories, so it is easier to read for the viewer. Here are how some of such programs lool like along with BIOS:

 BIOS – is used to perform hardware initialization during the booting process, and to provide runtime services for operating systems and programs.

 Speccy – specializes in the monitoring of computer system and its hardware. It detects the name, features and some real-time data from hardware. One of the "cleaner" versions of monitoring programs.

 HWinFo - Professional System Information and Diagnostics. Comprehensive Hardware Analysis, Monitoring and Reporting for Windows and DOS. Used by Nasa to monitor computer systems for failures in high radiation fields.

 ASUS ROG Gaming center - ROG Gaming Center software provides user options for releasing memory, running applications, overclocking, shortcuts, lighting effects and boosting fan performance (depending on the software and functions supported by the machine) to meet different users requirements.

 MSI Dragon center - is a Windows hardware control and management program. Developed by MSI, this tool allows its users to monitor the status and change the settings of their computer hardware.

 Intel® Extreme Tuning Utility (Intel® XTU) - is a Windows-based performance-tuning software that enables novice and experienced enthusiasts to overclock, monitor, and stress a system. The software interface exposes a set of robust capabilities common in most enthusiast platforms along with new features available on new Intel® Application Processors and Intel® Motherboards.

 The open hardware monitor -  is a free open source software that monitors temperature sensors, fan speeds, voltages, load and clock speeds of a computer.

 The information that is displayed by these programs about hardware can be found at three different places in a computer without such programs. Still some details, such as name of RAM, one has to open the computer cabinet to be able to find.

(device manager)(System in control panel)(System information)

 **Speccy is providing all necessary information of the system and should be used as a base for this project to gather the general system information that is usefull for user.**
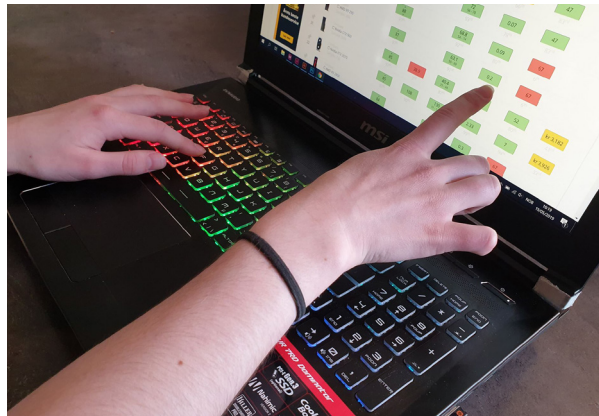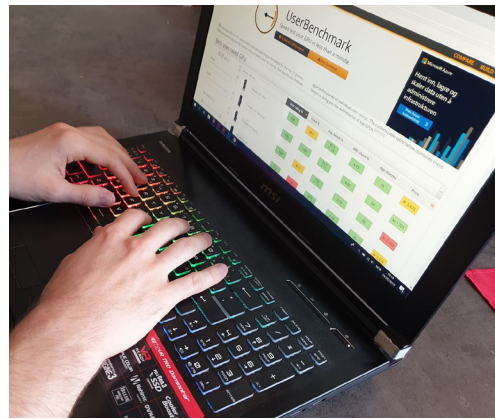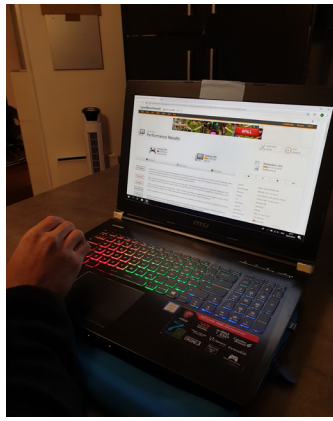
Workshop requests were to find what hardware this computer has
3 steps, uncomplete information
Observe how websites were used to
find a compatible part for upgrade
Understand the results of the scan and what should be done
go through self diagnosis sequence

These tasks are all part of how to maintain a computer.

# Disclaimers

**Only desktops**
In this concept I have chosen to work only with desktop computers. The main reason for this is that there is just too many variations of computers for this short period of time. Desktops and laptops, though having same components, still have one major difference. Due to small size, many laptops have some of its hardware soldered together. Thus making it extremely hard to repair, or in most cases irrepearable. I see this limitation as a future potential for concept expansion. There are still some easily repairable laptops out there, but they are not the most used ones. And "laptop hardware" is harder to purchase from local Norwegian stores than the desktop hardware.

**No Apple products**
Due to huge difference in operative systems there are programs that can't run on Macs. Since I am working alone in this project  and that I have chosen to continue with desktops, I chose to use Windows friendly programs. This limitation is temporary (this project only), because there are enough other programs that are compatible with Apple computers.

**Troubleshooting sequence is adressing only hardware issues**
When it comes to the origins of issues in computers, it can either be a hardware or a software problem. Hardware problems usually show themselves in a different way from software problems.  There is no way a hardware problem can be mistaken for software problem. The hardware will either work or not. When it comes to software problems it has usually something to do with either drivers*, the operating system**  or a register library***. If it is drivers that malfunction, the computer will most likely give a notification about this. If not, a quick system scan can easily detect and resolve this issue. An operating system problem or a problem with the register library are two other types of software problem. The issues with these are easy to separate from hardware issues too. Though they require more steps in order to be resolved. For this project I will only focus on hardware problems.

**Visual identity**
The final delivery includes a set of screens that are there to better describe the idea of the proposal. The visual identity is thus is less important than the structure and content. I have been focusing on including the main elements and structuring them in a user-friendly way. Therefore, the visual identity is not final

.

*a driver is a computer program that operates or controls a particular type of hardware)*
*** an operating system is a software that supports computers basic functions. (Windows, Linux, macOS)*
**** a register library is a set of registers. Registers are used to quickly accept, store, and transfer data and instructions that are being used immediately by the processor (CPU), there are various types of Registers those are used for various purpose.*

# Outlining the concept

**1 Troubleshooting is an underlying basis.**

One of the most motivating reasons for the users to start the learning process about computers is when something does not work. Thus, to search for issues should be the main function of the digital platform.

**2 Watch the language!**

A good place to start for writing the text for the user is to assume that most users have little to no knowledge of the computer hardware. Thus, the texts must be explanatory and written in a friendly language.

**3 Respect the fixers and Fixefest rules**

People that play fixers role at Fiksefest are doing so of their own free will. They are here to have fun and try to help with the issues as good as they can. Therefore, when attending to a fiksefest, one must remember that it is the user that will repair the PC with some guidance and help from a fikser. And in rare cases, if issue could not be resolved - it is ok. This is not a traditional repair service; Here the learning outcome of the user is what matters. A fixed issue is a great bonus though.

**4 Limitations**

Computer problems can be wicked and hard to describe for new beginners. The issue may lay in hardware, software or in both. Thus, in some cases, the troubleshooting sequence can't be 100% correct about what is malfunctioning. Especially when majority describe their computer problem as "it is being too slow".

# Delivery

# Direction and major choices

In this part I present my concept and show how it works in two scenarios. During the scenarios the screens are shown.

# Reflections

During the ideation phase I had a lot of ideas for implementations that had to be reconsidered to be added later due to time frames. I wish I have started with Prototyping of the final concept earlier.

# The concept describtion

"Untangled" is a concept of a digital platform that combines an online database and an existing social event, Fiksefest. Which is provided by Restarters.

The database consists of two parts.

One of which stores a number of selected articles that explain computer components. Also, several step-by-step guides on how to handle the hardware and relevant video tutorials. Its main purpose is to provide a beginner-friendly source of information about computers.

The second part is dedicated to troubleshooting. Troubleshooting is a term for searching for malfunctional or damaged software and hardware. This part of the website will provide an existing program that scans the user's computer. During the scan it detects problems and analyzes the performance of the components. Though in some cases, the hardware problems cannot be detected by a scan. For example, when computer's processor is broken, the scan will be impossible to run. The computer will be simply not able to even load the operating system. Thus, a manual registration of the symptoms (observation sequence) must be available both as a primary and secondary source describing the health of user's computer. The level of the observation precision of the troubleshooting is directly dependent on the users. Most of whom are completely new to this field. Therefore, this part must be written in a very comprehensible language.

Untangled

A database about computers                    A troubleshooting sequence
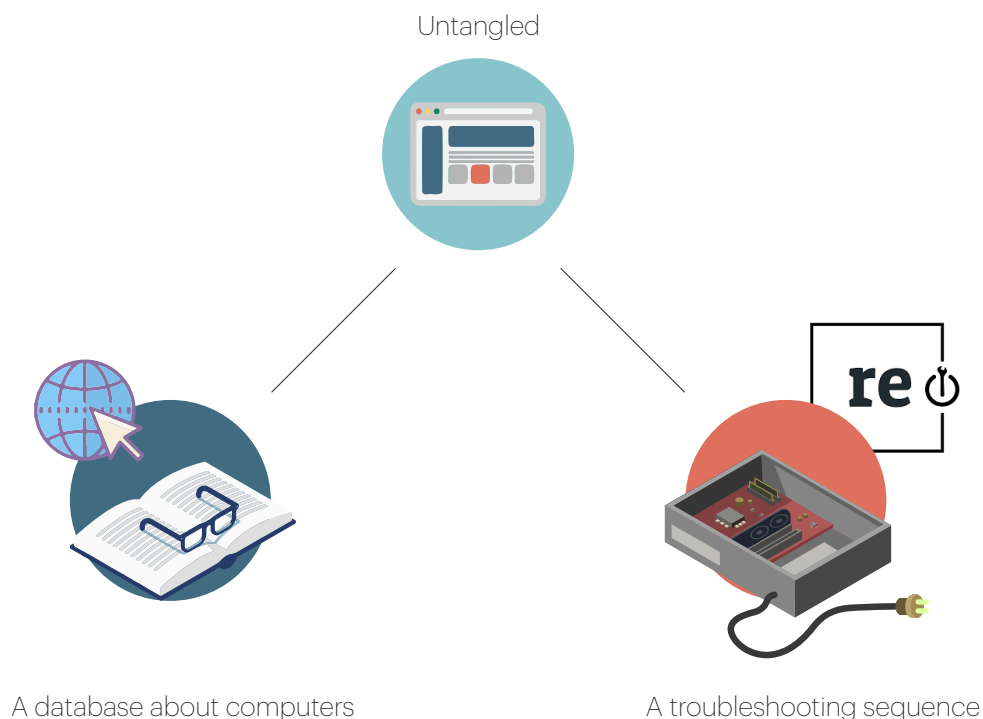
**The growing content**
In the beginning of the "Untangled" project implementation, the "knowledge" part of the database will mostly consist of links to the existing guides and articles from other websites. In time this part will be filled with content produced by fixers and enthusiasts approved by Restarters. The source of the content that fills the guides will be the issues that users come with to the Fiksefest.

**Fixers motivation**
Beside the intrinsic motivation that the fixers have for helping resolve these type issues, they potentially are enccouraged into creating guides and articles on this topic. Providing that the threshold for creating a guide is low enough, the guides could be seen as a thorough way of documenting of Fiksefests. In addition, this can prove useful for fixers in the future. Created content can be used in a personal portfolio in job search circumstances.

**Future Ideas for guide making**
In order to make the threshold for guide making easier, I suggest to use the opportunity at fiksefest itself. When a fixer and a user are working together over a computer, it is always one person that is outside the computer. It is simply room for only one person inside a computer case. This can give the possibility to either person to take photos of the process. These photos are then saved in a common file that will be rewritten later.

When fixing it is simply too distracting and time consuming to write down notes. This can be made easier by simply recording the fixers voice. The footage then can be automatically captured as written comments. Later after the Fiksefest, both the pictures and the comments will be used to write a guide.

Fikser

User

Fikser

*Step 7:*
*Remove the four screws*
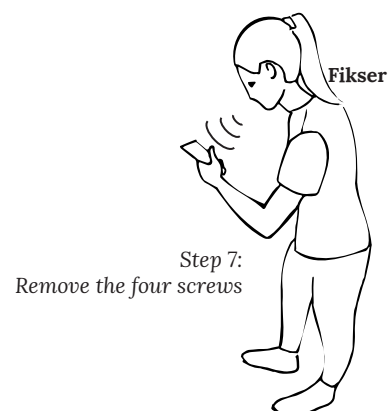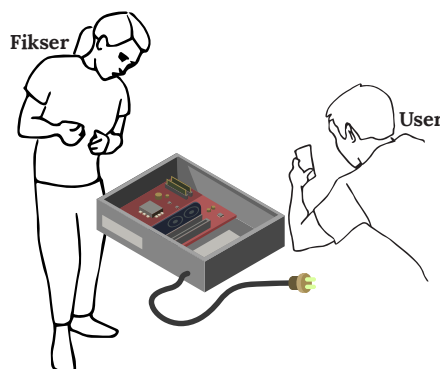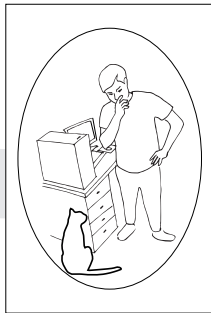
One day Nils notices that it is something wrong with his computer. It became significantly slower than before.

After working for a while over presentation, he was going to plug in his headset. Suddenly, he felt that computer case is much hotter than usually. He also does not hear any usual humming sounds from his PC.

After several attempts to try to use the computer, he understood that something must be done.
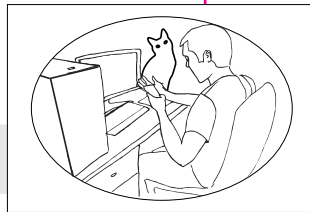
Later , a friend of Nils told him about a norwegian website where he could get help with his computer issues. He also mentioned that it was for free.

Nils thought that it was worth a try and went to the Restarters website. There he found a link to "Untangled", a digital platform that helps with computer issues.
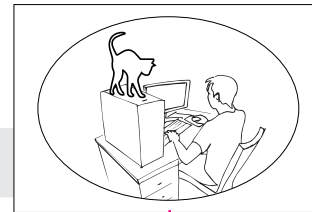
After finishing reading a short introduction to the website, Nils proceeded to the troubleshooting sequence. He clicked on "FIX" button.

The landing page of restarters



The landing page of Untangled
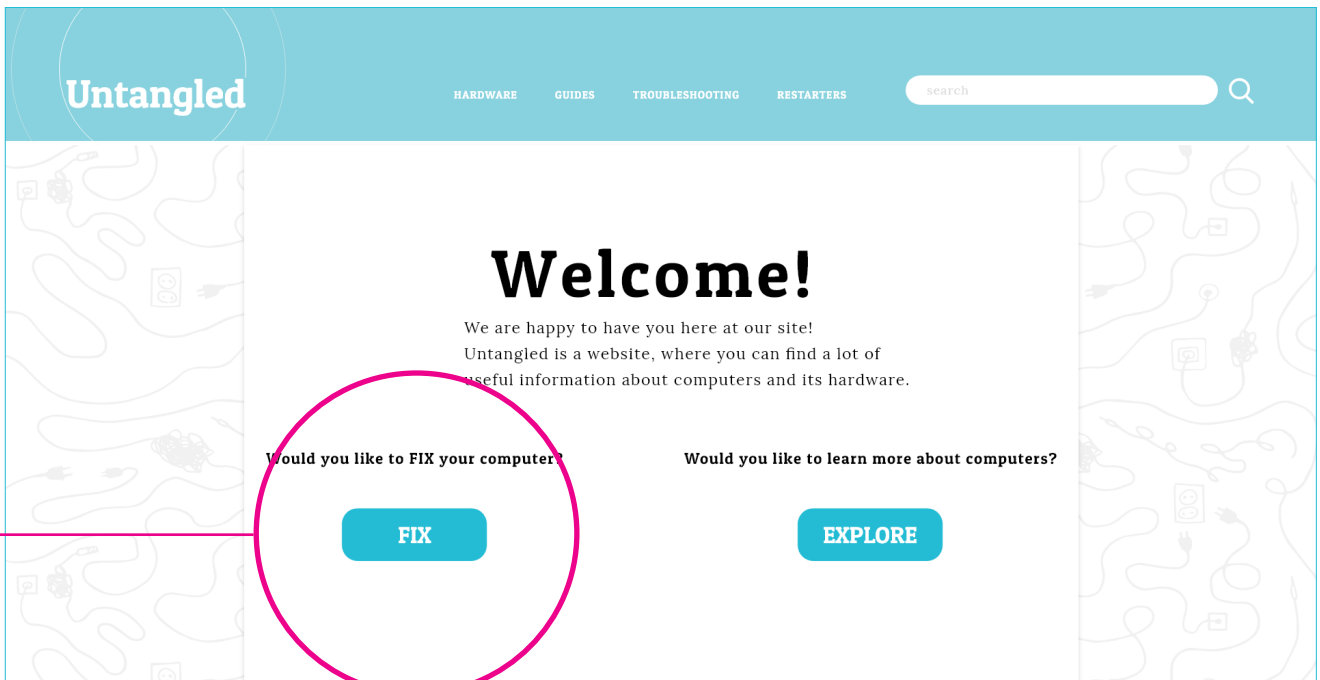


Being a part of Restarters and Fiksefest, It is natural that the link to Untangled is placed on their website. To show that it is a new feature, Is marked with different color than other destinations on the navigation bar. I chose to usea blue color because it is an accent color on the original Restarters website.

1      This is a start window for troubleshooting. Since Nils have a computer that functions, he chose
       to run a scan of his system. The other two choices are also useful, but not recommended in
       his situation. Since he did not know what was malfunctioning, option 3 willnot help him much.
       Option 2 is a backup solution for option one, in case a malfunctioning computer does not
       startor is unstable. Choosing second option would result in less information and therefore less
       precision in the solution.

**TROUBLESHOOTING**                    ✕

# Getting started

In order to find what hardware is malfunctioning,
please choose one of the following options

By downloading a scanning program, you
ensure the most precise results. The program
will check  the performance of your hardware.
It will also list down what kind of hardware you
are currently using. This information will be
very useful, in case if you will have to upgrade
the malfunctioning hardware.

>      **Scan my computer**

       **Use only observations to find the issues**

       **I know what is malfunctioning, take me to the guides.**

       **Proceed**

3      Now Nils can add any comments about his computer. He wrote that computer is getting too
       hot and before he was ready with the sentence, the correct phrase appeared. On the right side
       the results from the scan are collected.

◀ Back      **TROUBLESHOOTING**                    ✕

Scan sttarted    Requirements    Observations    Graphic    Troubleshooting
                 noted                           test       in process

# Observations

Do you have any observations regarding you computer?

Hot|                              🔍

HOT to touch the case

becomes HOT very quickly

**Proceed**

**Summary**

Type of tasks:      Photo editing
                    3D rendering

List of requirements

Observations:       Hot to touch
                    Too quiet
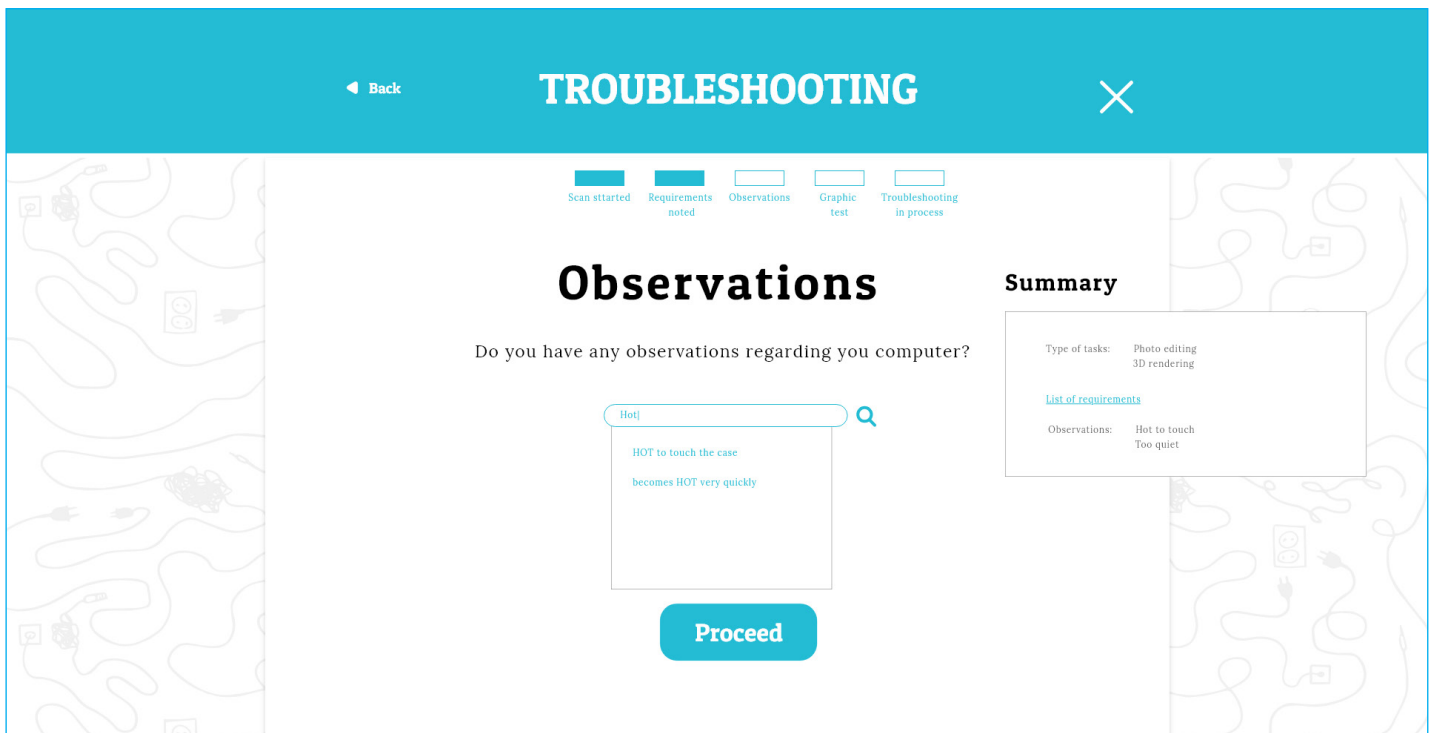
2  After the scan was initialized, Nils was asked to tell what is he using his computer for. This question is crucial to determine how well his computer perform under stress. While the scan is doing its work in the background, Niels proceeds to the next question
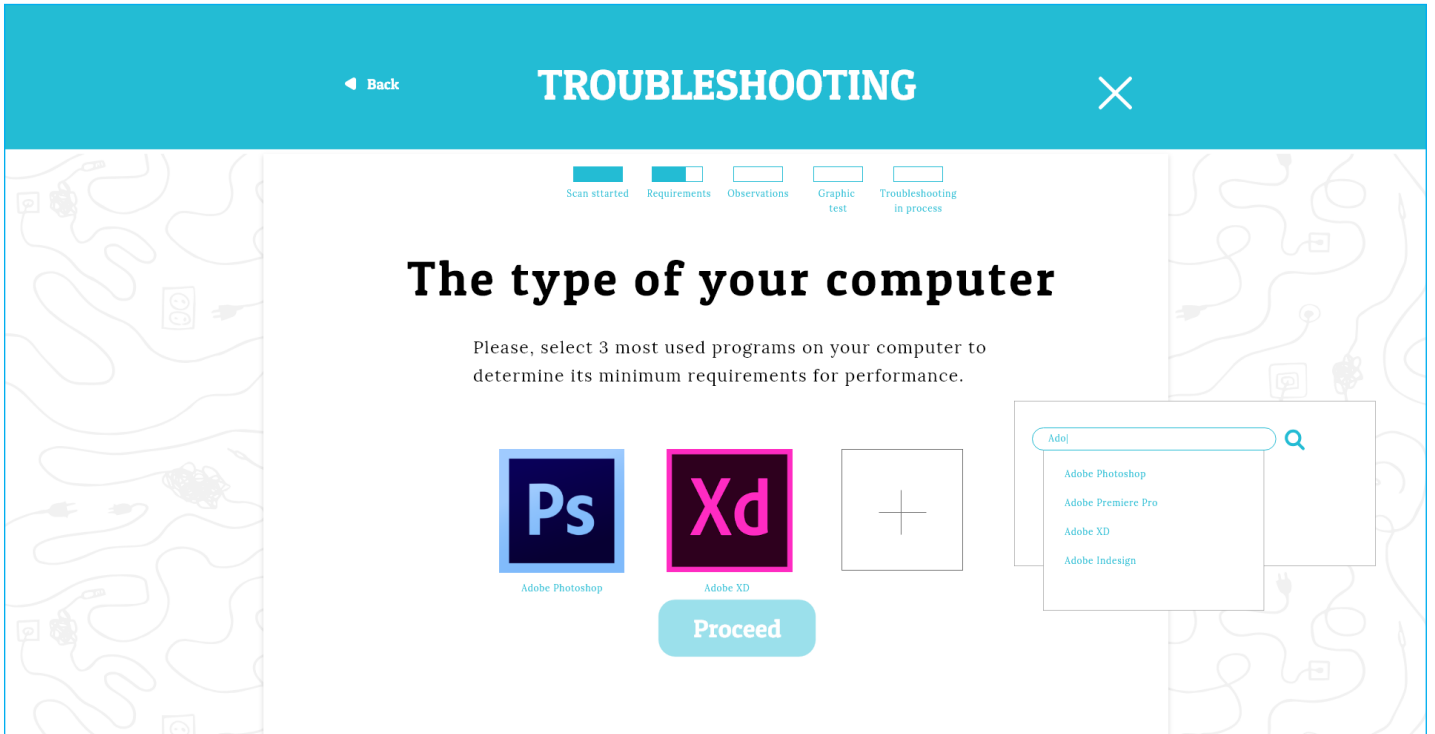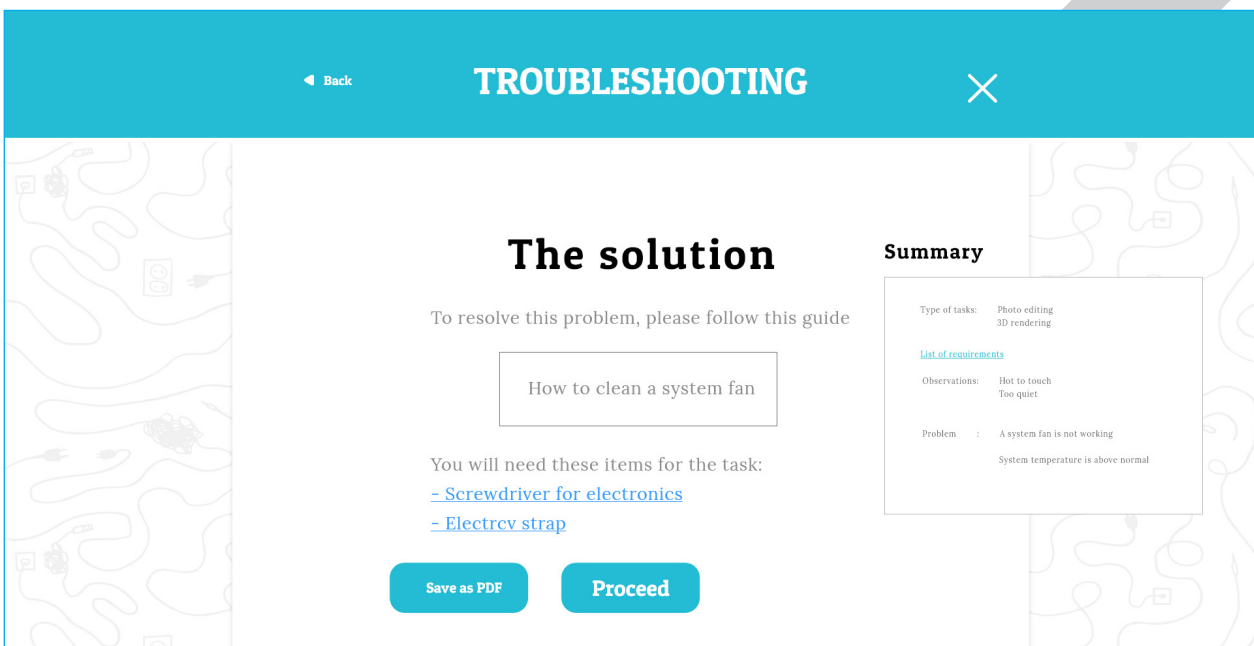


4  The last step of the testing is the test of graphics. During such test the screen flickr several times, thus this teest was separated to the end from the rest of the scan. After test is done, The problem is detected.
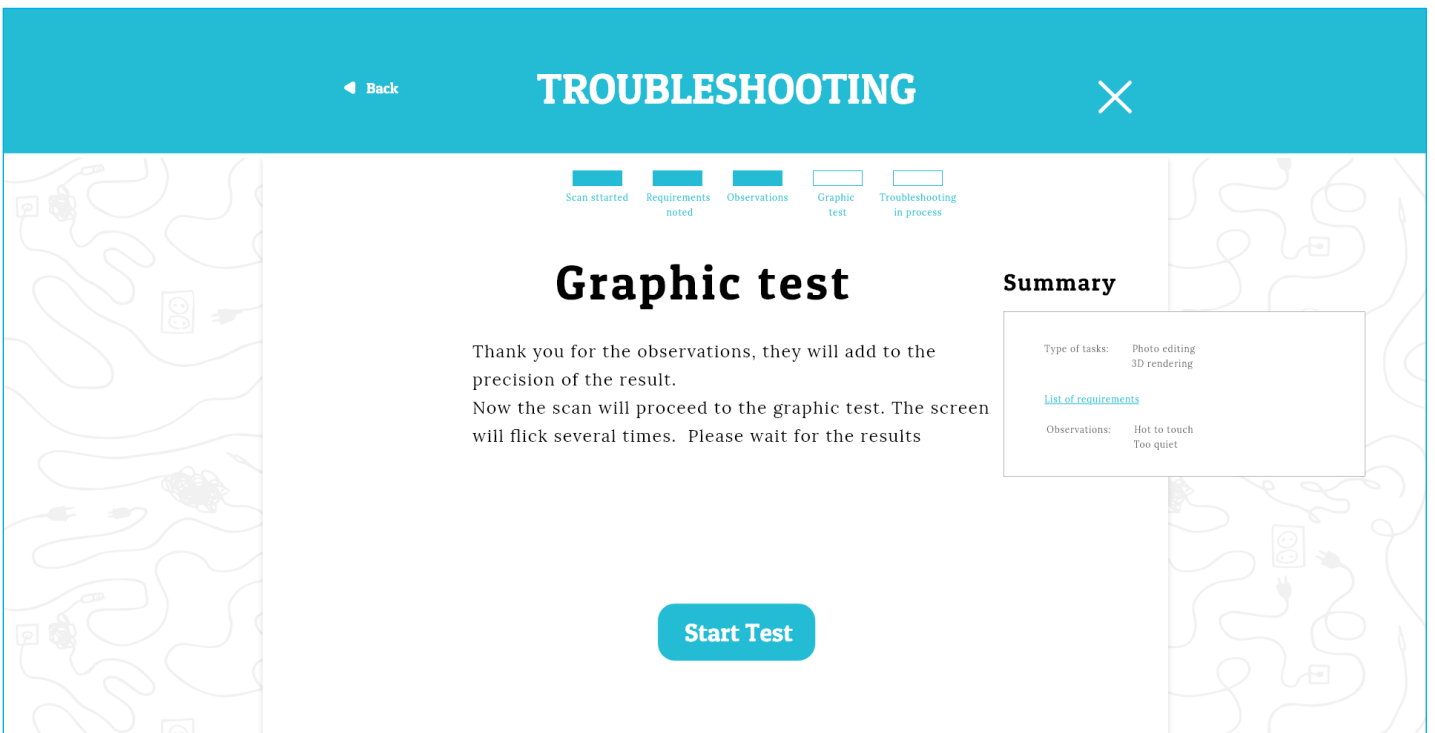
5    The results show that it is a malfunctioning system fan inside the computer. The second issue notifies that the temperature of the computer is indeed higher than normal. Which is bad for the hardware.

◀ Back            **TROUBLESHOOTING**            ✕

## Results

The scan has detected two issues:

1          Overall system temperature is far above normal.

2          One of the system fans is not spinning.
           It's speed is 0

**Proceed**

**Summary**

Type of tasks:       Photo editing
                     3D rendering

List of requirements

Observations:        Hot to touch
                     Too quiet
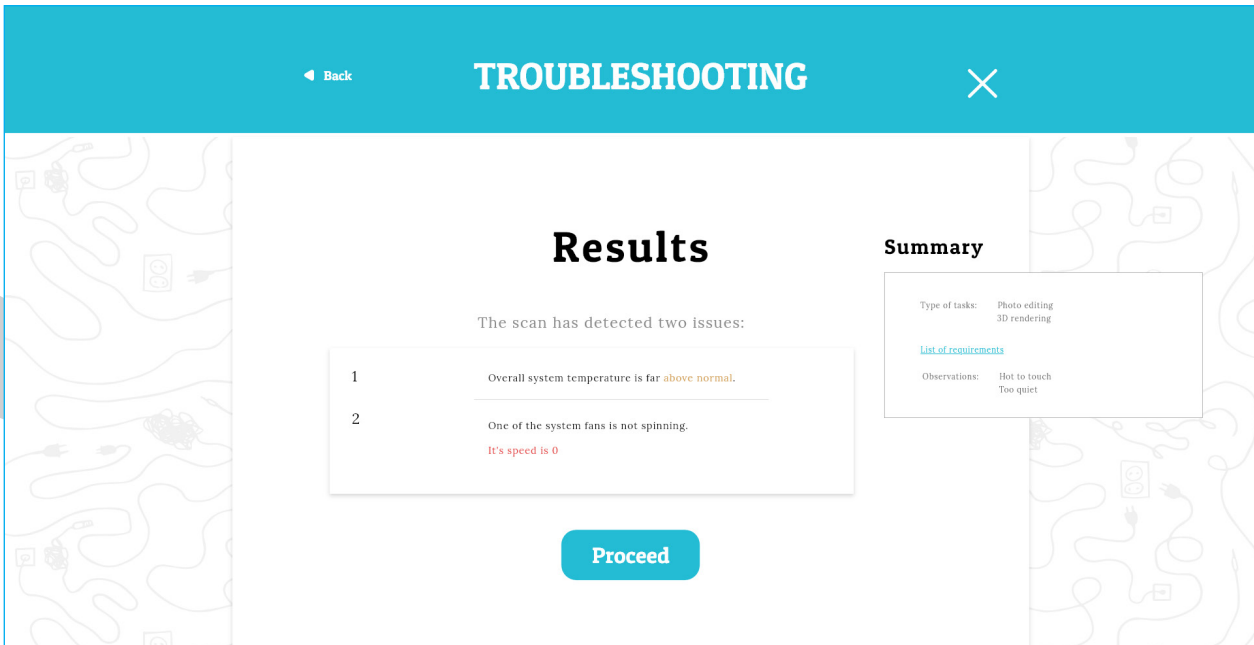
7    The solution window shows what tools are needed and how many guides are availible to solve this problem. Nils can proceed to follow the guide. In the beginning, all the guides will be external links to existing guides. Bust as time goes on, the library will be filled with new, tailored guides. Right now, Nils was redirected to an instructable guide.

◀ Back            **TROUBLESHOOTING**            ✕

## The solution

To resolve this problem, please follow this guide

How to clean a system fan

You will need these items for the task:
- Screwdriver for electronics
- Electrcv strap

**Save as PDF**        **Proceed**

**Summary**

Type of tasks:       Photo editing
                     3D rendering

List of requirements

Observations:        Hot to touch
                     Too quiet

Problem      :       A system fan is not working

                     System temperature is above normal

6    Based on the issues found and  the observations noted, The troubleshooting sequence decidees that the fan is the main problem of it all. The certainty level shows how precise this diagnosis is.
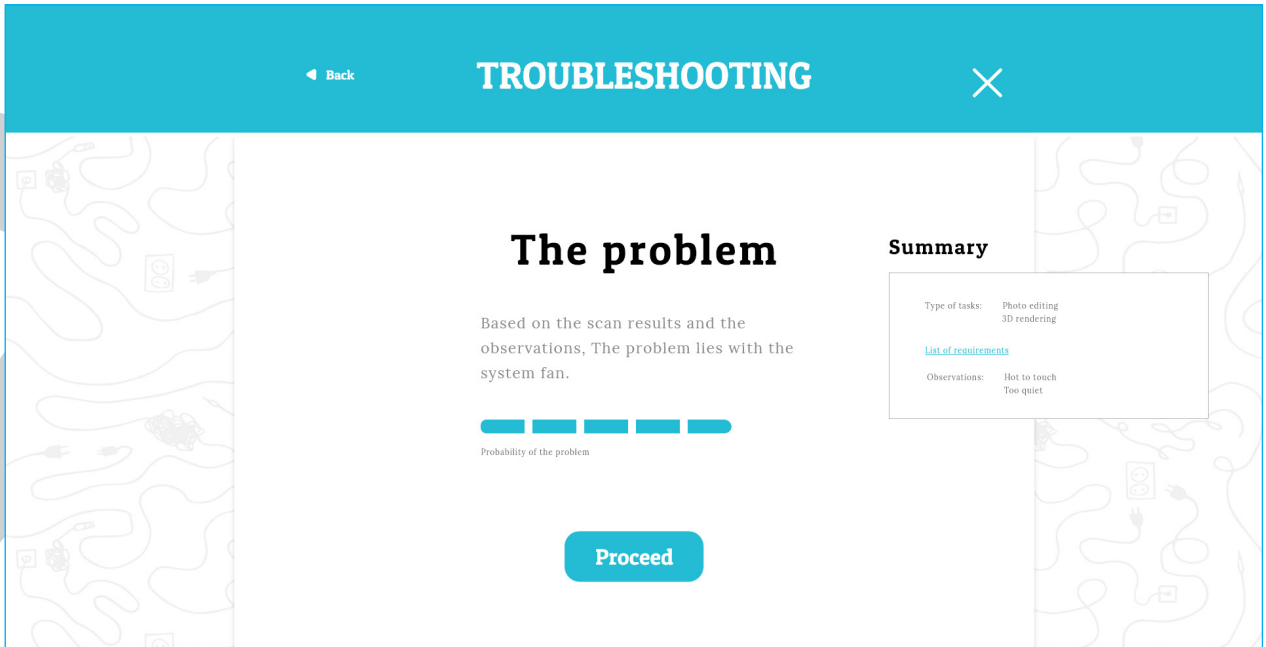


Nils now knows what is wrong with his computer now. And he has a guide to how to solve this problem. Luckily he has all equipment needed in order to start fixing.

First task is to find the malfunctioning fan. It is a rather easy task to do. Especially because the fans in his computer are easy to acess.

Following the steps in the guide, Nils removes the system fans. He quickly realizes that the culprit of his problem was a huge amount of cat hair stuck in the fan blades.
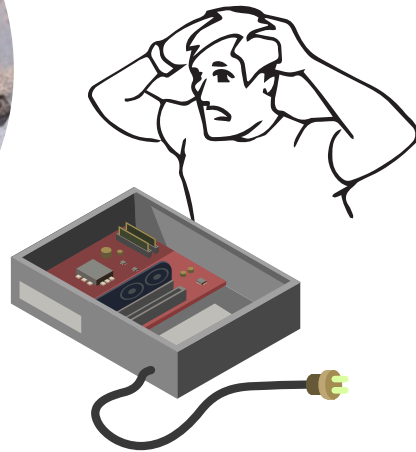


According to the guide, Nils plugs the clean fans back to the computers motherboard. He then sets the rest of the computer together (the screen, the keyboard, etc) and turns it on.

The computer is working as it should. And so do system fans! Nils is very happy with his achievement. He has never before performed anything like this with his computer. And now he knows how to perform the mainentance if this situation occur again.
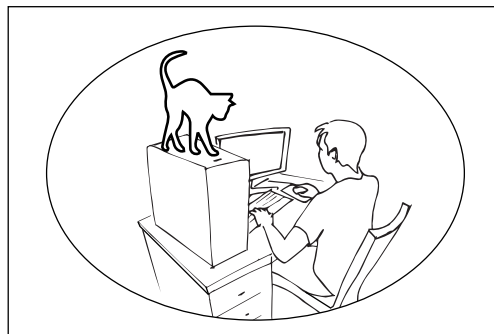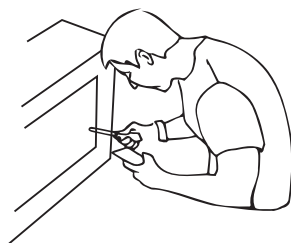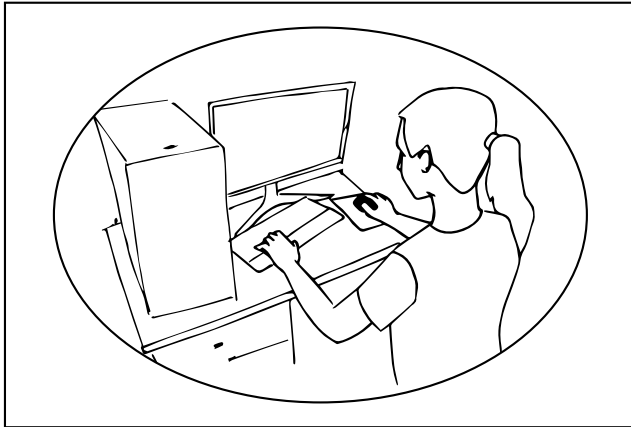
Anna has been working on her 3D model of a house for quite a bit now.



Suddenly, her computer screen turns blue and computer turns off.
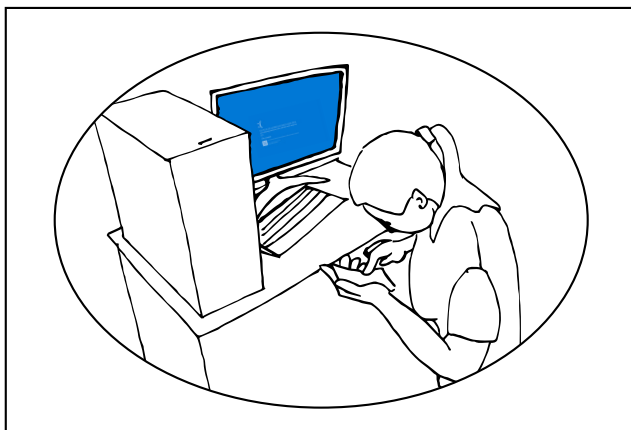


She tried to restart her computer several times, but each time the screen turned blue less than in five minutes.

She seeked on internet, using her phone, to see what it might be.
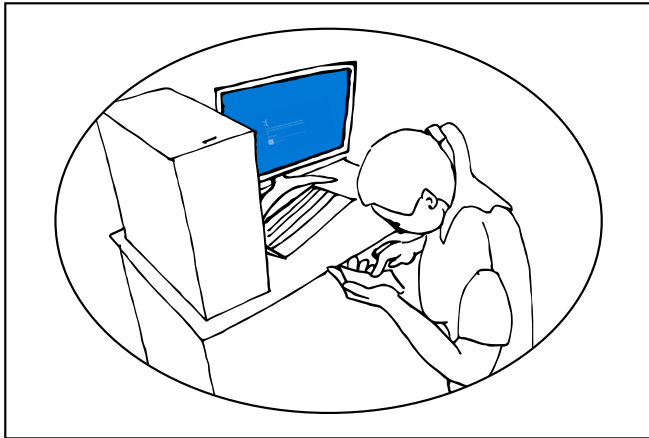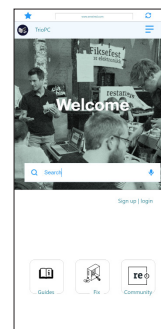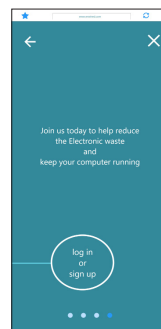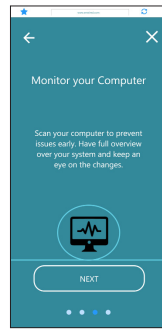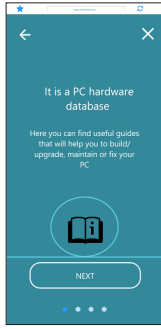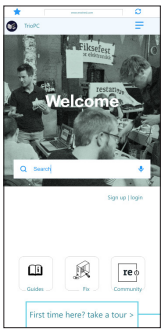
Her search took her to the instructables website. There she learned about a way to solve her problem. A troubleshooting sequence could help her find what is wrong with her computer. Alas, she can't run a system scan, because of the nasty blue screen problem. But she tries the second option, the option that bases itself on observations
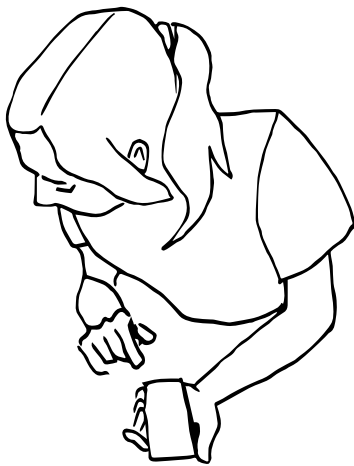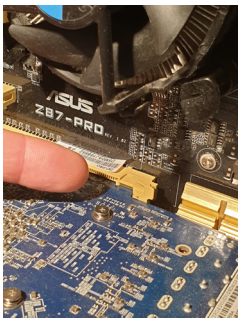


Answering to the sequence of questions it becomes clear that the problem lies in the processor (CPU). It is broken. In order to replace this part, Anna has to know its name. She follows a guide that helps her oen the computer and look inside. Sadly, rest of the guide seems too complicated, and she lacks proper tools to dig deeper. The website then suggests a way around this little problem. Since she already has opened her computer, she can easily then read the name of the Motherboard. She easily fills in the name.
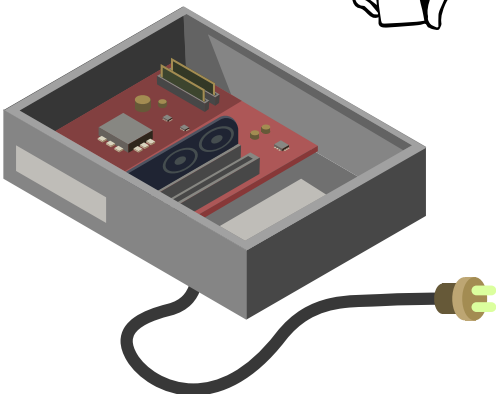
The troubleshooting sequence then looks up this motherboard in its database and finds compatible suggestions. Anna choses one that suits her requirements based on what programs she use and the budget. She also notes that next fiksefest will be in the coming week.
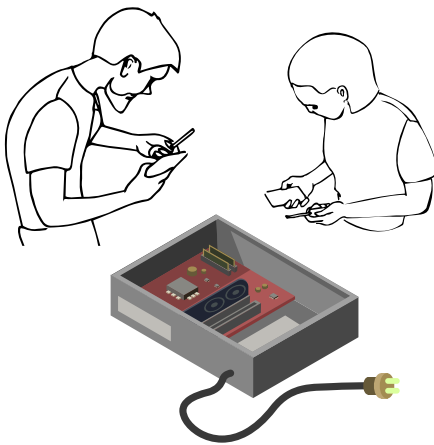
Anna buys the needed hardware online and
is now ready to go to fiksefest.
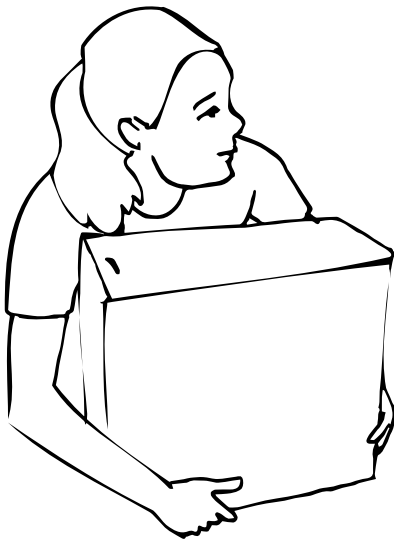


Next week anna arrives to the Fiksefest with
her computer and its new part.

There she meets Fikser Alexis, who gladly helps her with the computer. She shows him the guide the saved as pdf last week during the troubleshooting sequence.

Together they change the broken Processor with the new one. In the process Alexis shows Anna how to apply cooling paste on the processor too.
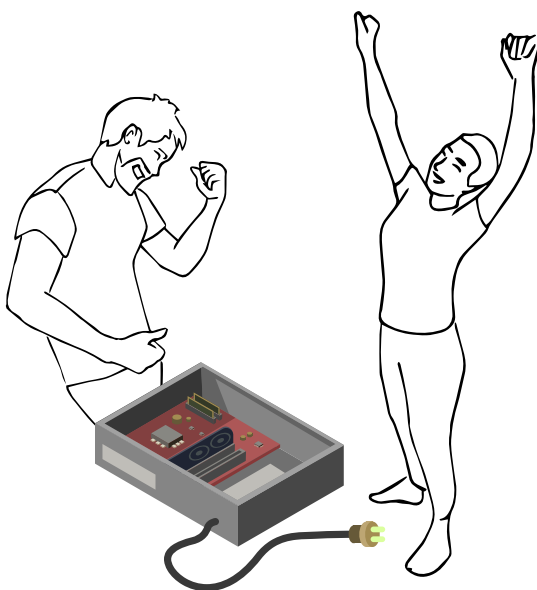
Together they finished the task and fixed the computer. Before Anna returned home, Alexis reminded her of proper diposal rules for E waste.

# Project name

## "UNTANGLED"

UNTANGLED = demystify, clarify

make (something complicated or confusing) easier to understand or deal with.

When dealing with computer hardware, it is a hand-on experience. There will be A LOT OF WIRES and it may seem that one is litterally ENTANGLED in the PC problems with no solutions.

But all one need is a little elbow-grease and mental fortitude to get the task done.

With a clear step-by-step guide from the website and some help of an experienced fixer, any PC related problem can be untangled.

# Lofi prototyping

During the second part of the Diploma I have been working on sketches and paper prototypes of the concept. Later these were converted to lofi prototypes at Adobe XD. Using the grid from Material.io and the visual cues (colors, fonts, spacing) from Restarters.org I was working on the screens that will aid scenarios.
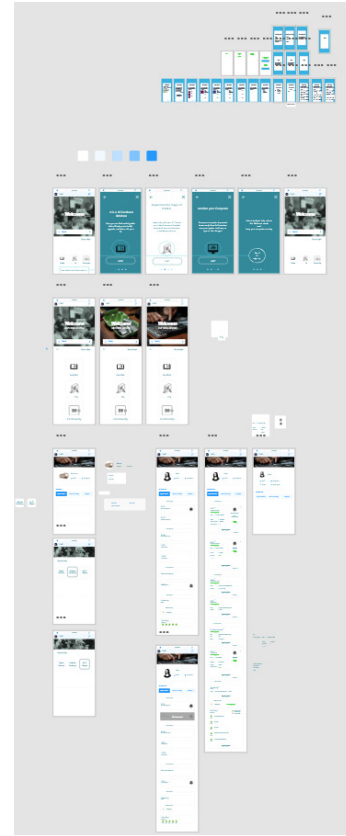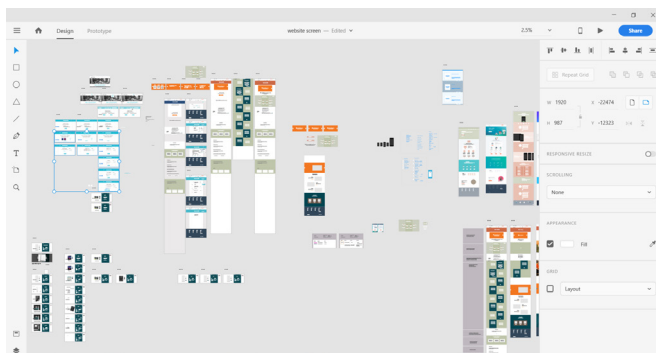




# The card exercise



After the concept was outlined and all elements from the state of the art workshops were collected, I did a short exercise with about 10 people, both users and fixers. The goal of the excersice was to establish a logical core structure of the digital platform. The majority of the variants were verysimilair. Thus, it became the final structure for  the concept.

At the time of the workshop there were more elements to the digital platform than in final delivery. The main sections of the website included a database, a troubleshooting sequence, a page for hardware monitoring, a marked for used parts and an extended community page. Sadly, features such as monitoring (where one could see the the age of used hardware, when next maintenancy is scheldured and estimated price based on usage, age and market tendencies), did not make it to the final concept. But rather became expansions of the concept in the nearest future.
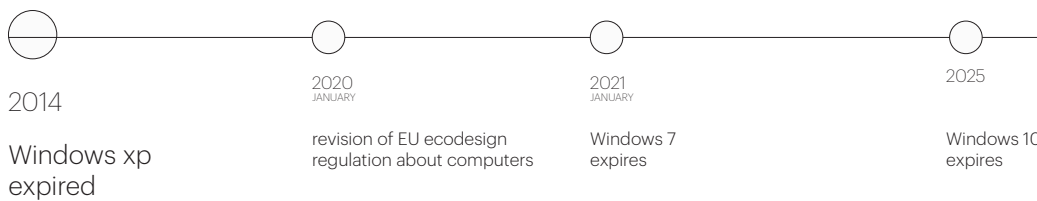
# Reflections

Did I achieve the level of contribution to the E-waste reduction I was seeking? I think so. Thid diplooma has been a learning journey both for myprimary user group and for me. I believe I created a concept where knowledge can be easier acceed in a rather social way. This particular knowledge raises both awarenes about E-waste, Teaches hand-on how to delay exparation of the computers and in a way confronts consumerism. Though the diploma was planned and executed as I was intended to, I wish I could be better at documenting and writing rapports.

### Design Ethics

This project is approved by NSD. Partisipation in the project is voluntary and requires concent signedby form.

### Images

The images in this rapport I have either created myself or used from Restarters community website. Statistics ithat describe E-waste are taken from the companies descibed in the same chapter. Company logos belong to the according companies.

2014

2020
JANUARY

2021
JANUARY

2025

Windows xp
expired

revision of EU ecodesign
regulation about computers

Windows 7
expires

Windows 10
expires



media coverage on Windows XP disposals in 2014
source: https://talk.restarters.net/t/reality-check-millions-computers-are-going-to-dump-this-year/1391

**Important events**

Already in 2020 there will be a new revision of ecodesign in computer electronics. By implementing this concept, Restarters could gather useful data that would aid them to influence computers to be more repairable.
Later in 2021 and 2025 it is predicted a huge amount of diposed computers, because Windows 7 and Windows 10 will expire. The last time this happened in 2014, when Windows xp expired. By helping people to learn how to fix, maintain and upgrade their computers, This concept can reduce the amount of the PC that are being disposed off in nearest future.

## Sources:

### General information about Computing:

https://www.explainingcomputers.com/
Explanations of PC hardware and terms by Christopher Barnatt, news in the computing field, PC history

http://www.techtutorials.net/
technical explanations of PC components and more.

https://www.bleepingcomputer.com/tutorials/introduction-to-your-computer/
A nicely written introduction to a PC.

https://www.windowscentral.com/should-you-buy-second-hand-computer-parts
news, advice and buying recomendations for PC components.

https://www.pcbuildingsim.com/
3D PC building simulator.

https://www.makeuseof.com/tag/5-free-benchmark-programs/
The list of benchmarking software. Used to compare practical information layout.

https://nptel.ac.in/
Cources about technical information. Used to define structure and information placement.

https://ark.intel.com/content/www/us/en/ark/products/97185/intel-core-i7-7700hq-processor-6m-cache-up-to-3-80-ghz.html?fbclid=I-wAR1NEdeBPPragZ7lkWpL6a-ba9Pk0AVgifCShkeM2YkZAl-5_WIyVuj8o0k
new: https://www.multicom.no/intel-core-i7-4770k-35/cat-p/c/p6169723
used: https://www.finn.no/bap/forsale/ad.html?finnkode=144252441
used to compare hardware information

### Troubleshooting and how-to-guides:

https://www.makeuseof.com/service/windows/
How to guides about windows hardware and software. Used to decypher the structure of information flow in guides.

https://www.makeuseof.com/tag/5-free-benchmark-programs/
The list of benchmarking software. Used to compare practical information layout.

https://nptel.ac.in/
Cources about technical information. Used to define structure and information placement.

https://www.ifixit.com/Device/PC
Guides to hardware replacement.

https://www.computerhope.com/
https://forums.tomshardware.com/threads/perform-these-steps-before-posting-about-post-boot-no-video-problems.1285536/
https://www.easypcmod.com/know-processor-failing-fix-troubleshooting-guide-287
Basic hardware troubleshooting. Used to formulate the questions that are asked when searching for the problem.

www. explaining computers.com
www. explaining computers.com

### Hardware specific texts, used as sample texts in delivery:

https://phoenixts.com/blog/why-is-ram-so-important-and-what-does-it-do/
#RAM #Memory #Explanation

https://www.quora.com/Is-RAM-size-or-processor-speed-more-important
#RAM #Memory #Forum

https://www.cnet.com/forums/discussions/how-important-is-the-performance-of-your-computer-s-video-card-377417/
#Graphic card #Forum

http://www.mooreslaw.org/
#CPU #Processor #Explanation #Moore's law

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#CPU #Processor #Explanation

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