

# PROCESS REPORT

## GROUP 4

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**Project title:** AirGo

**Study program:** Service Systems Design

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# Information

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# Abstract

This report presents the process and the outcome of a project focused on air pollution in Copenhagen. The design challenge was presented by Gehl and is a collaboration between them and Aalborg University Copenhagen.

The purpose of the project was to design and develop a service concept that can inform and empower people, and especially children, to be change agents, as well as understand and learn about air pollution. To work with this challenge, a human-centered approach was chosen and as a methodological approach, Design Thinking was adopted.

The outcome of the project report was the service concept AirGo. An idea that consists of two elements; a wristband and an app. The concept aims to help children with asthma to a healthier everyday life.

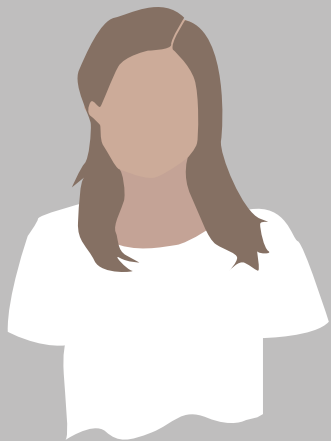
## Keywords

Service design, Air pollution,  
Child health, Asthma

# Team

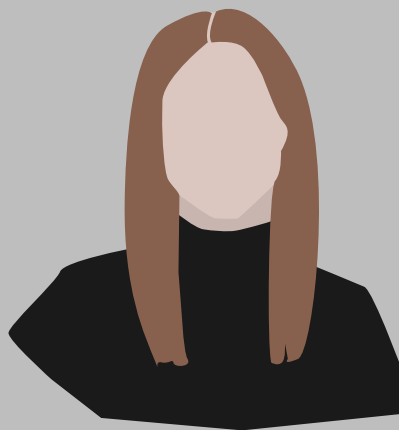
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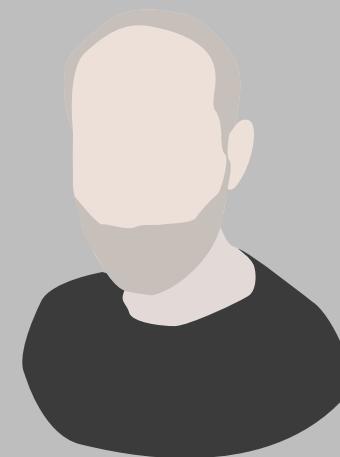
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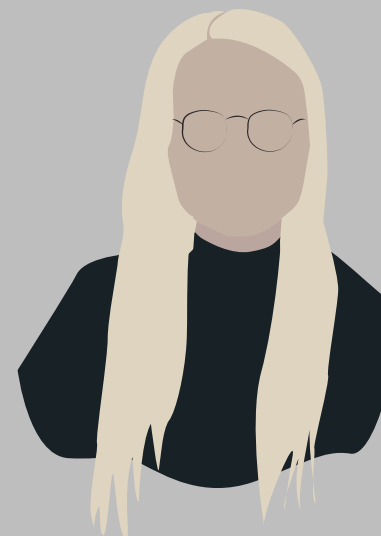
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# Introduction

As a part of the second semester on Service Systems Design at Aalborg University, a collaboration with the external partner: 'Gehl Architects' has been made, and a problem statement has been given.

With the aim of solving the problem statement, the team employed IDEO's design thinking approach. This enabled the team to apply service design methods and tools while focusing on a human centred design perspective. Additionally, the report is chronologically represented to illustrate the iterative process while indicating the identified challenges and ideas developed throughout the process.

# Learning goals

In order to align the team's expectations for the project, after being familiar with the semester project (given) goals, the team shared and discussed their personal learning goals.

During the discussion each team member presented their background and experience, that could be applied for the project. Additionally, the team reflected on their obtained knowledge from the previous semester in terms of which methods and approaches worked well.

The team agreed on the following personal learning goals in addition to the course learning goals:

## **Given learning goals:**

The team members will understand the nature and structure of distributed systems and learn how to integrate technical and human components in a service platform.

They will be able to plan and describe competencies of different components/actors in a modular service architecture and to organize them appropriately.

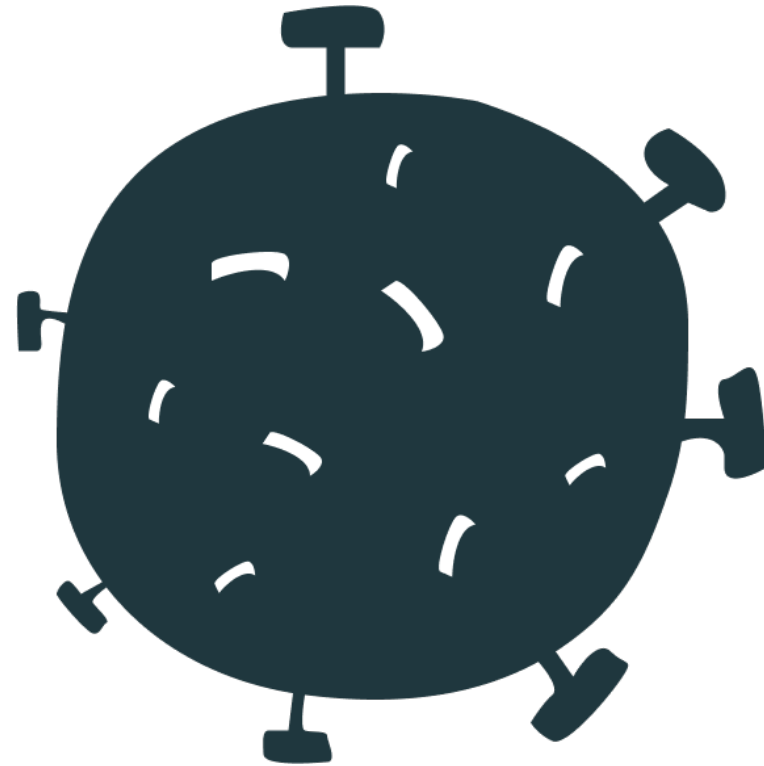
They will learn and apply the techniques that support the participation of actors with different backgrounds, skills and culture (Project Module Description, n.d.)

## **Personal learning goals:**

- The team will use and improve knowledge from the first semester
- They will effectively combine their skills and knowledge from different backgrounds and thereby learn from each other and improve their personal skills in service design
- They will use the obtained knowledge from the current semester courses and implement it in the project.

# Project limitations

The process of the project had some limitations in regards to our degree of involvement and planning of the project. In March, the Covid-19 disease was spread all around the world forcing Denmark in a position of almost exceptional condition (Sonne, 2020). This meant that some of the planned activities were cancelled and all physical meetings were transformed into virtual meetings. The temporary conditions, had an impact on some of the directions and decisions made for the project.





# Contextual framework

Gehl's focus is to make cities for people from strategic vision to design and implementation. Solving some of the most difficult challenges in the cities all around the world by putting people first in their design solutions (service, n.d.). In the design brief presented by Gehl for the second semester of the master program, difficult challenges was also the main theme of the brief. Gehl has recently been working on how design can contribute to reducing the negative affects of air pollution but also increasing access to good air quality in the city (Gehl slides, 2020). The cases represented focused on air quality in the city planning of Copenhagen having the youngest residents as their target group. Understanding that solving the challenge with air quality may require different approaches and long term planning. The different approaches used for their solution was either to invite the target group to areas with less air pollution or looking at how they could possibly reduce air pollution in the areas where they spend the most time. (Gehl slides, 2020).

Moving on to the next phase of their work, Gehl wishes to look more into local solutions focusing on two areas in Copenhagen: Inner City and Amager (Gehl slides, 2020).

The challenge of the semester project that has to be tackled is:



“How might we design services to inform and empower citizens, and in particular young generations, to be change agents towards a more sustainable and carbon-free city by understanding/interpreting/collecting/producing useful datasets about air pollution” - Gehl



# Word definition

A definition of some of the words used in the initial problem statement was made in order to align the expectations and understanding of the words, for the group to agree on what to aim for when designing the service.

## Change agents

From the dictionary the team found inspiration from a definition on change agents:

***“An individual who instigates or implements change within a social unit or situation (e.g., a family or group) or within an organization by communicating to, managing, and encouraging others in the change.”***

(APA Dictionary of Psychology, n.d.)

A new formulation was made based on the definition above and how the team imagined a change agents in the context of the project and given problem statement.

***“An individual who is well informed within a specific area, to be able to react and use their knowledge to inform and encourage other people to make a change and improvement within that area”***

## Empower

The team also looked into the definition of empower and chose to use the definition below as a guide for the development of the service for the project.

***“Give (someone) the authority or power to do something.”***

(Lexico n.d).

# Distributed systems

A sociotechnical system is merging social innovation with technological innovation. They are heavily based on technology, however, they are more complex than just that, and can not be separate from the social part of the service. A system from where a new generation had emerged which is referred to as distributed systems. Distributed systems are socio-technical systems that were partly independent, scattered but still connected parts in a wider network. They could be individual, adaptive, and separate working systems but will, however, be linked in a bigger network from a local to a global level. The more scattered the system is the more the social innovation part of the system had to be considered. This make them different from centralized systems, where the social aspect do not necessarily have to be considered as it might not affect the implementation. Moreover, a distributed system highly relies on dedicated people to commit to them and implement them in order for them to actually work (Manzini, 2015).

Distributed systems are increasingly being recognized as they challenged the traditional production model, by enabling new ways of solving problems between e.g. local and global. (Manzini, 2015).

# Methodology

The approach chosen for this semester project was the Design Thinking approach. Design Thinking is a human-centric approach focusing on how to solve complex problems (Dam & Teo, 2020).

The approach worked as a framework for the project. By using Design Thinking, the team followed a structure which contributed to a shared understanding of each phase of the project. Hereby, the process was classified into five phases: Empathize, Define, Ideate, Prototyping, and Test. Each stage was different and implied different tools and methods. The visual illustration of the model made a clear understanding of the design process of the project from start to end. However, the process of the project was not linear, as the model also allowed a more iterative and flexible approach (Dam & Teo, 2020). This made it possible for the group to move back and forth between the phases to obtain the best result.

With the aim of illustrating the iterative process, the “Squiggle model” by Damien Newman was used. The left side of the model shows the beginning of the project, which clarified the uncertainty that might occur and thereby force the designer to take a step back or maybe even go back to the beginning of the project (Almqvist, 2017), (Stickdorn & Schneider, 2019). The first part of a project often becomes chaotic in nature as it is often not known what is going to be designed yet. In this phase the designer has to explore many different areas, to understand what to design and maybe even also what should not be designed (Sanders & Stappers, 2008).

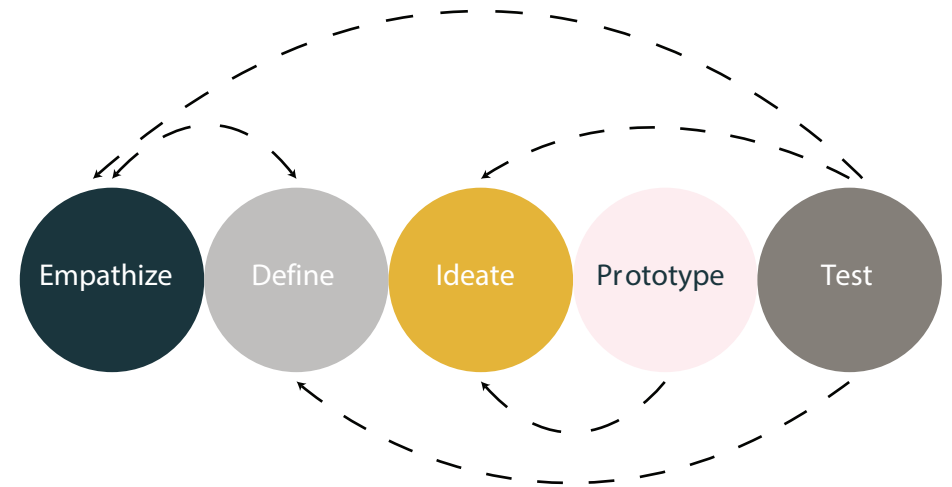


Figure 1: Design Thinking by interaction desing foundation (Dam& Teo, 2020)

Noise / Uncertainty / Patterns / Insights

Clarity / Focus



Research & Synthesis

Concept / Prototype

Design

Figure 2: The squiggle by Damian Newman (Almqvist, 2017)

# Methods

## EMPATHIZE

In the empathize phase the group gained an understanding and empathy toward the problem that was to be solved, by discovering and researching the area (What is Design Thinking?, n.d.).

- Initial desk research** Initial desk research was done, to get familiar with the problem area.
- Initial observation and interviews** Initial observations were done as the first part of field research. This helped the team to get familiar with the potential target group and Inner City
- Initial target group** Choosing initial target groups helped the team to narrow down the target group and to reach out to these target groups - families and daycares.
- Survey** The survey was created to reach out to parents in Copenhagen, and gather insights about their attitude towards air pollution. Survey also helped to find participants for further project involvement.
- Current stakeholder map** Current stakeholder map was created with the purpose of getting an overview of the involved stakeholders, in the Inner City, regarding the chosen target group.
- Gehl data collection** Gehl data collection helped the team to gain more insights regarding people's habits and activity in Inner City.

## DEFINE

All the information from the first phase was accumulated, analyzed and synthesized in order to define the core problems identified. (What is Design Thinking?, n.d.).

- Choosing an area** An area was chosen, for further investigation. The team chose to work further on with Inner City.
- Targetgroup** The target group was chosen in order to focus further on, mainly on the target group and develop a service concept for the chosen target group.
- Interviews** Interviews were conducted with participants from the chosen target group, to gain better insights and get familiar with the target group.
- Personas** Personas were created based on the gathered information about the target group, such as: surveys and interviews. Personas helped the team to empathize with the target group.
- Challenges** Possible challenges were considered, when further on working on the concept.
- Problem statement** A new problem statement was created, based on the research.

## IDEATE

Based on the knowledge from the two previous phases ideas was generated and illustrated (What is Design Thinking?, n.d.).



In the pre-ideation phase, the team was narrowing down the problem area.



During the ideation phase, the team did several ideation exercises, which helped to come up with possible ideas, and an idea, that was further on used in the service concept development.



A moodboard was created for inspiration of the service concept



A storyboard was created to further on explain the service concept idea.



A stakeholder map was created, to gain a holistic overview of all the stakeholders involved in the service AirGo.



Value exchanged was created based on the stakeholder map, to visualize all the values exchanged between the stakeholders.



Motivation matrix gave was created, to have an overview of the motivation between the stakeholders.



A system map was create to map out how the entire system worked.



Cross-channel ecosystem was created, to visualize all the possible user journeys of the concept..



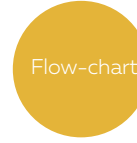
Customer journey was created to show the primary persona journey while using and interacting with the AirGo service.



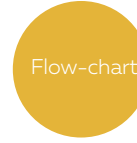
Different use cases were created, to show different ways that the AirGo can be used.



The blueprint was created, to show an overview of the service: the front-stage and back-stage actions.



A flowchart was created to showcase the app flow.



A flowchart was created to showcase the app flow.



A 3D mockup of the wristband was created, to visualize it and get a better understanding of how it would look.



Distributed system model was created to visualize how AirGo works as a distributed system.

## PROTOTYPE

To identify the best solutions for the problem, a low-fidelity prototype of the idea was made (What is Design Thinking?, n.d.).



Prototype was created to test the concept idea, in a video format, by sending it to interview participants, as well as it was shared on a relevant Facebook group.



A prototype of the app was created, in order to test it further on, on the user.

## TEST

The complete product was tested. This was the last phase of the project, but more testing could have been done to continuously redefine or improve the product (What is Design Thinking?, n.d.).



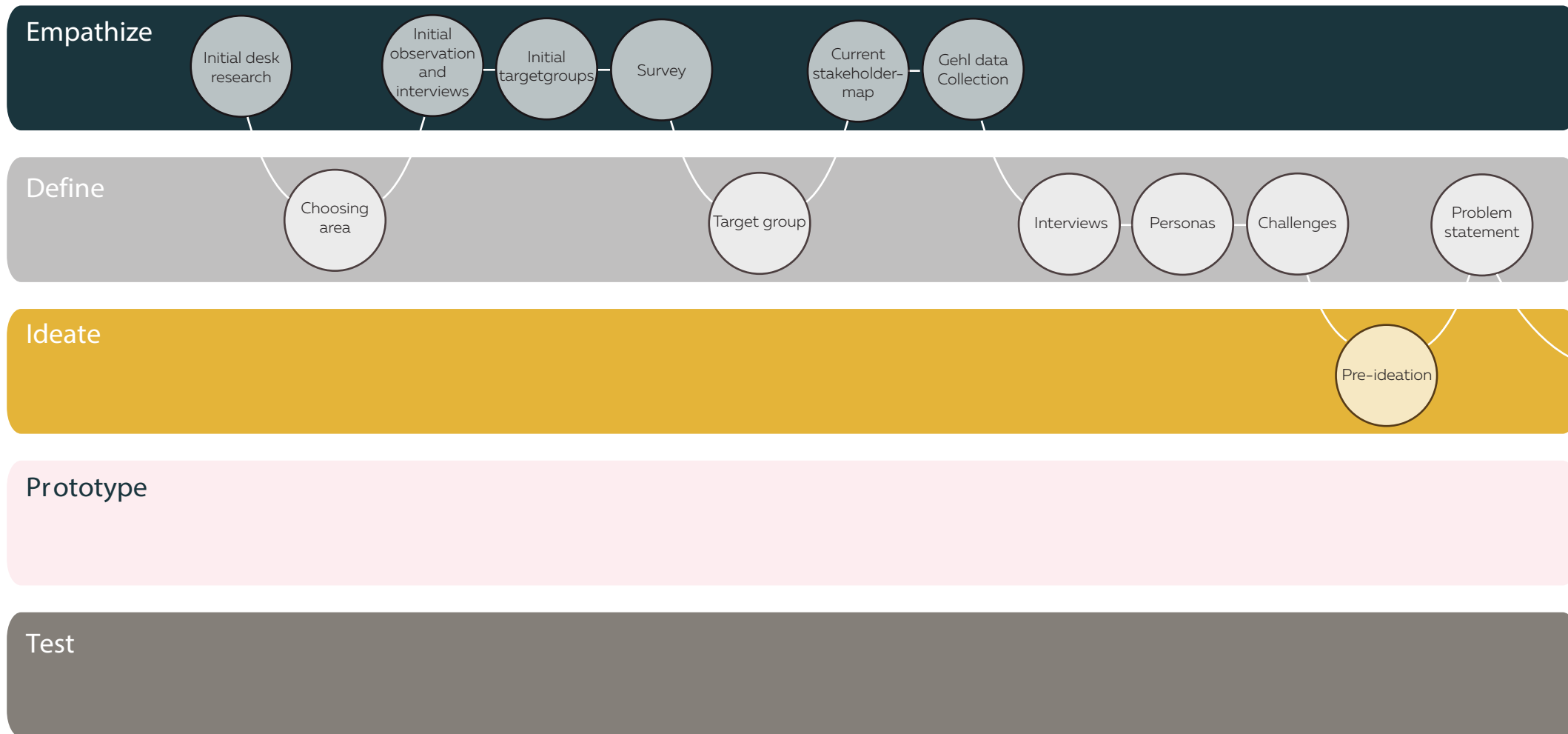
Prototype testing gave the team insights if the chosen concept is a good idea and if it should be developed further.



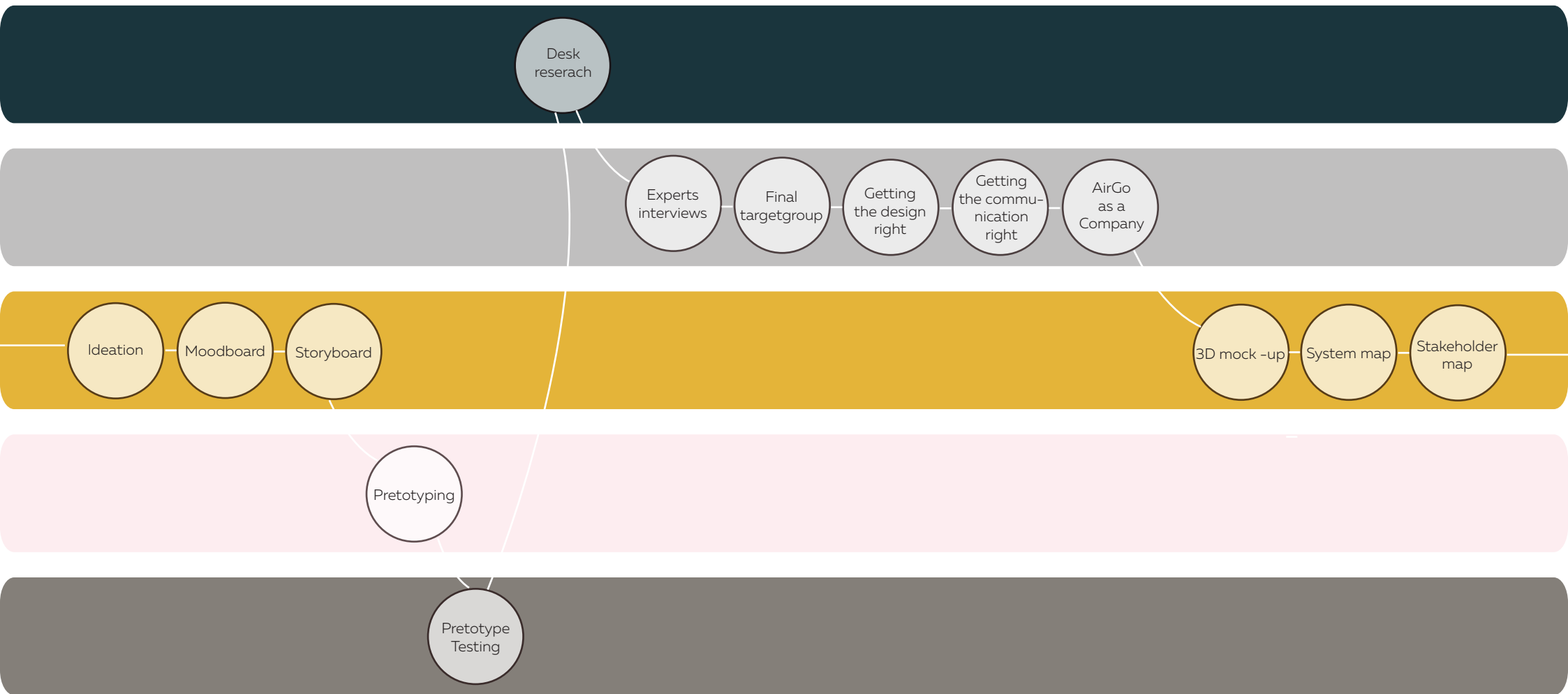
Prototype testing gave the team insights on how the app could be developed further on, and if the users find it functional and user friendly so far.

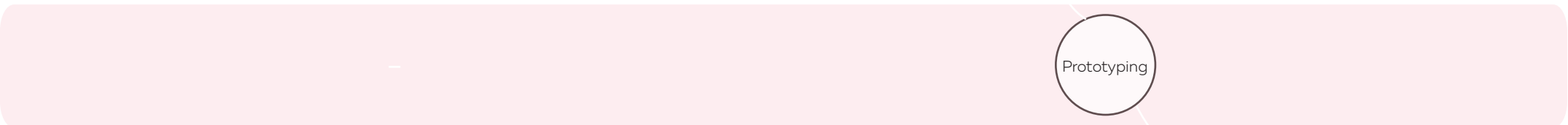
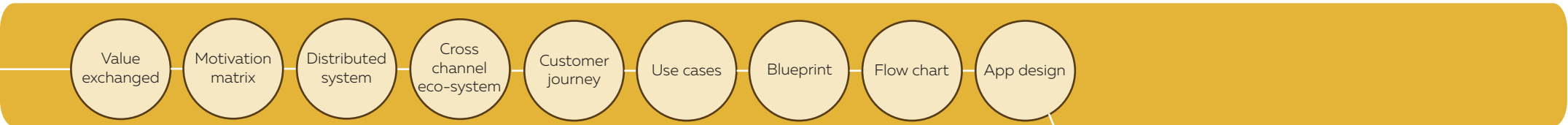
# Iterative Process Overview Diagram

In order to obtain a better understanding of the iterative process the project went through, the process and steps are shown below.









# Project management

At the beginning of the semester, the team decided to arrange a meeting to talk about the project management through the process. At the meeting each team member shared their individual expectations in relation to the group work. The team decided to let one person be responsible for taking notes during all team meetings with the purpose of documenting everything that was being talked about. By doing this, it became easier for the team to remember what happened along the way. At the same time, it was decided to begin writing the report as soon as it was possible, because this was a learning for all the members from last semester.

After a few meetings an initial timeline was created in order to structure and organize the time remaining before the group had to hand in the project and to make sure the team did not fall behind. The timeline could be seen to the right.

From the very start, it was decided that the team needed some tools to structure the process. Therefore, the team agreed on using Slack given that it was a good communication platform (Slack, n.d.). In order to divide all tasks between each team member, it was decided to use Trello, which is an online tool. By using this tool the team got a general overview of the progress of the current work flow (Trello, n.d.). Another tool used was Miro, an online whiteboard, which was used in the brainstorming processes, to create mind maps and to join workshops along the process of the project work (Miro, n.d.).

It was decided to create a gantt chart to support project management and help the team to have a better overview of the project timewise (appendix 1). It was possible to generate the gantt chart with the tasks divided in Trello, which was a help to follow the current milestones or deadlines. If any part of the project delayed, it was easy to change the dates in this app afterwards, and Gantt chart just automatically adjusted all the other tasks on the timeline related to the changed ones.

Due to the fact that Aalborg University Copenhagen was closed because of the current situation, the team members had to review the chosen methods as well as finding alternative solutions for team meetings and tasks. Therefore, it was decided to host Zoom meetings every week and to assign tasks to each team member (Zoom, n.d.).

The tools mentioned were used throughout the process of the project and were very useful for the team. Even though it was not possible to meet up physically, the tools made it easy to get in touch online and to host online workshops etc.

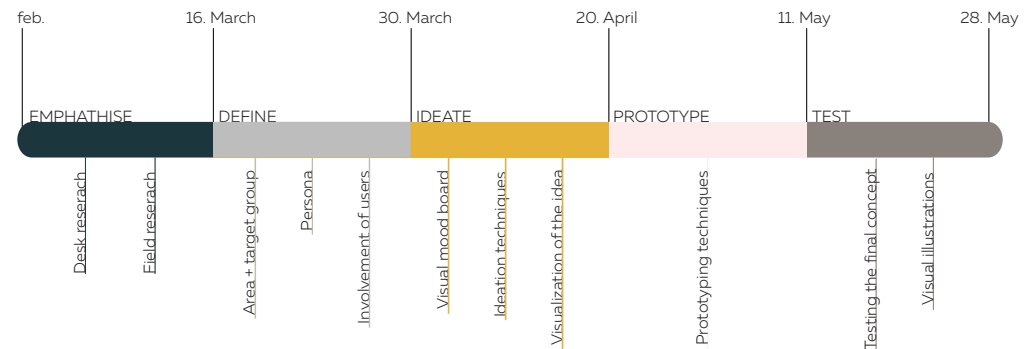


Figure 3: Initial timeline for the project

# Emphasize and define

The emphasize- and the define phase were the first two steps of the design process. They were compounded in the report due to the fact that it was an iterative process that involved a lot of going back and forth between these two phases.

The function of the emphasize phase was to understand the challenge the team was given and in addition to that discover and identify opportunity fields concerning air pollution based on desk research and field research (Stickdorn et al., 2018).

The aim of the define phase was to collect the achieved knowledge from the emphasize phase and then analyze it with the purpose of defining the core challenges and define new and improved problem statements.

Even though the next step in the design process was the ideation phase, the report will continuously return to the empathize and define phase whenever new desk research and field research should be obtained or defined.

# Initial desk research

## Air pollution



Air pollution is a combination of particles and gases that affects health, climate, biodiversity and agricultural productions (Ellermann, 2020). It is classified as anthropogenic and natural sources. Natural air pollution has emerged by volcanoes, forest fire, and sea salt. Anthropogenic air pollution is caused by traffic, agriculture, log burners and power stations, etc. (Københavns Kommune, 2018). The different types and amounts of particles are crucial factors for how dangerous air pollution is. If the concentration of pollutants is large, then it causes negative environmental impacts (WHO, 2020). To locally reduce air pollution, it is necessary to start looking from a global perspective. This is due to the fact that air pollution is being transported in long distances by the wind and thereby it affects other areas as well (Københavns Kommune, 2018). Therefore, EU and WHO have advanced a permit level for air pollution due to health estimations, which Denmark must adjust to (DinGeo, n.d.).

Besides the permitted level, it is necessary to make every single person more aware of air pollution according to doctor Steffen Loft. Since particles are invisible for humans, it is still a crucial factor for people to behave and react in a certain way e.g. by avoiding walking next to busy traffic, etc.. By being aware, people are able to abate inhaling bad air quality, which will affect their health quality in the long run (Hvordan undgår du den usynlige luftforurening? 2019). Nowadays, from a worldwide perspective, 90 % of the planet inhale polluted air (WHO: 90% af planeten indånder forurennet luft, 2018).

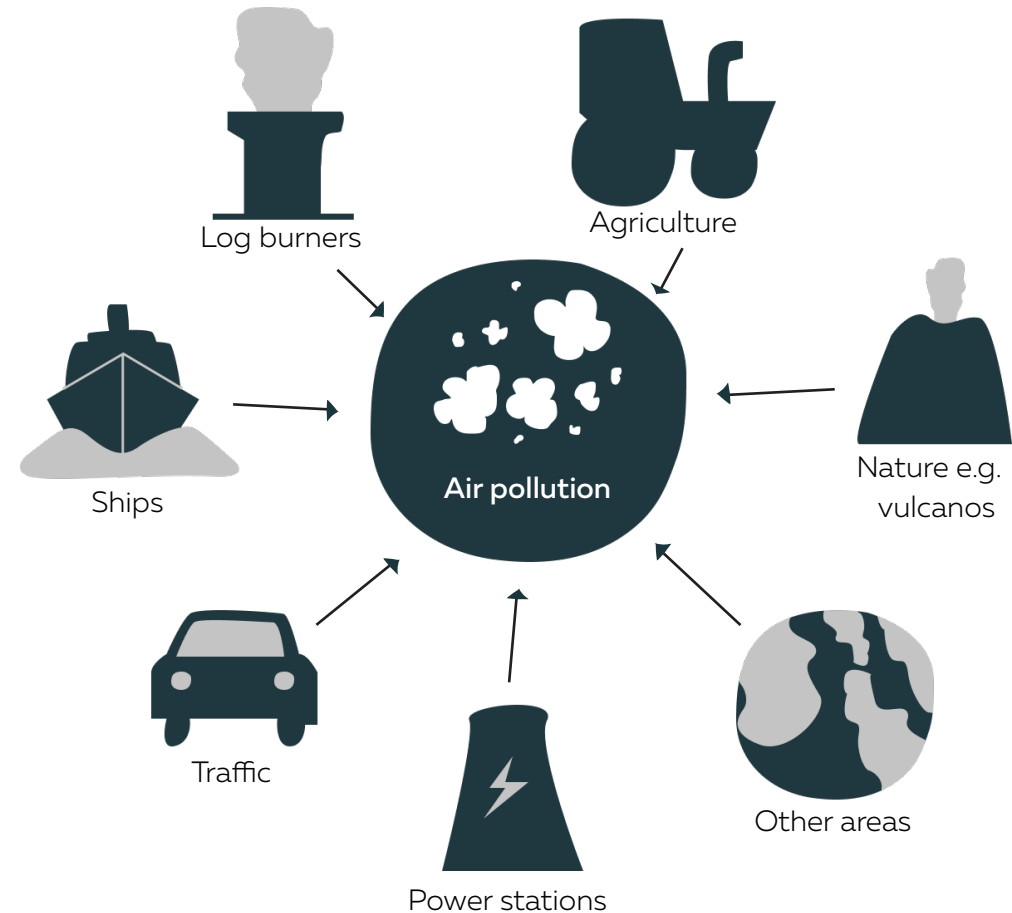


Figure 4: Illustration of sources that causes air pollution

# Initial desk research

## Air pollution in Copenhagen

Copenhagen's goal is to become a carbon neutral city in 2025. 95% of the air pollution with particles in Copenhagen is caused by sources outside the city and is being transported with the wind (Københavns Kommune, n.d.). Studies shows that there is a high concentration level of fine particles in Inner City as well as on access roads (Copenhagen Solutions Lab, 2019). Inner City, which is a frequented area, has the same level of fine particles as the most trafficked roads in Copenhagen (Københavns Kommune, 2019). According to a report from Miljøpunkt, fine particles in Copenhagen are caused by traffic, power stations, ships, and woodburners. Based on measurements, public transportation in Inner City is seen as the main carbon emitter that is causing a large number of fine particles. Therefore, it is crucial to find solutions that reduce the number of fine particles, caused by the anthropogenic air pollution, with the aim of creating a healthier environment for soft road users (Københavns Kommune, n.d.).





# Initial desk research

## Air pollution as a health issue

In 2017, 460 people living in Copenhagen died too early because of air pollution (Sundheds- og Omsorgsforvaltningen, 2020). The team found it interesting to investigate which health issues there might be for people when talking about air pollution.

In general, the pollution has consequences for everyone and especially in regard to our health. Air pollution is causing sickness, lost quality of life and can among other sicknesses cause cardiovascular disease, cancer, asthma and diabetes. Specific groups of the population are more vulnerable than others, among these are children, expectant mothers, elderly and people with a chronic disease as well as people with lung diseases are especially effected by air pollution (Sundheds- og Omsorgsforvaltningen, 2020), (Hvordan undgår du den usynlige luftforurening?, 2019).

Newer research shows that there is a link between air pollution and accelerated aging and the development of dementia, mental illness, breast- and bowel cancer, and neurological diseases in children (Sundheds- og Omsorgsforvaltningen, 2020). Other research shows that when living in an area where there is a large amount of polluted particles can be harmful for the lungs over time. Therefore, people living in these areas can get a reduced lung capacity (Hvordan undgår du den usynlige luftforurening?, 2019)

It is shown that there is a connection between air pollution and the risk of getting asthma. The air pollution can on a short base cause a aggravation of asthma and over longer time people can get respiratory diseases as for example asthma. In Denmark the air pollution are causing 200.000 cases of asthma (Sådan påvirkes dit helbred - Astma-Allergi Danmark, n.d.).

# Initial desk research

## Children and air pollution



As there in the presentation from Gehl was a huge focus on children, it was decided to look further into how air pollution affects them.

A report made by World Health Organization called "Air pollution and child health" described how children's health is affected by air pollution. It stated that every day 93% of the world's children under the age of 15 inhale polluted air, and because they are still growing and developing their bodies and their brain, it is a serious risk. Children also breathe more rapidly than adults, which is why they are more exposed to air pollution, in addition to that they are also in a level where some of the pollutant are in a higher concentration and affects them more. Actually, children can already be affected by air pollution before they are born. Furthermore, the report states that air pollution is one of the biggest threats to child health (Zvobgo, 2019).







# Initial desk research

## Existing air pollution technologies

The team was aware that there are already some existing services on the market, that can measure air pollution. Therefore, it was interesting to investigate how some of the different alternatives work. The ones that were decided to explore, was Google Home, Tado thermostat and the AirVisual app, which are all described shortly here.

### **Google Home**

Google Home is a system that can help you with a lot of different things in your daily live. One of the features is that it can measure the air quality in your house (Alle varer, n.d.).

### **Tado**

Tado is a thermostats that you replace with your normal thermostats. It is connected to the Tado app, so it is easy for the user tog et the information. It measures the air quality and tell you when it is time to open up a window. Furthermore, it also shows the air quality both inside and outside (The Smart Thermostat for your heating system - That's how it works! tado°. n.d.).

### **Air Quality - AirVisual**

AirVisual is an app that shows air quality information in more than 10.000 cities in the world. The data are real-time and show detailed figures on key pollutants. This app also provides a forecast for the next seven days, which makes it easy for people to plan the week (Air Quality | AirVisual – Apps i Google Play. n.d.).

The described products work differently but are all related to air quality. The AirVisual app is especially found interesting, as you can get the real-time data while bringing your phone with you, in more than 10.000 cities around the world. The other services are mostly to use inside your home. However, Tado also show the outside air quality.



# Initial desk research

## Trends

According to the brief the team found it interesting to look into trends within the area of children in Cities. The purpose of the research was to get an idea of some of the trends and predictions of how cities would or should be designed in the future to fit the needs of children. For the further work this could be a help in the ideation process.

In the publication "Cities Alive", ARUP looks into how cities are designed for children and uses this knowledge to understand how to design better cities for people now as well as in the future (Arup, 2017).

In 30 years, ARUP states that up to 70% of people in the world will be living in cities and that the majority of them will be under the age of 18, which categorize them as children. It is argued that designing for children will be beneficial in order to create successful cities in the future, not only to the children but all citizens (Arup, 2017).

### **Arup lists five core challenges they think designers have to take into account when designing for children in future cities:**

- 1) Pollution and traffic - It hinders children's development and independent mobility.
- 2) High-rise living and urban sprawl - it can lead to cramped conditions and isolation
- 3) Social fear - Can determine how independently a child can move around
- 4) Not everyone has access to the same and poor quality of green spaces - can lead to social inequality
- 5) Inadequate opportunities for discovery and poor public places/streets - can lead to isolation and intolerance (Arup, 2017).

# Inner City and Amager



The team chose to look into the presented areas from Gehl, which was Amager and Inner city. Therefore, five locations were chosen in order to investigate the areas. Three locations in Inner City and two locations on Amager.

## INNER CITY:

1. Rådhuspladsen
2. Kongens Nytorv
3. Nørreport

## AMAGER:

4. Sundbyøster/Villakvartererne
5. Amager west

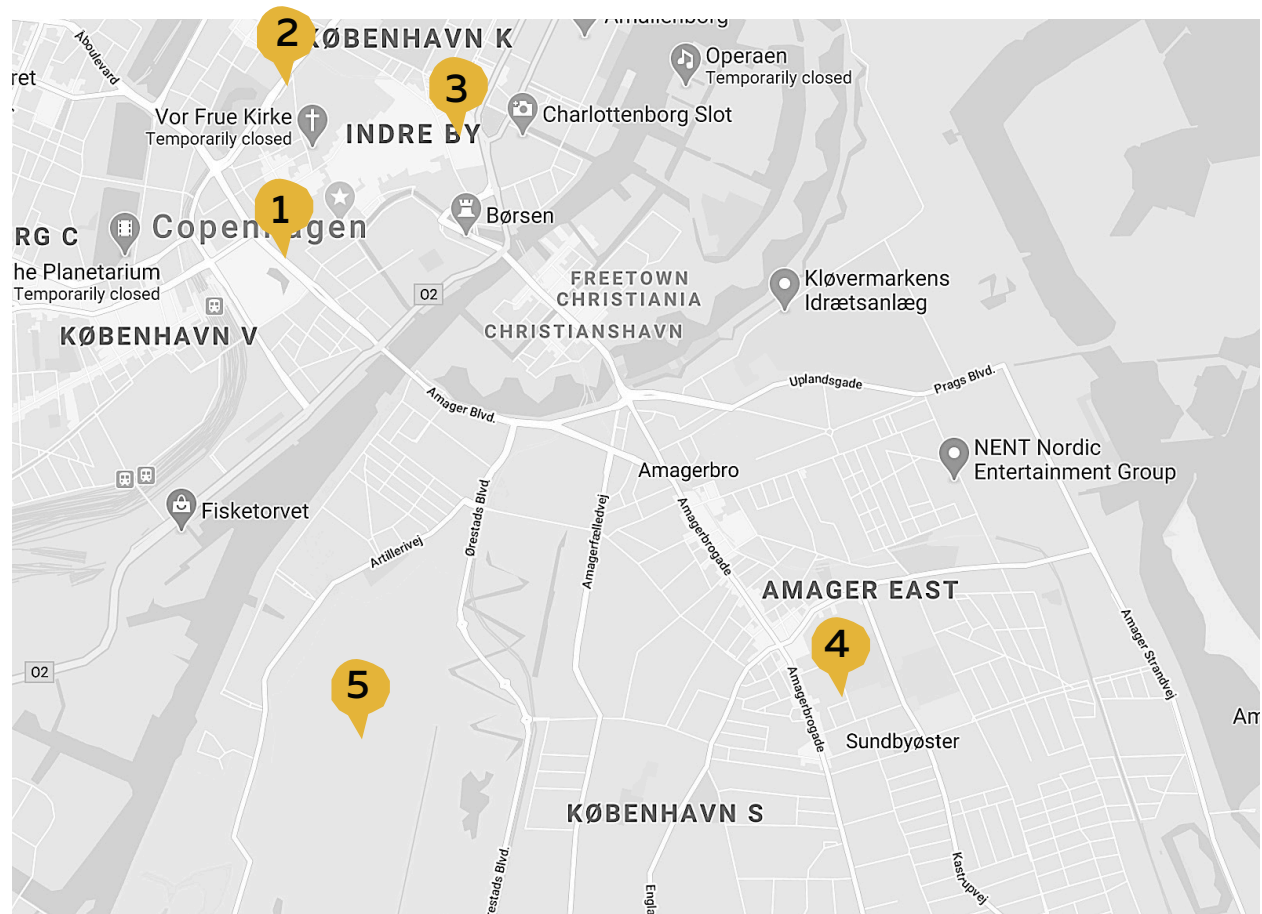


Figure 5: Map of chosen areas in inner city and amager

# Choosing area



Desk research of the five initial locations was done. This was done to get a better insight and understanding of what was happening in the area, what had already been done due to air pollution, how the locations were used, what the plan for the area was (if there was one) and to discover new and unknown things about the locations. This provided the team with an overall understanding of the two main areas for the project. The team was aware that the five chosen locations, might not represent the entire main areas, however, it was seen as a good starting point in order to achieve an initial and overall understanding of the areas.

Looking into the desk research of the chosen locations in Amager and Inner City, both areas were taken into consideration, however, the team chose to proceed with Inner City.

To further proceed, the team chose to do observations and interviews in the chosen area - Inner City. It became clear that it was too early in the process to narrow the research and project down, solely, to those three locations. Therefore, the group chose to expand the area, not only to cover the three chosen areas, but to focus on the entire area of Inner-city instead.



# Initial observations and interviews



The initial research of Inner City was done to get familiar with the Inner City area surroundings, as well as people's behavior. The main focus of the observation was to get an overall idea of the area such as; what types of people are in the areas, and what are they doing.

The observations started as non-participatory observations, where the team-researchers, were only observing the participants, without them knowing or interacting with them (Stickdorn et al., 2018, p.122, 123).

Later on in the observation, the team strived to use a method with higher user involvement. The team decided to conduct contextual interviews by asking a few questions to the pedestrians in Inner City. The object of this method was to talk to people about the topic in the surroundings, also referred to as "in situational context", as the participants could point out elements in the environment, where the interview took place (Stickdorn et al., 2018, p.120, 121)

## **Focus.**

It was agreed to focus on people with children when observing the areas, as this was the focus of the presentation by Gehl. (Gehl slides, 2020)

## **Goal.**

The goal of the observations was to examine the environment in Inner City and how people behave in different areas. It was important to look for different clues related to the environment, pollution and children. In terms of the contextual interview, it was important to get an understanding of people's awareness of air pollution and which areas they are visiting with their children.

## **The observations.**

Observations took place in Inner City, the area of Nørreport and on the way to Rådhuspladsen. The observations started in the area of Nørreport and ended at Rådhuspladsen. The team chose to conduct contextual interviews with few people that were in the Inner City area.

## **Contextual interviews.**

Contextual interviews were done with 3 parents and 1 daycare employee. The main goal of the interviews was to find out if people are aware of the pollution and which green areas in the city they usually went to.

# Initial observations and interview

## Our findings



When doing the short interviews, the team discovered that most people were aware of pollution, however, when talking to the daycare worker, the response was that they were not aware of pollution. An interesting finding was, that even though the daycare was located in Inner City, they were mostly spending time in green areas outside of Inner City such as Amager Strand or Hareskov. In general, they told, that they did spend a lot of time outdoors. The team met the daycare worker in Ørstedsparken, which is located near Nørreport. The park was quite empty and mostly filled with daycare workers, children and cleaners. This could be caused by the time of the day, as the observation was done before noon.

The group went to Rådhuspladsen, and it was observed that bicycle stands were overcrowded everywhere, and there were only a few people with baby trolleys walking down the streets. On Rådhuspladsen, there was solely big groups of tourists with guides and local pedestrians.

Overall, the team came to the conclusion that it might be beneficial, to look deeper into daycare workers' routines and attitudes towards air pollution, as daycare workers spend a large amount of time with small children who are very sensitive to air pollution.





# Initial observations and interview Reflections

The field research, in terms of observations and interviews, provided the team with a better understanding of the area of Inner City. In addition to that it gave insight in peoples thoughts about air pollution, and where they usually went with their children. Overall, the aim of the field research was done to get insight and experience on how to gain more valuable findings in the next research steps.

The validity of the observations can be discussed (Bjørner, 2015, p. 109), as the participants observed and talked to, did not know on which background the team was asking them the question. They might also have felt, that they had to answer what we wanted them to answer and it was also thought that they maybe were answering what they did because they felt embarrassed by saying that they did not think about air pollution when going around outside. The reliability in these observations can also be discussed (Bjørner, 2015, p.110), as they were done in the morning and it might have been another result, if the observations were done at another time of the day. Furthermore, the weather was not really good the day this was done and it might affect how many people the team met on their way. It could for example have been beneficial for the observations to go out and observe another day.

# Initial target groups



After the observations and contextual interviews, the team chose to focus on two different target groups. It was decided to look further into both of them in order to choose one for further work.

## Families

When doing the observations in Inner City of Copenhagen, the group met many mothers with children in strollers. Most of them told that they were aware of air pollution and thought about it when going out with their children. The team found this interesting and chose to look deeper into this by creating a survey. The goal was to investigate if parents living or moving around in an air polluted area are aware of it and think about it. Additionally, the team wanted to see if the parents would like to know more about this topic to be more aware of where they are spending time with their children in the future.

## Daycares

The team solely spoke to one daycare when doing the initial observations and contextual interview, but found it relevant and interesting for the project to look further into this targetgroup. 12 daycares in Inner City were contacted by e-mail in order to obtain a deeper understanding of their everyday life and their awareness of air pollution when working with children. The e-mails were meant to be the beginning of a longer collaboration with the daycares (appendix 2)







# Initial target groups

## Families – Survey

First, a survey targeting families living in Inner City was sent out and shared in different Facebook groups and platforms (appendix 3). However, after sending out the survey the group experienced that it was difficult to reach the target group and started wondering if the target group might have been too specific, as only two responses were gathered after 24 hours using this method. Alternative approaches to reach the target group were thought through, as it was found relevant and important for the project to gather quantitative data based on the problem statement. However, the group quickly realized that the current situation had an impact, and did make it almost impossible to raise the desired number of respondents.

Because of this, it was decided to change the focus of the target group a little in order to be able to reach more people, and thereby, also get some more valid findings that could be used later in the process. An approach of reaching families outside Inner City, was used believing that it would be possible for the group to use the answers to also reflect the living of families in Inner City. The goal was to keep the survey as close to the original as possible so the project did not change direction and the group would still be able to use the data. As the survey was no longer solely focusing on Inner City, some questions were changed and some questions were added to the initial survey (appendix 4)

The survey was changed to target families living in Copenhagen (Amager, Frederiksberg, Sydhavn, Nordhavn, København NV, Vesterbro, Østerbro and Inner City) to make it possible to reach more people within a bigger area.

This seemed to be the right method, as more people answered the survey.



# Initial target groups

## Families - Survey

The findings from the survey were used to gain a deeper insight in the potential target group. It was discovered that 70% of the respondents do not think about air pollution when walking around in Copenhagen with their children (appendix 5, figure 1). Based on that the survey participants were divided into two groups: The ECO-thinkers and the Non-ECO-thinkers. These two definitions had been used throughout the report. One of the most remarkable findings showed that the ECO-thinkers, in general, do not react towards air pollution. Additionally, it showed that 85% of the total amount of respondents have a positive attitude towards the idea of receiving more information about air pollution. Therefore, this was seen as a potential market for the team in order to develop a product that creates awareness about air pollution.

Beside the above-mentioned, key findings discovered where the target group prefers to spend time with their children and why they decide to go to these certain areas based on their age (appendix 5, figure 10). The obtained data were used in order to develop realistic personas based on data.

### Reflections

If the team had the chance to go back in time, they would investigate the children's behavioral patterns and needs. In addition to that it would have been useful to examine the relationship between a child and its mother regarding their attitude towards privacy and surveillance.

# Initial target groups

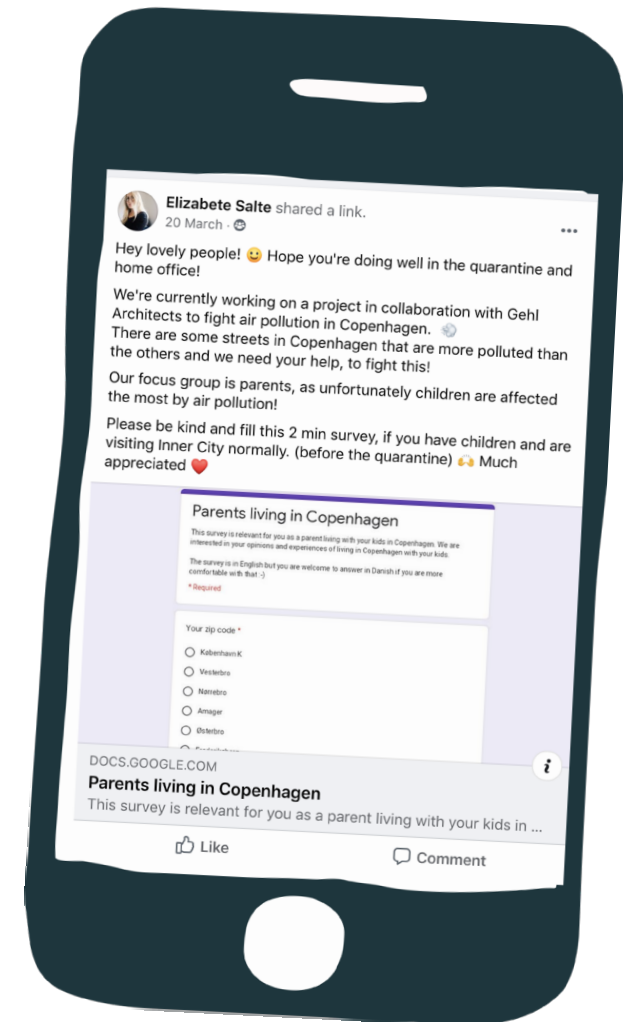
## Reflection



The general lack of answers from both attempts was presumed being caused by the circumstances since parents most likely were focusing on the changing conditions among that to take care of their children, and therefore, did not have time left to respond the survey. 20 answers were collected through the second survey, however, it was not much compared to previous semester where all team members experiences to get around 100 answers with a similar survey.

The survey were send out through the team members Facebook and LinkedIn profiles and were also posted in a Facebook group called "Expats in Denmark" with around 45.000 members (Expats in Copenhagen, n.d.).

As the survey were sent out through Facebook and LinkedIn, some of the answers might have been from the team members friends and family why the team is aware that the answers may be reflected by this. The reliability of the survey could also be discussed (Bjørner, 2015, p. 110), as it was clear to the team that the circumstances had an impact in the ammount of answers.





# Defining target group

## Families

After conducting data from desk- and field research, it became clear which of the two target groups the project should focus on.

Only two responses were received out of the 12 daycares that the team had reached out to at this point, which made it clear that it could be difficult to initiate a collaboration. This was not the situation the team had hoped for, as it would have been a potentially interesting direction to take the project. During other circumstances, the team would have tried to reach the daycares in other ways, like for example through phone or showing up. Due to the situation, it was needed to show respect for difficult and frustrating times. If the group did not have a fixed time frame, it could have been interesting to wait for the situation to be normal again and then make more field research in different daycares placed in the Inner City of Copenhagen.

In the current situation it was decided that further work on the project should focus on a final solution for families. Through the empathize phase the team looked more into children and how air pollution affects them. The detailed research showed how children are affected and why it is important to think about them in this case. Furthermore, the research showed the team that there is a big health issue when talking about air pollution and that a lot of people get sick or somehow is affected by air pollution.

# Current stakeholder map



A current stakeholder map was done to get an understanding of the current situation and the stakeholders involved (Giordano et al., 2018). In order to not end up with a map that was too extensive, it was decided to do the map after the target group was defined. However, the map was still ending up covering quite a large area with many different actors involved. It was decided to group the actors in the inner circle of the map, and then specify each group by listing the actors in each of the groups.

Having a comprehension of the current situation before entering the ideation phase, allowed the team to achieve a deeper understanding of where a possible solution could be implemented or/and where there might be possibilities for new design solution (Giordano et al., 2018).

## Reflections:

It was challenging to create a current stakeholder map as the topic of the project was a broad topic to cover as it at this point of the project was not narrowed down yet. It gave the team an overview of the surroundings of the families living in Inner City. However, the team did realize that the map became broad and therefore, could be challenging to work further with in the project.

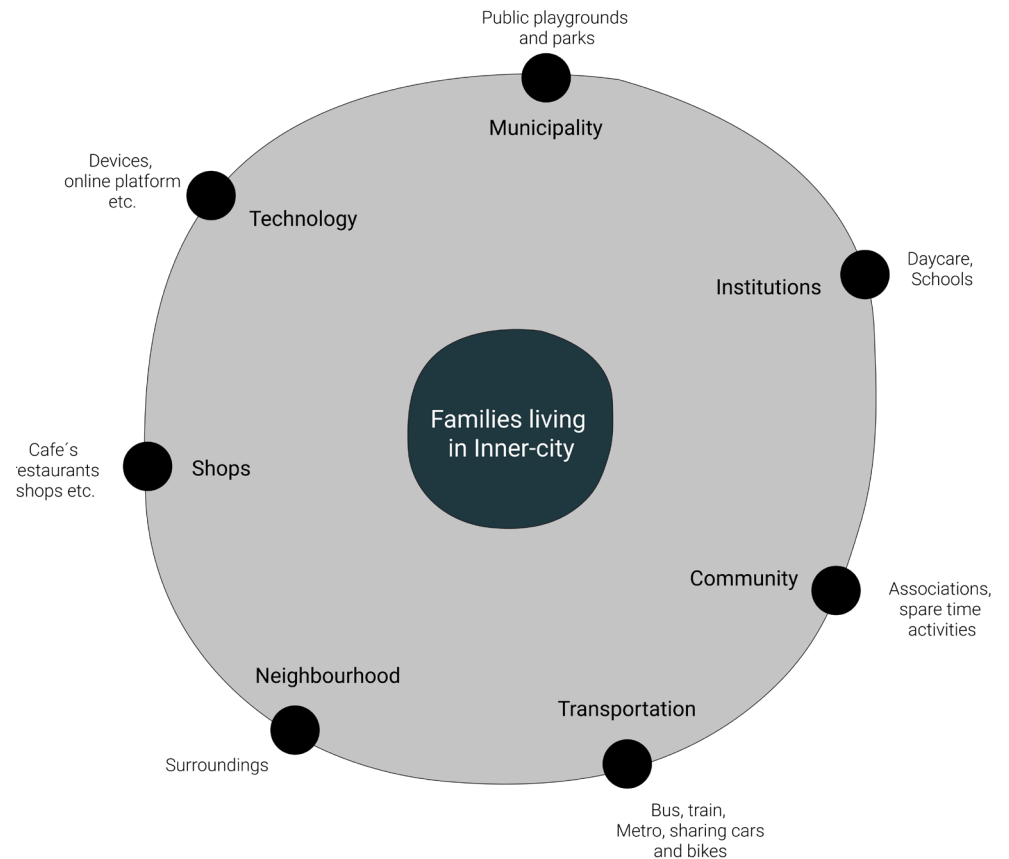


Figure 6: Current stakeholder map

# Gehl data collection



The team took part in data exploration in collaboration with Gehl. During observations, observers were assigned to different locations in Inner City. In the app each observer had to note down how many people entered the areas, their age, and what they were doing. The data exploration gave insights in people's behaviors and age groups in Inner City. The data could provide meaningful insights and help in the further steps of the project.

## The team chose to focus on the exploration of 3 aspects in the datasets:

- When people are visiting areas the most;
- Which age groups are visiting which areas the most;
- Moving vs stationary behavior in the areas.

### Reflections:

These 3 main aspects were chosen with the main goal to have an overview of exact numbers, that will help to gain insights into which areas it would be beneficial to do more observations in the next steps of the project. Due to circumstances out of the team's power, further observations were not able to be pursued. The data was supporting the team when considering future solutions for this project. At the time it was considered, that if the potential solutions will be geo-located, or time-based, this will help the team to consider certain areas in Inner City and certain timeframes.



Figure 7: The most visited streets by children in Inner City (appendix 6, figure 19)

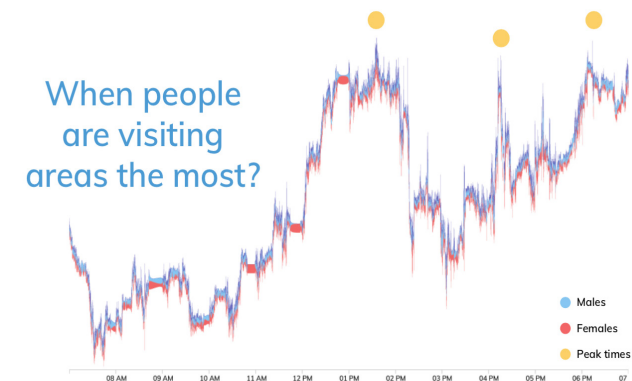


Figure 8: When are people visiting the Inner City areas the most? (Appendix 6, figure 18)



# Interviews

## Asynchronous individual interviews

Interviews were conducted to get a deeper insight into parents' thoughts about air pollution and to gain knowledge about how families in Copenhagen live and spend their time, as well as getting to know their transport patterns. In consideration of the circumstances, it was not possible to do interviews physically face to face. Four people signed up for participating through the survey, and they were asked how they would like to get interviewed, due to the fact that the team knew that they might be affected by the situation. Most of them preferred an online writing interview, as they could fill it out whenever they had the time. Furthermore, it was not possible for some of the participants to do the interview at Zoom or phone. It ended up with 3 interviewees, since one of them, unfortunately, informed us that she did not have time to do the interview after all.

Online interviews are not a typical way of doing interviews, but the group discussed the pros and cons in relation to the outcome and came to the conclusion that in the given situation this was the best solution.

The group decided to use the method called "asynchronous individual interviews", which is a non-real time method (Bjørner, 2015 p. 77). The biggest advantage for the group in this situation by choosing this method, was that it was possible to reach people that normally would be difficult to reach due to time restrictions and busy everyday life's. Furthermore, it allowed the interviewees to have deeper reflections because they had more time to consider their answers, as well as the participants might feel more comfortable at their own places (Bjørner, 2015 p. 78). Further this could give some more in depth and reflected answers from the participants compared to a video or a phone interview. The cons about the method was that it was not possible to do follow up questions directly to the participants, but after receiving the answers, it was possible to send out some questions to follow up if relevant. Moreover, it was not possible to elaborate the questions, if the participant did not understand the meaning of them, but as it is shown in the interview guide, the group explained to the participants that they could ask if they had any questions or comments (appendix 7).

# Interviews Findings

The interviews helped the team discover a clear pattern and get to know the lifestyles of the families better. They all like to go for walks frequently, and one of the participants mentioned that she tries to avoid busy roads, as she associates them with air pollution. It was widely mentioned that cars were the first association for people when hearing the words: air pollution. These findings were a valuable step, in the process of moving forward and getting to know the target group better.

## Main findings (appendix 8):

2 out of 3 interviewed families had been affected by asthma, and both families who are affected by asthma use cars daily. All interviewed families associate air pollution with cars, and like to go for walks in nature as their spare time activity. They don't know much right now about air pollution and would all be interested to know more about air pollution.

# Synthesize

In order to synthesize the interview findings, the team built a digital research wall, using the online tool Miro (Miro, n.d.) It was decided to build a research wall in order to visualize and synthesize the findings and identify patterns (Stickdorn et al, 2018, p.128, 129).

To start off, each interview participant had its own section – and the team added post-its with interview findings. That included more general information, such as their occupation, location, how many children they have, as well as information from the interviews related to air pollution. To give a better visual overview, a colour was assigned to each participant.

Next step of the process was to cluster and organize the data into smaller piles with different categories. The team chose to cluster the interview data in 5 categories: general information, health, transport, air pollution, spare-time activities.

The method helped the team to cluster the data, identify patterns and categorize it in different parts to create a simple overview that should be used when developing personas and a user journey.

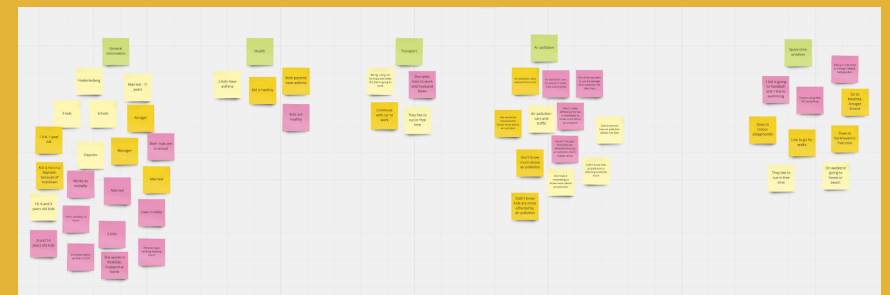


Figure 9: Synthesise of interviews (appendix 9)



# Interviews Reflection



Overall, the choice of approach had an impact on the team's findings. In-depth interviews would have given a deeper insight and a more real-time view of the parents, but on the other hand the data gained from the online asynchronous method might be more reflected due to the fact that the respondents had more time to reflect about the answers. This might give us some more thoughtful answers, but it also made that there were no solution for direct follow up questions. There were both pros and cons about this approach, but the outcome was useful for the group to work further on the project.

It might have been more beneficial to conduct the interviews physically, if this has been possible and therefore the validity (Bjørner, 2015, p. 109) can be discussed, as we do not know if we have got some different answers doing the interviews in a physical setting.

# Persona



The team aimed to create engaging personas due to the fact that they are based on data collection and analysis of data. Additionally, the obtained data and invented stories were used in order to make relatable personas, which would engage the team to create the best product for the personas. By following professor Lene Nielsen's 10-step-process, three personas have been made (Dam & Teo, n.d.). Each persona consisted of a mother followed by an introduction to her family. The mothers' were acting as buyer personas and user personas since they were buying the product and assisting analysing and explaining the data results from the app to their children. Contrary, the children would solely be the user personas given the fact that they are wearing the wristbands. The amount of personas was intentional, because the three personas addressed dissimilar roles which contributed with different perspectives and motives that helped to understand their lives. Additionally, they had different needs, motivations and perceptions, which were interesting in terms of developing a product that meet their needs (Heinze et al. 2016).



The three personas was assigned nicknames that fitted their personality. The first part of the name "eco-thinkers" or "non-eco-thinkers" refers to the family's view on air pollution and the second part e.g. "the skeptic" refers to the personality of the mom.

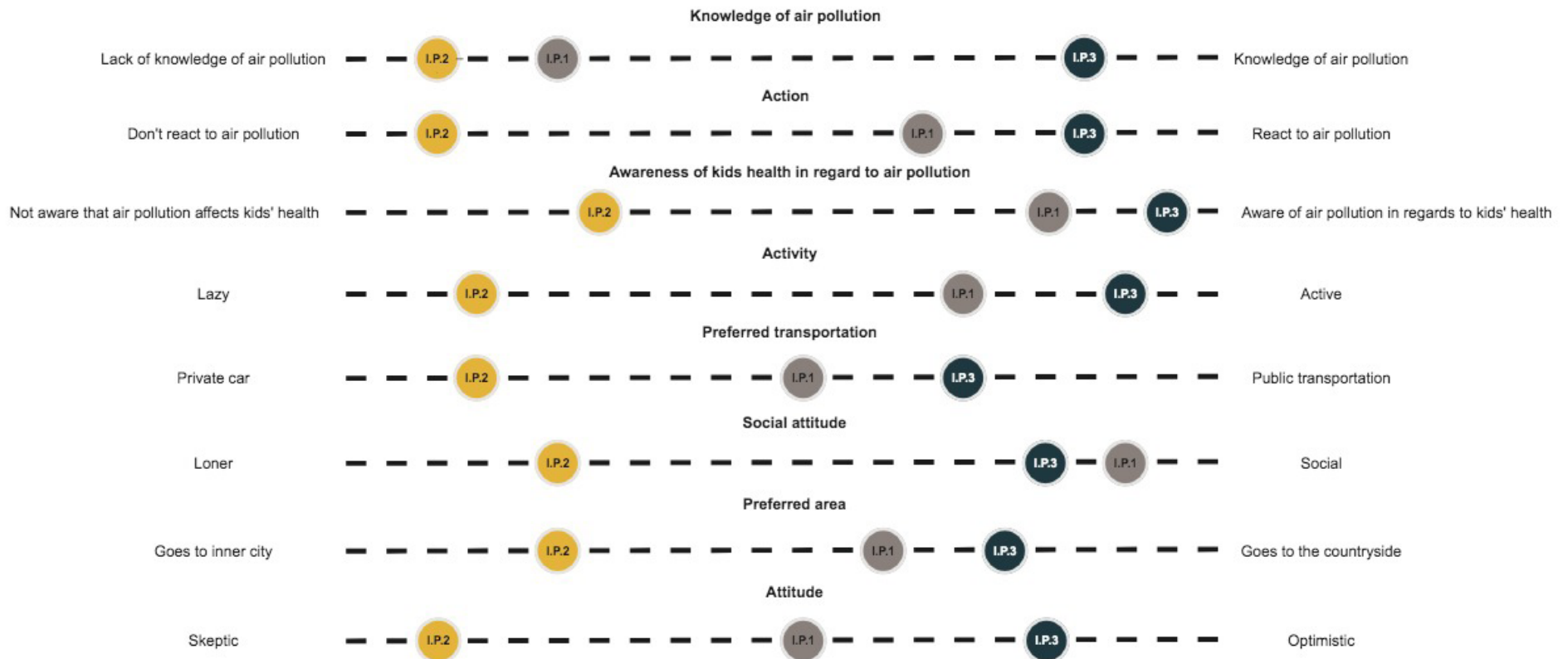


# Persona

## Polarity map

Based on the previous research and analysis of the survey, different patterns were found and clustered. After determining several characteristics, all respondents were analysed as well and placed on the scales below.

-  Interview Participant 1: I.P.1
-  Interview Participant 2: I.P.2
-  Interview Participant 3: I.P.3



Model 10: Polarity map

# Persona Eco-thinker – The leader



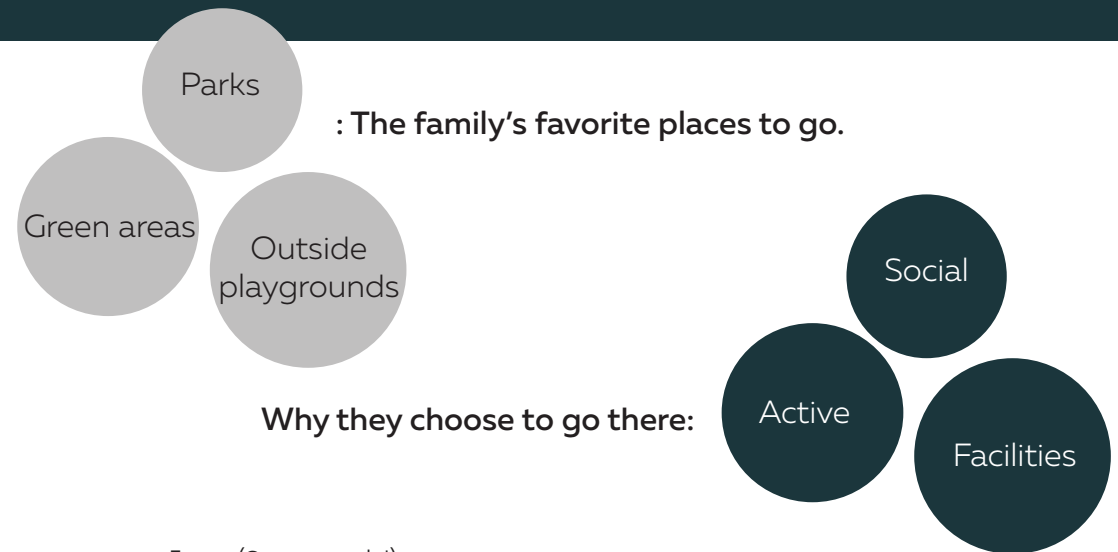
## Future goals:

- She would like to use knowledge about air pollution for her bike trips
- Spend more time with her family
- Stay healthy

## Frustrations:

- Not surrounded by enough nature
- Public transportation
- Scheduling her day

“I think of cars and that it is the worst in the cities. Have once heard that a big smoker living in the countryside has cleaner lungs than a non-smoker living in the center of KBH. That claim, I often think of when I think of air pollution, but do not know if it is true.”



**Name:** Gitte

**Age:** 39

**Education/profession:** Healthcare profession

**Personality:** Outgoing, punctual, active

**Attitude towards air pollution:** She’s aware of air pollution and has a strong view that cities are more polluted than in the countryside. Aware of it that it strongly affects childrens’ health.

**JENS**  
**YULIANA**

**Jens** (9 years old)

**Educational institution:** School

**Hobby:** Handball - twice a week, computer games

**Juliana** (5 years old)

**Educational institution:** Daycare

**Hobby:** Drawing, Ipad

# Persona Non-Eco-thinker – The thinker



## Future goals:

- Know more about air pollution
- Fast and cheap transportation
- More safe, child-friendly streets (traffic)

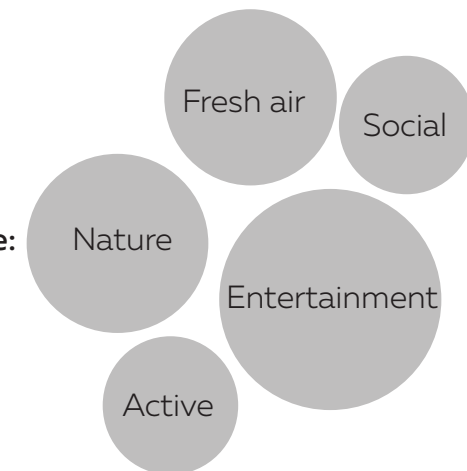
## Frustrations:

- Her children's health
- Saving time, going from A to B
- Expenses of upkeeping her car

"We like to run in Frederiksberg Garden and Søndermarken. If we need a trip to the inner city or Frederiksberg we usually take a bike, bus or metro. Faster and cheaper. On weekends we would like to take a car trip to a forest or beach approximately 40-50 km away from the city."



: The family's favorite places to go.



Why they choose to go there:

**MOM**  
**Name:** Vica  
**Age:** 31  
**Education/profession:** Marketing manager  
**Personality:** Thoughtful, helpful, social  
**Attitude towards air pollution:** She doesn't know much about air pollution, but associates it with cars and traffic. She would like to change her habits, to help decrease air pollution, such as use more bicycle and metro. She thinks it might affect childrens' health.

**KIDS**  
**Carl** (6 years old)  
**Educational institution:** School  
**Hobby:** Biking and running  
**Other:** Has asthma  
**Mattias** (2 years old)  
**Educational institution:** Daycare  
**Hobby:** Playing with toys

**Cecilie** (9 years old)  
**Educational institution:** School  
**Hobby:** Biking  
**Other:** Has asthma

# Persona Non-Eco-thinker – The skeptic



## Future goals:

- Avoiding busy streets, when going for walks
- Assure that the kid doesn't get asthma
- To know which streets are polluted

## Frustrations:

- Asthma
- Traffic, when going to work
- Lifestyle changes, being a new mom

**"I don't think you can make the busy roads less busy necessarily, but I would myself avoid certain streets when I walk with the stroller. I already try to do it, but obviously I don't know if it is a polluted street or not."**

**Name:** Pernille

**Age:** 27

**Education/profession:** Account manager

**Personality:** Skeptical, caring, prefers comfort

**Other:** Has asthma

**Attitude towards air pollution:** She doesn't know much about air pollution and she associates air pollution with cars and thinks it is impossible to stop cars from polluting streets. She tries to avoid busy streets, as both she and her husband have asthma, so she can prevent their kid gets asthma as well, but she doesn't think she can do more than this about it.



**Why they choose to go there:**

**MOM**  
**YIDS**

**Selena** (1 years old)

**Educational institution:** Daycare

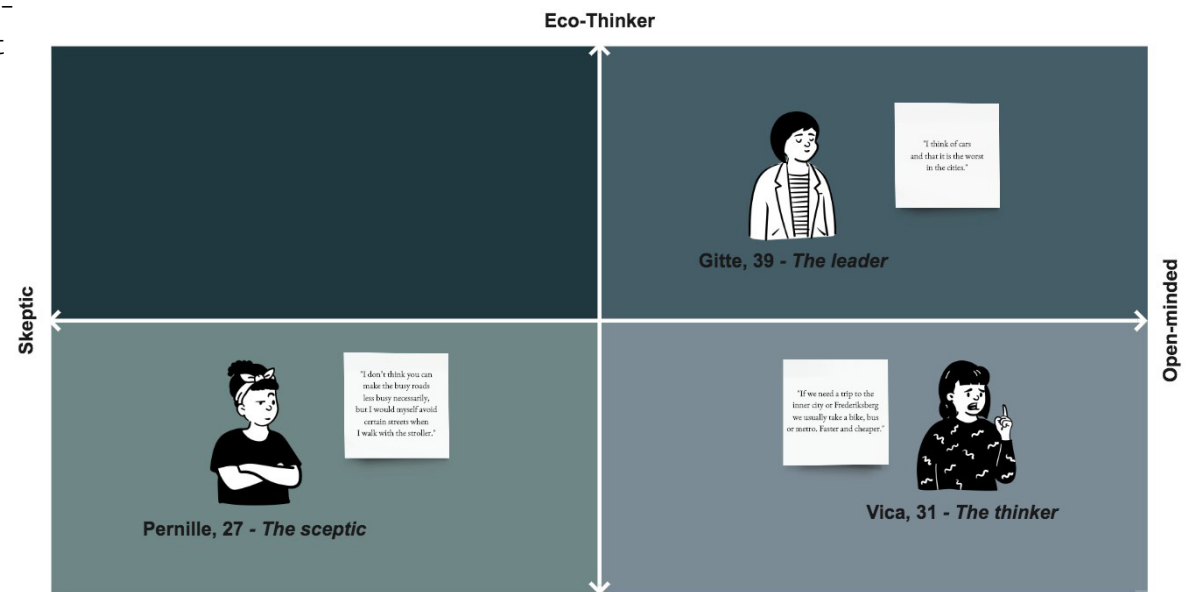
**Hobby:** Watching cartoons

# Multiple Persona Matrix



Multiple Persona Matrix (Quattro Stagioni model) presents the 3 personas. On the X-axis, "Skeptic" and "Open-minded" were used to define their personality traits, and on the Y-axis the "Non-Eco-Thinker" and "Eco-Thinker" were used to reflect their behavioral patterns towards air pollution (Morelli, Jonas & Munch, 2008).

These 4 characteristics contributed to understand and compare the personas' current behaviours and to reflect upon their future demands on a the teams upcoming concept. The main purpose of this step was to clarify possible future contexts, and to make unexpected situations explicit since that might influence the success or failure of the concept.



Model 11: Multiple persona matrix

Non-Eco-Thinker

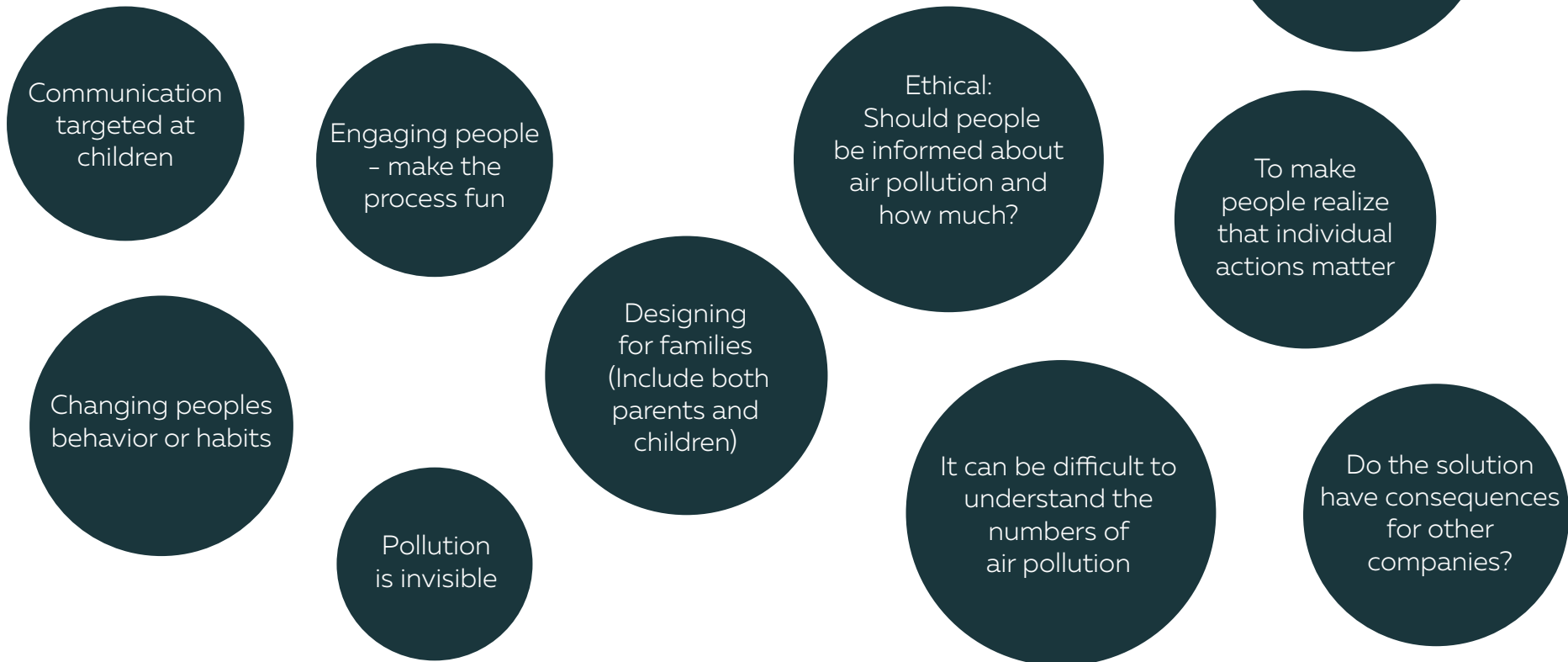
miro

# Pre-ideation

## Defining challenges



Based on the work done until now, the team came across some challenges, that they found relevant for the further work on the project. Therefore, a brainstorm that highlighted some of the challenges and main issues was done, in order to have them in mind when starting the ideating phase. The team did not know if it was possible to incorporate the findings, but hoped it would help to clarify how to build or not to build the final solution.



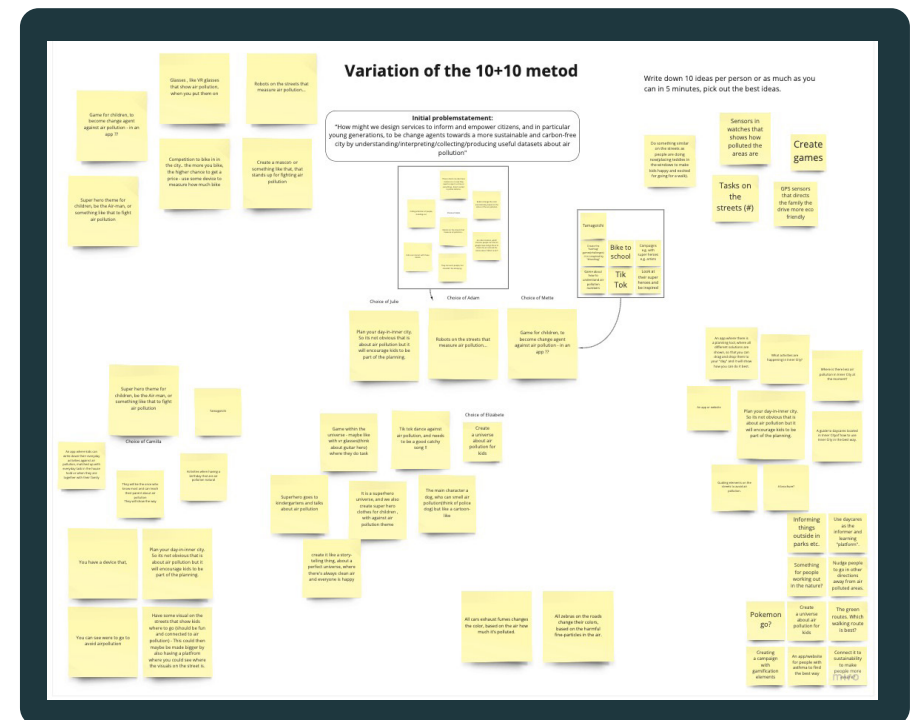


# Pre-ideation

## Variation of the 10+10 method

With the purpose of coming closer defining a problem statement, a variation of the 10+10 method had been used (Stickdorn et al., 2018). The aim of using a different variation of the 10+10 method was to make it fit well into the design phase and make it realistic to execute during digital circumstances. Beside the above-mentioned purpose, the object of the initial brainstorm was to get insight in each group members thoughts of the direction of the project. Additionally, it was a way to demonstrate ideas and to get inspired before choosing an initial problem statement.

The first step of the method was to, individually, start brainstorming ideas for 5 minutes. Thereafter, the ideas were presented for the team members, and each member chose one idea out of the total amount of ideas to continue brainstorm on for 5 further minutes. In the end of the detailed brainstorming process, ideas were presented for the group members. As a result of this, the outcome of the brainstorming process was used to help defining which problem statement to work further on (model 11).



Model 12: Ideation 10 + 10 metode from workshop in Miro (appendix 10)



# Problem statement

## Choosing a problem statement

After using the variation of the 10+10 method, more problem statements were made within the team, focusing on different topics and areas of the desk research. Three problem statements were chosen to work further with, and for all problem statements, a virtual ideation workshop was facilitated (appendix 10).

This approach was chosen in order to investigate the possibilities and solutions within different areas.

The aim was to generate as many ideas as possible throughout the ideation workshop, as it might provide the group with many different ideas that potentially could be crossed connected or partly used in a final solution.

After the ideation workshop, an idea and problem statement was chosen based on the strong connection to initial work, personas and the team's agreement on the potential of the idea.



# Ideate

The purpose of the third phase of the design process, was to develop the concept even further. A problem statement and an idea was chosen, by using different ideation methods. The chosen idea required further desk research.

The ideation process's next steps were to create a shared understanding and goal of the idea, so different methods and tools were used. More desk research was done to achieve a ground understanding of some of the unknown elements related to the service.

# Ideation workshop



In order to generate ideas based on the problem statements, three virtual workshops were facilitated by one of the group members (appendix 10). The ideation workshop was the same for both ideas, and the same methods to ideate were used.

The ideation workshop was facilitated by using the online tools Miro and Zoom at the same time, so the group members could interact and work together as a team. This was a really useful approach to the workshop, as it worked almost as well as if the workshop was being facilitated in a physical room with all team members presented.

Two different ideation tools were used to ideate. Both of them had different approaches to generate ideas that required the members to think in different patterns. First, a cross-connection exercise was done and from that, some of the ideas could be used in the next exercise (Nielsen & Thurber, 2017). After the cross-connection exercise, brainwriting was executed and as the team had ideated many ideas it became easier to use and start the brainwriting exercise (“Brainwriting”, n.d.).





# Ideation workshop

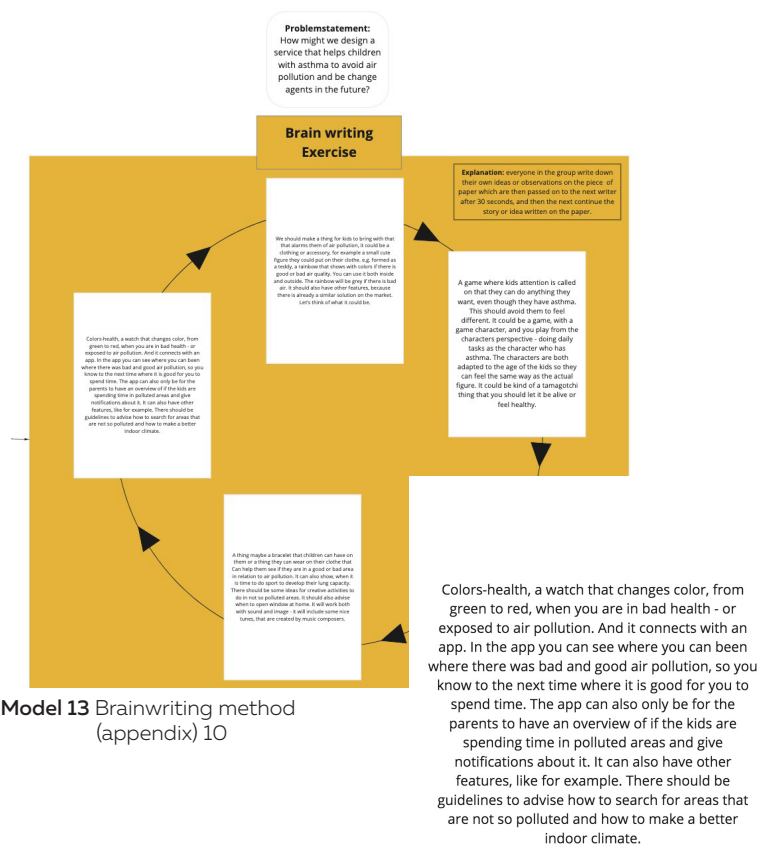
## Cross-connections & brain writing method

### Cross-connections:

The cross-connection method was used for the team to discover new and different combinations that they might not have thought of in the first place (Nielsen, & Thurber, 2017). First of all, two topics connected to the problem statement was chosen. Thereafter, all team members started ideating on words related to that topic. When the team could not think of more words for each topic, they started connected the words randomly (Nielsen, & Thurber, 2017). Everyone started creating small ideas with the combination of the words, still having the problem statement in mind. Each idea was read by all team members and the ideas with potential or some interesting elements were put to the side for later use e.g. in the brainwriting exercise.

### Brain writing:

A method called Brainwriting has been used in order to generate many diverse ideas quickly ("Brainwriting", n.d.). Each team member was given 30 seconds to start writing an idea in silence. When time ran out, the ideas were passed on to another team member, whereas they continued by expanding or commenting on the idea. The Brainwriting ended when all group members had a chance to add their thoughts. The outcome of the method resulted in a clearer idea of which elements the final idea should involve.





# Idea

## AirGo

From the ideation workshop, the team came up with many different ideas but decided to continue with the following problem statement and idea.

### The idea

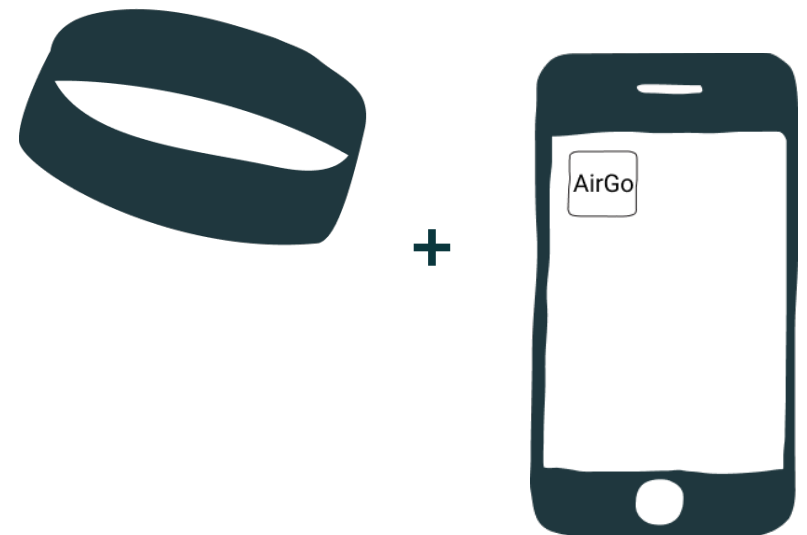
The idea focused on making children with asthma aware of air pollution as it has a negative impact on their health. By making the invisible visible and tangible, the concept would help them understand what causes air pollution and how to avoid it, in order for them to maintain a better health. Inner City have many very polluted areas, which was why it became relevant to look into how families could help their children spend more time in areas with good air quality and less time in areas with bad air quality (appendix 6, figure 19). Furthermore, to understand and be aware of air pollution might be the first step for the children towards becoming change agents when they grow up, as they understand and feel the negative impact of bad air quality on their own body and know what causes it.

The idea was based on two main elements. A wristband and an app; which works together and shares information. In the wristband, a small sensor detects the air quality and inform the owner by changing appearance. Additionally, the wristband has an integrated GPS in order to analyze the measured data. The wristband sends data with the information and location to the app. Thereby, the information about the air quality in the visited areas, will be available for later use. Overall, this will provide the owner(s) with an instant understanding of the air quality in the present location, in order for them to act on it. The product will be providing a general understanding of the air quality in the visited areas for later use.

### AirGo

We chose the name AirGo as it fitted our concept perfectly, having both the connection to Air (air quality) and Go, that referred to how you bring it with you.

“ How might we design a service that helps children with asthma to avoid air pollution and be change agents in the future? ”



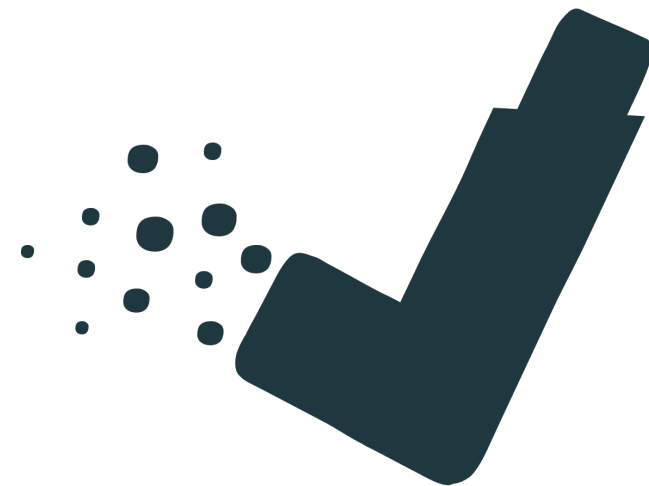
# Why focus on asthma?



After doing both desk- and field research, it was found that air pollution is a complex topic for most of us. Therefore, the research was focused into the people that were more affected by air pollution in their daily lives, and not on people with no diseases. The research in the field of asthma gave the team a lot of useful information on how people with asthma are affected by air pollution. The team found it interesting to further investigate this and gain knowledge about how kids with asthma are dealing with air pollution and if they are aware that air pollution has an effect on air pollution.

It was decided to target people that are actually affected by air pollution and can relate to the issue, instead of people that found it as a complex topic and do not know what to use the information for. By focusing on this target group, it was possible to develop a concept, that could be helpful for a group of people and that hopefully could be used in their daily lives.

The team is aware that the concept can be used in other places than only Inner City of Copenhagen. However, from the Gehl data, it was found that Inner City is one of the most polluted areas in Copenhagen. It is also assumed that it might be more relevant to use a concept like AirGo when using time in a place like Inner City, and because of this, the concept will also be relevant for kids living around in Copenhagen, and often go to Inner City.

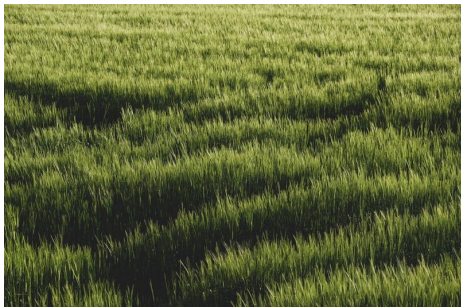
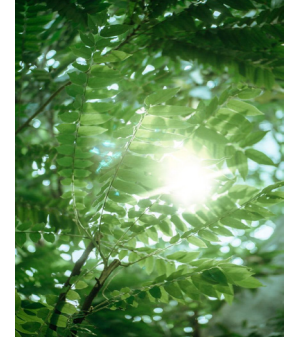
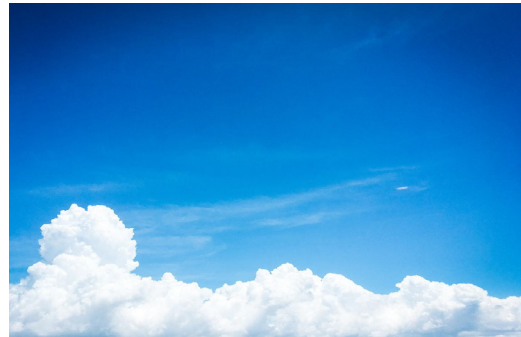
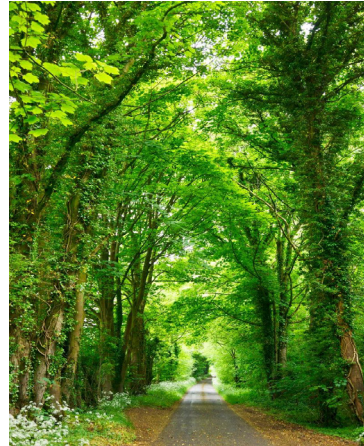
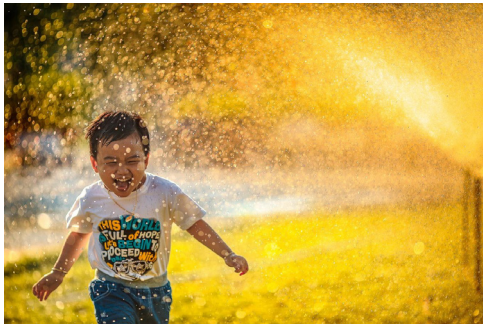


# Moodboard



With the aim of visualizing the current product strategy, a moodboard has been created. It was a creative approach that helped communicating the brand identity such as the quality of the product, the emotions and the intended design direction (Stickdorn, et. al. 2018). Additionally, it created a common understanding of the product for the group members and for the target audience (Tran, 2019). The purpose of creating the moodboard in the ideation phase was to visualize ideas and ground principles of the intended product that might be useful when designing the final concept. The moodboard was seen as a guideline and could always be edited during the design process (Stickdorn, et al., 2018).





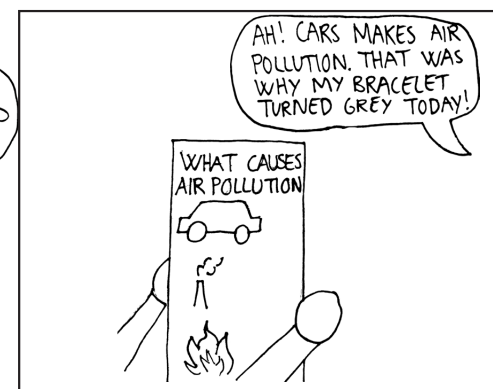
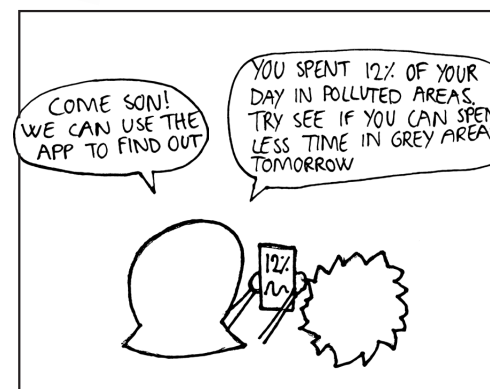
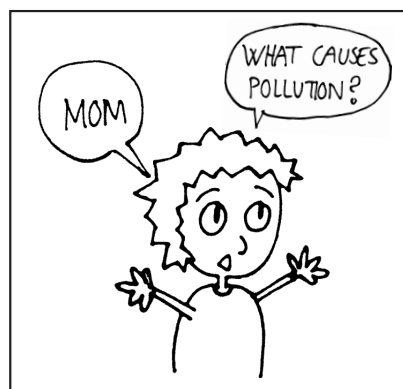
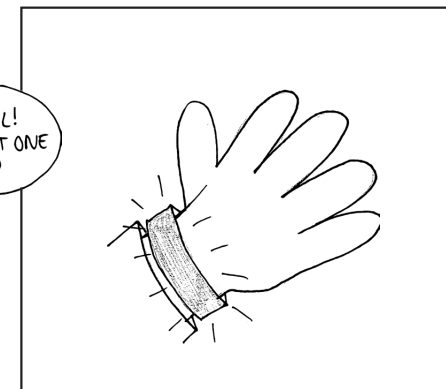
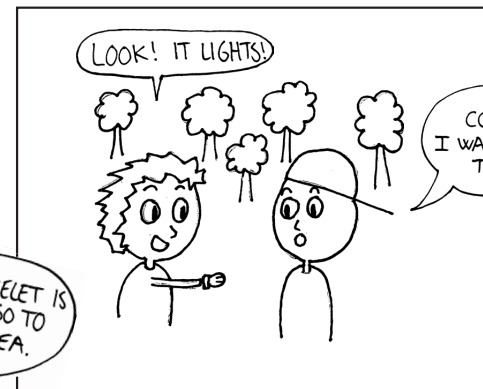
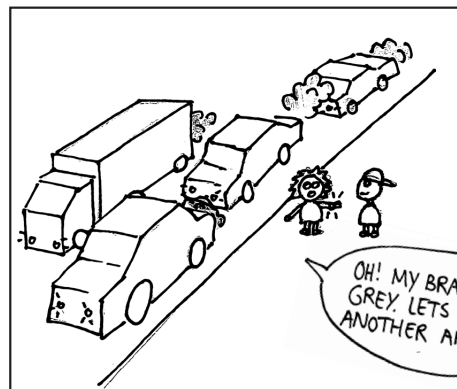
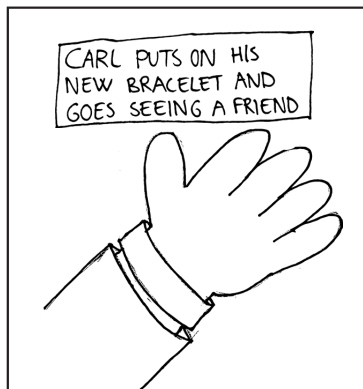
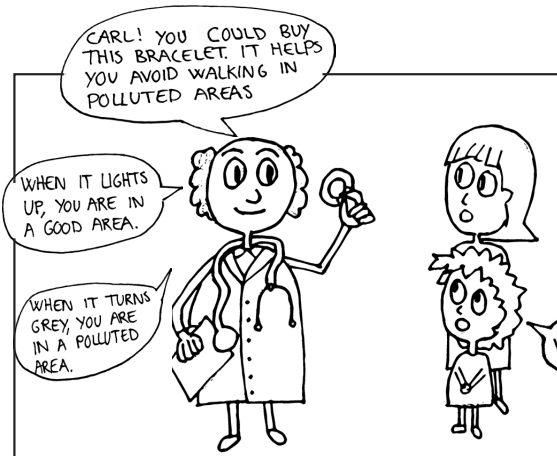
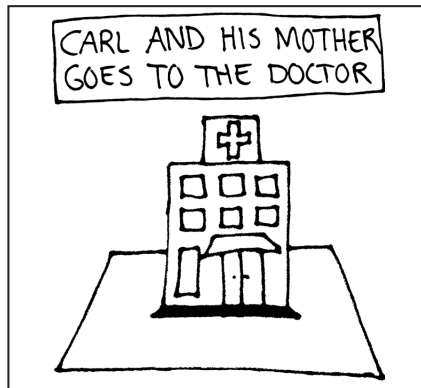
Model 14 Moodboard

Unsplash (n.d.)

# Storyboard



A storyboard was made in order to visually represent- and provide a common understanding of the concept (Stickdorn et. al., 2018). Additionally, the purpose of this low-fidelity prototype was to quickly generate constructive feedback and insight in potential users needs in the early stage of the product development. The storyboard was presented during the Midterm Presentation, whereas the team obtained useful feedback that created great value in the further design process. Hereby, the team illustrated and tested the functions of the product: AirGo without investing hours in building the prototype. (Rudd, Stern, & Isensee, 1996).



# Identifying the uncertain elements



In this phase of the project, the team had identified some unclear parts of the concept that had not been answered through the research yet. Therefore, it was chosen to look deeper into the subjects listed below, in order to continue the further work with the concept.

## **Age**

It was not clear how old the children should be to benefit from the concept. Therefore, the team chose to do some desk research about childrens' development and to talk with families within the target group.

## **Design**

The team wanted to understand if the design should please mothers, in order to make them buy the wristband or if it should be designed for the children to make them wear it. The team decided to talk to the target group while testing the concept with the purpose of understanding their preferences, when it came to the design of the wristband. Beside that, desk research of existing services was done with the aim of getting inspired by other similar products, and by learning from their mistakes.

## **Ethical issues**

The team knew there potentially could be a problem with the tracking of children. It was decided to talk with the target group when testing the concept, to be able to understand how they felt about it. Apart from that, desk research was done within this area in order to get a deeper knowledge of the existing ethical issues of similar products.

## **Technological wearables**

It was decided to look into the trend of technological wearables to get an insight into people's thoughts of the existing services that were similar to the service the team wanted to develop. It was to understand what people liked/disliked, and what their motivation for using technological wearables could be.

## **Learning, communication and memory**

Lastly, the team wanted to understand how children learn and memorize in the best way and how to communicate the information in the app in the best possible way. Therefore, the team chose to do some desk research within this area, and furthermore, they chose to contact specialists since the service should be a solution for families that were affected by asthma.

# Pretotyping



An experiment was staged (Munthe-Kaas & Hoffmann, 2016) in form of a video sketch that presented the concept (Hvied, 2020). The stop-motion method were used to create the video, and the aim of the pretotype was to get feedback about the concept from potential users. It was decided to create a pretotype because the team found it useful to explore if the market was ready for a concept like AirGo before moving on with the concept. The advantages of the pretotype was to save time, money and effort, and it provided a low-cost option to show the concept in a way that was better than traditional things, like paper, powerpoint, etc. (Vang, n.d. p. 62-63.) Pretotyping was an ideal method for the team to use in this part of the project, as it was a fast and cheap method to use before moving on in the project. Furthermore, the team had the opportunity to ask questions about some of the features that was not yet decided upon to get an idea of the potential users' preferences, before further development.

The pretotyping was testet on 4 participants. The video was sent prior to the follow up questions, so that they had a chance to watch and reflect on the video. An interview guide was created (appendix 11), to make sure that all testings was done in the same way. The questions that the participants, were asked, was created to answer all the uncertain elements of the concept in this stage of the project.



Hvied (2020) [https://youtu.be/Eyv\\_d3EbuQE](https://youtu.be/Eyv_d3EbuQE)

# Pretotyping

## Findings



The testing findings (appendix 12) were clustered in the same way as the first interviews collected (appendix 9). In this case the findings were sorted into 5 different topics so it was possible to see how the different participants have answered compared to each other. The 5 different topics were design, age, features, tracking and using the service.

In the topic design, it was found that children have a lot of different interests and it would therefore be difficult to design one bracelet that would target different ages and gender. Furthermore, some of the participants found it important that the design of the bracelet should be something interesting to the kids to make them wear it. One other participant said that it should be simple to avoid that it would look like toy and she also mentioned that it should be something that the parents would also like and not only the child.

In the age part, all of the participants thought that the concept could be used by children in the age of around 6 years. 2 of the participants also mentioned that the children would understand it in this age, but maybe they would not reflect that much upon the consequences and because of this do not take action.

Regarding features, it was found that there were different ideas from the participants. Only one of them mentioned that she like the idea of implementing a game element that could be for example a point system. Another participant talked a lot about that the product could be scaled up and she would actually like to use it herself when running for example. She also mentioned that she think the app should be really simple because it has to teach the children and not the parents, and she thought it could be a good idea to add learning elements that incorporate the senses. Furthermore, all of the participants thought they could learn something as a family by using this product.

The tracking part of the interviews gave the team some insights into what the users are thinking about it and if they are sensitive to data. All the participants said that they did not have a problem with sharing the data with the company, as they know that it is beneficial for them as well. Some of the participants said that they thought this could be a problem in the future when the children become teenagers and they do not want their parents to know where they are all the time. One of the participants also mentioned that she expected the company to only use the data for developing their product and nothing else.

The last part is using the service and it was here the team found if the users would like to use a product like this. Overall all of the participants would like to use the product, but one of them mentioned that she was afraid that it could cause a fear in people to use this. Another one said that she would like to use it herself even though she do not have asthma, but she find it interesting to know where there is bad air pollution, especially when she is doing sports in the nature. She also said that it could be beneficial to use for her younger children as they are in a risk of developing asthma.

### Reflections

The ideal situation would have been to have participants only within the buyer persona, however, it was not possible for the team to achieve this and had to settle with the potential users from the beginning of the project. This also gave an interesting perspective, as the participants had different needs in regards to asthma and air pollution.

# Existing similar services



## Inspiration

Wearables were increasingly becoming more and more popular, because they allowed users to measure things themselves (Eklund, 2018). In order to develop a unique feasible wearable, an analysis of existing services has been made. Hereby, the group could be inspired by other similar products, which could be useful when designing the product. The two similar products were ReimaGo and Garmin Vivofit jr. 2, and they were both recommended in tests (Eklund, 2018).

## ReimaGo

The purpose of ReimaGo was to engage children to become more active. It was a small chip that could be implemented in children's jackets. The chip measured children's activity, whereafter parents and children could analyze the data together within an app. The interface of the app was made in cartoon style, which created increased engagement for the users. The app involved gamification elements such as a vouching system that offered rewards depending on personal activity goals (Østergaard, 2016).

The ReimaGo chip was easy to carry during the day. It was waterproofed and the app was available in several languages. ReimaGo was solely measuring movements and did not track physical location, which was positive according to tests (Reima, 2016) (Bennetzen, 2016).

ReimaGo had caused a debate about if it was healthy or not for parents to track their children's activity. This may e.g. cause distrust between a child's kindergarten and the parents. On the other hand it could be useful for parents to track them with the purpose of seeing how active they should be with their children after kindergarten (Cita-historie, 2016).

## Garmin Vivofit jr. 2

It was a smart-watch/smart-armband that worked as an activity tracker for children. It made it possible for parents and children to measure the children's activity during the day. The armband was connected to an app, which included a vouching system, so when children have been active for one hour they could unlock new games within the app. This worked as a motivational factor for children in order to become more active. Additionally, the parents could add duties for the children such as making them brush teeth whereas the children could earn new vouchers. The app was installed on the parents' phones, which enabled them to keep track on their children's activity, to measure the children's sleeping rhythms and to check if they slept badly. When the children needed to unlock new games the phone could be turned into child mode (Eklund, 2018).

The materials of the watch was silicone whereas it was possible to choose a regular band or a band that could be slid onto the children's hands. The band came in different themes e.g. a princess- or a Star Wars theme and it was changeable so the

children easily could take out the watch and put it into another band. The interface of the app was connected to the band, so if the band had a princess theme, the interface of the app would show a princess world.

### **Intersting findings**

Based on the investigations of ReimaGo and Garmin Vivofit jr. 2, the team got inspired for what AirGo could contain, how it could look, how it should make people feel, and what to be critical about.

The team identified that the features listed below, worked really well for the existing similar services. Therefore, it should be considered in the further product development of AirGo in order to be inspired by their insight and work.

Well working features:

- A cartoon/disney style with changeable bands, which allowed the children to change the band according to mood and outfit.
- Waterproofed.
- User-friendly app and wristband for both children and parents.
- The possibility to turn the app on the parents' phones into child mode.

The negative elements that the team must explore further when designing the product would be the hacking issues. As presented in the chapter about technological trends, hacking became a critical factor in wearables due to unseen security flaws. Consequently, it was crucial for the team to develop products that solely uses and shares the needed information and in addition to that develop a secure product to avoid distrust.

Overall, the mentioned products above have a high engagement level due to the fact that the users found it interesting and funny to use. These was the feelings that the team strived to achieve.





# Desk research

## Asthma and children

As it was found, that air pollution have an impact on people affected by asthma, and the team decided to work further within this topic, it was decided to investigate this area further.

Asthma is a chronic disease, but it is possible to have periods without any attacks. The disease is caused by airways that intervene so it becomes harder to breathe. A child with asthma does not breathe normally, but it is different how it affects the child. For example, some children cough a lot and others are easily having difficulty in breathing. When looking at children, every third child under the age of 3 will have one case of asthmatic bronchitis. It is the same as asthma, but since two out of three children does not develop from asthmatic bronchitis to asthma, the diagnose have a different name, and one third of these children will get asthma later in their lives (Forskellen på astma og astmatisk bronkitis - Astma-Allergi Danmark, n.d.). For the older children going to school, 7-10% are diagnosed with asthma. In general, 80% of the children getting asthma get it before they turn 5 years old. As a comparison around 250.000-300.000 adults are diagnosed with asthma in Denmark (Astma hos børn - Astma-Allergi Danmark, n.d.). There are also different factors that can trigger asthma attacks, whereas one of them are particles in the air. It is different from person to person how the individual is affected, but it can be due to smoke, moisture or dust, as well as strong scents etc. (Årsager - Astma-Allergi Danmark, n.d.).

There are different kind of medicine for children with asthma, but most of the children with a diagnose needs medicine for astmatic attacks, to alleviate the symptoms and to prevent it. Additionally, there are different solutions to get the medicine according to the children's age and how bad the asthma diagnosis is. It is important that the children get their medicine to prevent attacks and to reduce the risk of chronic diseases on e.g. lungen (Behandling - Astma-Allergi Danmark, n.d.). However, it was found that researchers from the university of Copenhagen and Syddansk university, in a study about asthma medicine in 2014, stated that the use of asthma medicine for children have serious side effects. The researchers claim that it is something to be aware of when prescribe medicine for children. Furthermore, they state that asthma is one of the most frequent chronic diseases for children, and in the last 20 years, this has decreased. 5-8% of all children had asthma in 2014 (Hansen & Aagaard, 2014).

# Desk research

## Ethical issues



When developing the concept of AirGo, it was crucial to examine ethical reflections that could occur when using the product. Since there were no identical products on the market, the team investigated ethical discussions of similar products e.g. activity trackers for children. It could be discussed whether it was ethically accepted to connect children's wearables and apps with their parents' app or if it was counted as privacy violations. Based on a report from 2016 made by Epinion, one third of a group of parents thought it was positive to track their children and in that way to show solicitude and to ensure that they were safe (Lauritsen, 2014), (Skaaning, 2016). According to a professor in ethics, it was a sign of security addiction that curtailed the way of living life. Despite the constant change in technology, it was important to use it wisely and in addition to that make sure there was informed consent between the children and the parents (Ellesøe, 2016).

Another urgent consideration was hacking. Wearables like Safe-KID-One and Gator 2 have been uncomplicated to hack, which meant that hackers were able to track them, view data from the app and communicate with the users (Thomsen, 2019), (Lehmann, 2017). Therefore, it was crucial to reflect on which type of data the team needed the product to obtain from the users in case of GDPR in the aim of creating a successful product that was secure and would not cause distrust.

Overall, there were a large number of app's and wearables that offered parents the opportunity to track their children's activity and location, but there was no definitive answer whether it was ethically correct to use it or not. The potential users were in the prototyping testing asked about their opinion about the ethical issue about tracking their children. All of the participants had some thoughts about it, but was overall okay with tracking their children based on the age of them.



# Desk research



## Technological wearables trends

Technological wearables were researched, as it was found that it had a large impact on nowadays society, where quantification and measurements of oneself's health became possible. More than 60% of danes avail themselves of the possibility to measure their own sleep, pulse, movements, intake of calories etc. (Tolstrup, Ryttersgaard, & Hagelskjær, 2019). Based on examinations by Coop, one fourth employ self-measuring to obtain their personal goals (Laulund, 2017). The global market for wearable technology was expected to increase 17,66% from 2019 to 2020 (Business Wire, 2019). The global smartwatch market for children was forecasted to increase 16,44% from 2019 to 2026 (Menafn, 2020).

The motivation behind the self-measuring trend of healthiness was caused by several reasons e.g. excitement, security, performance culture and to be able to be in control of oneself's body.

Young people found it fun to measure their activities when they were combined with games like Pokemon Go. Some people found it motivating to share and compare oneself activity data with friends on social medias with the aim of receiving positive response and thereby to feel better. Others used it to be in control of their own body with the goal of living a healthier lifestyle. Hereby, technology became a tool to learn and behave according to self-measured data and in that way cure oneself of bad habits (Laulund, 2017).

The trend of technological wearables became relevant in terms of security as well. It made it possible for parents to track the location of their children and to do voice calls and in that way for both parts to feel peace in mind (Menafn, 2020).

The negative consequences of wearables could result in possessions and unrealistic goals, which affected one's mood and created unhealthy lifestyles. In addition to that it had been discussed whether it was healthy to compare oneself data with others or if it was more stressful than useful(Laulund, 2017). Another critical factor was hacking due to the fact that some wearables for children involved several security flaws (Lehmann, 2017).



# Desk research

## Childrens' development

In the process of developing the concept AirGo, it was crucial to understand children's development in different age groups. As children are constantly developing, it was crucial for the team to understand children's behavior in different age groups, and therefore get a deeper insight in how to further develop the concept.

Children are growing and constantly changing physically and emotionally. Normally, children follow a general pattern of growth and development. However, some children may develop slowly or rapidly (Age Characteristics of Children, n.d.).



### **Kindergarteners, age 1-4.**

Children in this age group have a lot of energy. They respond well to colourful images, songs and movement. They need to move and be active all the time. Kindergarteners respond well to exaggeration, loud sounds and big movements.



### **Elementary school students, age 5-10.**

This age group tends to be more focused than kindergarteners and they are slowly starting to think for themselves. At this age, role-playing is considered effective, as children at this age like to see themselves as small adults. They start to be more independent. Activities for this age group can be more competitive than for kindergarteners.



### **Middle school students, age 11-13.**

Being a teenager can be challenging - this age group's confidence can go up and down. At this age, they start to think more about what others think of them. Students interests usually include media and social media.



# Desk research

## Childrens learning styles

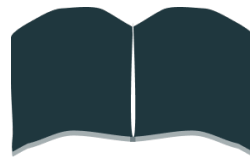
In order to understand how the team can reach out to children in the best way possible, it was decided to research how children perceive the world and how they learn. The team found out, that just as grown-ups, each child has a learning style. In general, there are 4 main learning styles: Visual, Auditory, Reading/Writing, and Kinesthetic.

The team decided to consider different learning styles, if focusing on an educational solution.



### **Auditory learners**

Auditory learners excel at music, such children tend to sing or hum when playing or doing homework. Auditorial learners enjoy talking to others and can follow well verbal instructions. Recommended tips for auditory learners is to repeat study notes out loud, make rhymes, stories or songs when studying.



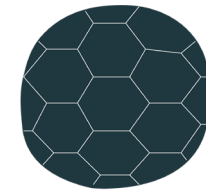
### **Reading/writing learners**

Reading/writing learners often take notes when working on a task. Such children enjoy reading books and writing stories and can easily remember what they have read. Study tips for reading/writing learners are to create checklists and write notes by hand.



### **Visual learners**

Visual learners usually excel at visual activities, enjoys illustrations, and learn best when there is provided examples of the tasks the child is working on. For visual learners, the best way to learn is to use different colours for learning and draw charts/diagrams.



### **Kinesthetic learners**

Kinesthetic learners excel in physical activities. They usually have a hard time standing still while learning. They enjoy to learn as a part of an activity such as playing games or drawing. Tips for kinesthetic learners include turning learning into a fun activity or game. (Grade power learning, 2018)



# Desk research

## Children's memory

### Children memory

The team discussed different approaches that could be useful when focusing on children. Hereby, several questions arose including the question of at what age do children start to remember things? Therefore, the team decided to investigate how children's memory works, in the aim of obtaining a deeper understanding of which age group the team should focus on, if focusing on children. Studies shows that most grown-ups biographical memories started at the age of 3-4 at the earliest (Hayne, Imuta, Scarf, 2015).

Memory absence from the age before is referred to as childhood amnesia. (Freud, 1963). It means the inability of adults to remember events from their early childhood and infancy. Normally, memories increase gradually, as the person ages. Such factors, as brain development and establishment of a self-concept, plays a big role in childhood amnesia. Usually, childhood amnesia lasts until the age of 2, and the majority of people have their first memories from the age of 3-4, however, some cases may vary, and have the first memories earlier or much later (Jack, Fiona and Hayne, Harlene, 2010).

Therefore, the team decided that if they wanted to focus on children, it made sense to focus on children in the age 3+ due to the fact that children starts re-remembering experiences at that age.



# Desk research

## Google or sensor data

During the ideation, the team started inventing the concept, AirGo, whereas several details of the concept were being discussed. One of the topics was: should the team use google data about air pollution on the streets and thereby send data to the wristband or should the team use a sensor placed inside the wristband to enable the individual users to measure air pollution themselves?

At first, it was decided to use the google data, but after a short period of time, the team discovered that google data is not real-time data. Google data is not constantly being updated and there might be areas that have not been covered with their measurements yet. Therefore, the team decided to use sensors instead. This was in the aim of being able to obtain the correct measurements no matter where the users are located (Google: Air quality, n.d.).

### Google data

Google launched the project in 2019, in a collaboration with the City of Copenhagen and Utrecht University. So far such data in collaboration with Google is available about Copenhagen and few other cities, for example - London, who are also part of the project.

The google data was collected by Google Street View cars on which they attached air pollution sensors. Therefore, the data is not real-time and will solely be updated when Google Street View cars with attached sensors will be in the areas. (Google: Air quality, n.d.)

### Sensors

Air pollution sensors are devices, that measure air pollution. The sensors work, by measuring air particles in the air. Such measurements happen real-time, which makes it capable of measuring the surroundings real-time. There are different air pollution sensors available on the market, whereas some of them are more expensive and more advanced, and some are cheaper. (aqicn.com, n.d.)

The team decided to proceed with the concept with the consideration of using sensors, that will be placed in the wristband. In this way, the wristband will be able to notify the user in real-time, if the area is polluted or not.

# Expert interviews



After having specified the product even further, it was time to make a deep investigation in how to communicate the product and how to teach children about air pollution in regarding to asthma in the best possible way. In the aim of achieving the knowledge, it was decided to interview experts in related fields. The team strived to get in contact with a doctor, a nurse, a pharmacist, and a person educated in health.

The purpose of contacting doctors, nurses and people educated in health was to gain insight in how to communicate the product ethically correct and to avoid scaring the children by the information given. In addition to that it was a method used to examine their interests in the product and how they thought the product could add value to the target group based on their experience (expert findings, appendix 13).

The reason for contacting pharmacists was to examine if a product like AirGo could be sold in a pharmacy. Apart from that the reason was to explore their interests in the product seen from a professional perspective. The team managed to conduct four answers, one from a medical student, two from pharmacists and one from an expert educated in health respectively. The outcome of the expert interviews contributed with broader knowledge within asthmatic diseases, further ethical reflections, new ideas, and communication strategies in the aim of avoiding critical issues that could occur.







# Expert interviews

## Key findings based on the interview

### Communication:

- The app should be easy to understand, and could e.g. be explained through metaphors.

- Avoid words and sentences that might cause fear

- Avoid words that are too technical.

- Always tell the truth: the children must understand that this product is a help, and nothing more. Additionally, they must be aware that it is impossible to avoid all air pollution and that is okay.

### Features in the app

- Regulation of the sensitivity of the sensor inside the wristband, to adapt to the users need. Some may need the sensor to be more sensitive than others e.g. depending on where they live.

### Engagement:

- Games are effective learning tools when educating children.

### Ideas:

- A function where users can choose if they live at the countryside or in the city, because the two types of areas have different levels of pollution

- Time-management in the app of how many hours the children are allowed to be in polluted areas.

- The wristband could also be relevant for healthy people in order to avoid polluted air.



# Final user persona

## Age

After the team had done more desk research, it was decided to further focus on children age 5-10, for the concept development. Research showed, that children, who are age 5-10, are more focused than kindergarteners, therefore it would be easier for them to learn what does the wristband functions, such as change of appearance.

Children at this age already start to go to school and tend to be more independent - which means, they might go on their own to some areas, where there might be pollution, so it would be important for them, to be aware - if there's air pollution (Teaching Different Age Groups: What Works and What Doesn't?, 2020).

Several parents, that we interviewed, also expressed their opinion, that children age 5-10 would be the best target group, as they start to be more focused, than younger children.

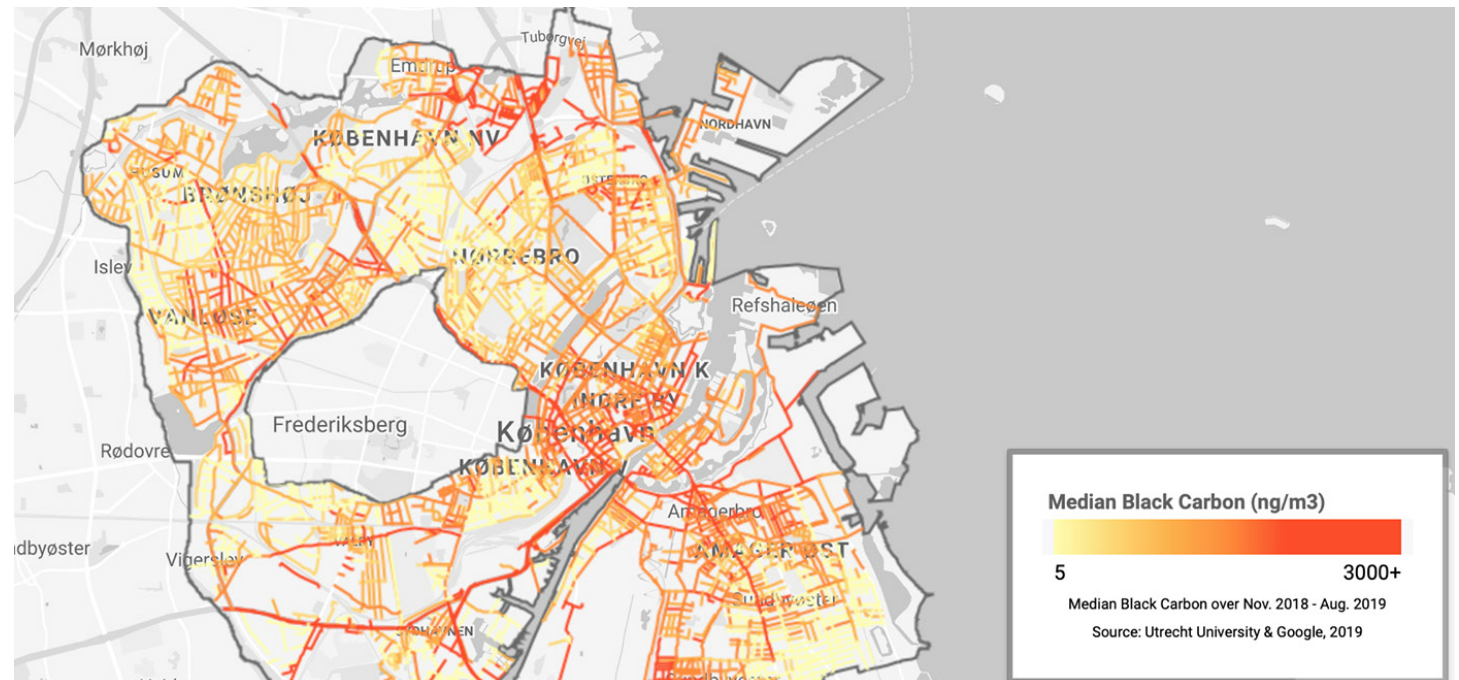
Overall, the research has shown, that children age 5-10 will be old enough to understand the meaning behind the wristband and how to use it. It's important to focus on children from a young age, as well as there can be other challenges if it would be decided to focus on teenagers. If the team would include teenagers in the target group, should take that in consideration in the design, and other aspects. After research and discussion, the team took the final decision to focus on children age 5-10.



# Final user persona

## Living

The concept AirGo was developed based on the information and research done for Inner City, and the user persona. However, it was found that the concept was relevant in more than just Inner City, and therefore it was chosen to expand the area to Copenhagen. It was found that in 2013 there was only 3.831 families living with children in Inner City. Compared to the total amount of families with children in Copenhagen, the number is 46.500 (appendix 14). When talking to the potential users through the field research, it was found that people living in Copenhagen were using different areas of Copenhagen in their everyday lives. Moreover, looking at the air pollution in Copenhagen, it was clear that the whole city was affected. Furthermore, it was chosen to work with the municipality of Copenhagen, and therefore it was also beneficial for them to gain data about the whole city, to improve areas by using the data collected by AirGo.



Model 16 Air pollution in Copenhagen



# Getting the design right

## Wristband

Based on data from desk research and clustering of in-depth interviews, the target group was specified into children in the age between 5 and 10 years, whereas it became manageable to design the wristband tailored to their needs. The result of the design was developed on the basis of trends, wishes and pain points from the target group and from inspirational tests analysis' of similar products.

### **Appearance:**

The appearance of the wristband should be personalized, cool and it might not look like a medical instrument or a toy. Therefore, the wristband should consist of a simple skeleton in white, whereas the users were able to buy covers that matched their style. Hereby, it was manageable to make the wristband personal and in that way to make it fit into a larger target group.

### **Materials:**

The materials of the wristband should be waterproofed in order to make it suitable regardless of the weather. Apart from that, the wristband should be made of sustainable materials, which most likely would offer the highest customer satisfaction due to the fact that sustainability was a trend (CSR, n.d.).

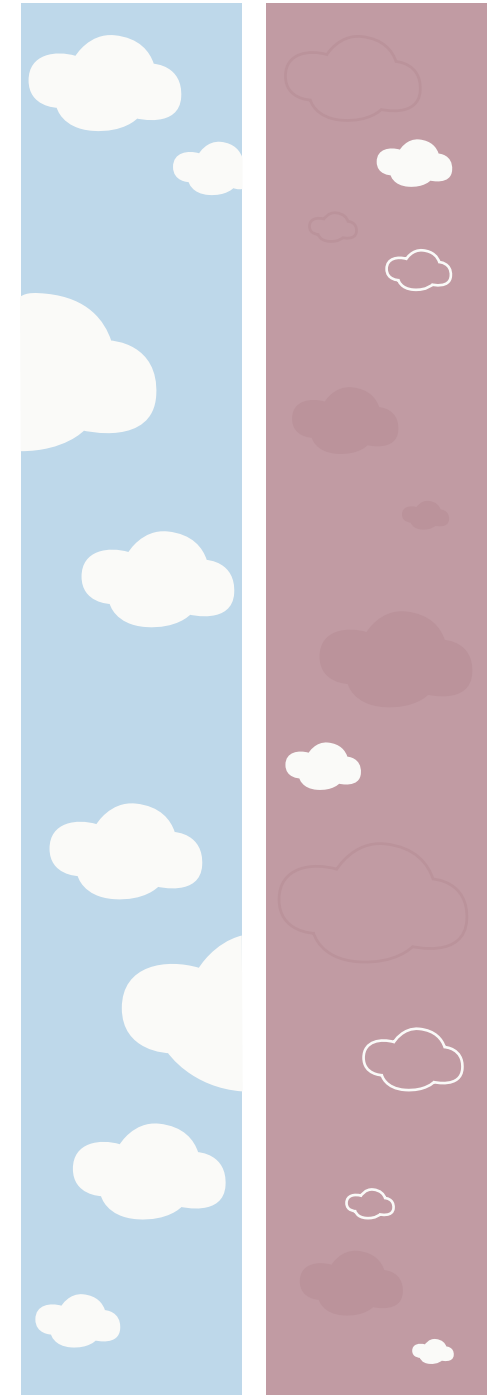
### **Function:**

The three essential functions of the wristband was to make it user friendly, to make it perceived by senses, and to make sure that the children noticed when the air was polluted or not.

In the aim of meeting the needs, the wristband should contain a simple design with a limited amount of buttons to make it less confusing and easy to use. Additionally, the color of the wristband needed to be noticeable, and in the aim of achieving that, a vibration function should be implemented, and activated every time the children entered polluted areas. Hereby, the color and vibration function of the wristband would be perceived by the childrens physical abilities of sight and touch, which would create increased awareness of air pollution.

# 3D mock-up Wristband

The design of the wristband was made based on the knowledge from the chapter “getting the design right.” The wristband consisted of two elements: a skeleton and a cover. The skeleton should be in a simple design and the cover would enable the wristband to be more personalized. The two designs to the right was an example of how the design of the wristband could look. The designs were made in order to match the criteria of not making them look like a toy, but still to keep them in child-friendly designs. Moreover, the cloud of the logo was added to the design of the cover to make the children understand the connection between the app and the wristband, which hopefully, would also contribute to make them understand that the wristband was not a toy. The team imagined that the future design of the wristband would be made by one of Philips' own designers.



# Getting the communication right

## APP



In order to design the communication within the app in a professional manner, the team found it necessary to take inspiration from the expert interviews, since they have experience with children, communication and health. In addition to that, the team used the conducted desk research about children's development and their learning styles, when designing it. The key findings and decisions of the communication within the app has been listed below.

### **Positive**

In order to create an app that diminish the negative associations and fear related to air pollution, the team strived to communicate in a positive manner. Hereby, all negative information should be turned into positive useful information that empower the users.

### **Visuals**

The app should contain graphical elements and metaphors in order to support the message and obtain a higher level of understanding.

### **Linguistic**

A conducted interview with an expert in health showed that it would be preferred that the app uses less advanced and technical terms with the object of a better understanding from the users (appendix 13)

### **Children's learning styles**

It was discovered that children have different learning styles. In the aim of meeting their needs and engaging them, the app should contain content that appeals to both audio-, reading-/writing-, visual-, kinesthetic learners (Grade power learning, 2018).

### **Tell the truth**

According to an expert interview it is crucial to tell the children the truth when teaching them about the asthma in the app. Additionally, to make children aware that air pollution is everywhere but in different degrees, and that it is not ideal for anyone to inhale that (appendix 13)



Air Go

# AirGo as a company

## Philips

Philips is a dutch leading health and technology company grounded in 1891 with the focus of driving value creation (Philips, n.d.a). Therefore, the company has existed for more than 120 years and is now a well-known, highly trusted global brand that contains several partnerships (Philips, 2017), (Philips, 2018), (Philips, 2016). Additionally, Philips' brand value has increased since 2010 to 2018 (Mikulic, 2020). The vision of the company is to improve health and sustainability through innovation with the goal of improving lives (Philips, n.d.b).

The product assortment includes everything from sound and lightning to personal care and health including products for people with asthma. Therefore, there is a broad interest and expertise within designing the right products for people with asthma (Philips, n.d.c).

Furthermore, Philips is delivering medical technologies that helps clinicians to make diagnoses and treatments. Additionally, the company facilitates cloud-based technologies that support analyses and sharings of data which enable it to deliver lower-cost integrated health solutions (Philips, n.d.d-e).

Apart from that, Philips is a user-centered company with the brandline: Innovation and you, which is further elaborated as the following: "...innovation is only meaningful if it is based on a deep understanding of people's needs and desires"(Philips, 2017).

Furthermore, the company has a global privacy approach in the aim of respecting customers and is experienced in handling personal data while being transparent(Philips, n.d.f).

## Collaboration

### Philips and AirGo

There are a large number of advantages of making Philips the sender of AirGo. First of all, Philips is a well-known brand that has existed for years, which might increase the target group's credibility of the product. Additionally, Philips is an experienced company in obtaining and working with data in terms of users' privacy, which would reduce potential distrust from the target group. Another advantage of collaborating with Philips would be due to its user-centered approach, its collaborators and expertise in technology, asthma and sustainability. A last prior advantage would be in terms of budget and marketing opportunities, since this might diffuse the information of AirGo more rapidly and thereby be helpful for people sooner.

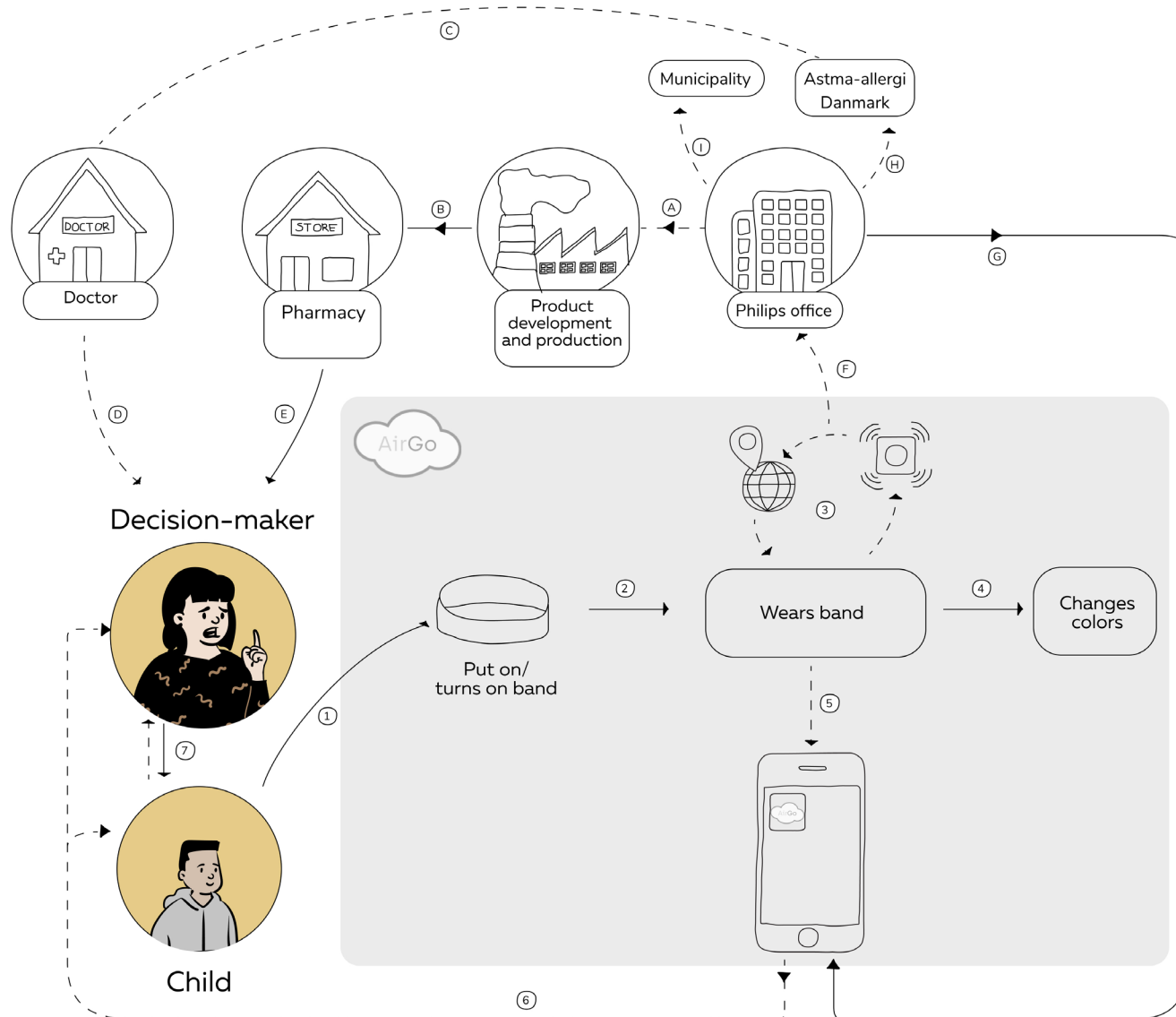


# System map




A system map was created to map out how the entire system of the concept worked, and thereby, in one single frame get an overall understanding of the concept. This was done by including all actors and the material- and information-flow between them (Morelli, 2007). This provided the team with a common understanding of the whole system of the concept, In the early phase of the idea. The system map illustrated the flow of information, however, it was decided to look more into the exchanged value between the actors by doing an stakeholder map and then a motivation matrix.

# System map



## Information

## Physical objects

 = AirGo Service

- 1 The customer puts on/turns on the band
- 2 The customer wears the band
- 3 The sensor in the bracelet registers the air quality and a GPS register the location of where the air quality has been measured.
- 4 Depending on the air pollution/air quality in the area, the band will either stay as it is (if the air quality is good) or loose its colors (if the air quality is bad).
- 5 The information about the air pollution/ Air quality is sent to the app
- 6 Customer uses the app to understand the air quality/ air pollution they have been exposed to through out the day.
- 7 Exchanges information and learns about air pollution through the app and the band

- A Philips communicate with the production company in regard to the produktion details
- B The product is distributed to pharmacies and stores
- C Astma-allergi forbundet will inform the doctors about the band and service and its functions
- D The customer will be informed about the band and product through the doctor
- E The customer will buy the band in the stores
- F Philips recieves the information from the bracelet.
- G Philips AirGo provides the software for the platform are developed.
- I Philips AirGo collaborate with Astma-allergi forbundet in regard to the service
- J The municipality recieves some of the information gathered and collaborate with Philips AirGo

# Stakeholder map

In order to have an overview and understanding of all the involved stakeholders in the AirGo service, a stakeholder map was created. (Stickdorn et al., 2018, p. 60, 61) It shows a holistic overview of the stakeholders. To better understand and visualize the role of these stakeholders, in the following figure, they were divided into 3 groups: users, collaborators and enablers.

Users symbolize the end-users, who will be using the service. Collaborators represent all the stakeholders that are involved in collaboration with AirGo. Enablers include the enablers of the service, who play an important part in enabling this service to operate.

Additionally, there are different layers of importance, to give a better understanding - there are secondary and primary enablers. This means that the stakeholders, who are in the primary enablers circle have bigger importance or power on the AirGo service. The same applies to collaborators, which are divided into secondary and primary, which also symbolizes the importance.

## The CPH 2025 Climate Plan.

### **The collaboration between the municipality, AirGo and Gehl.**

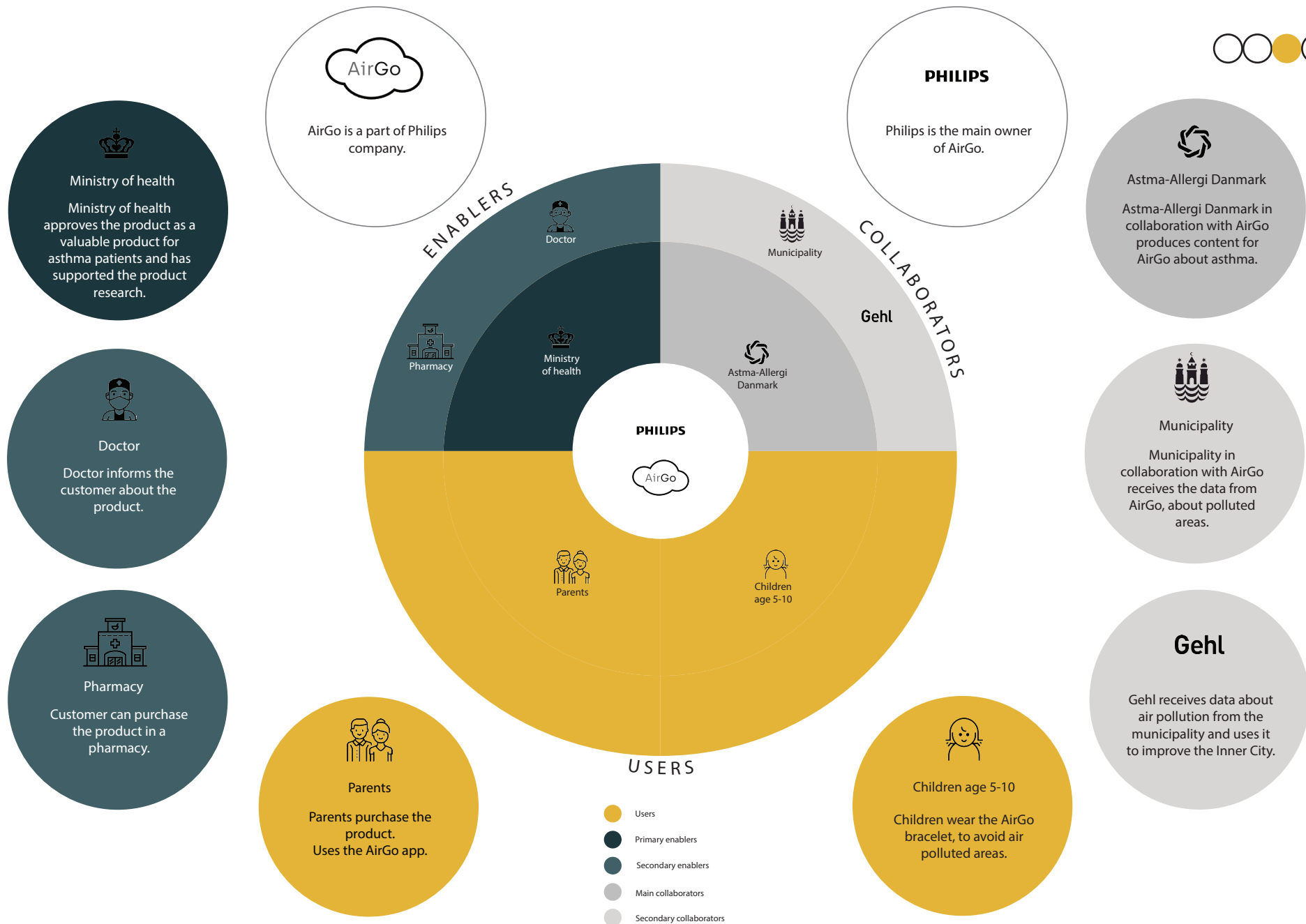
Copenhagen municipality has a plan, to become the first carbon-free capital city by 2025.

Therefore, a collaboration between AirGo, Copenhagen municipality and Gehl was created.

AirGo service collects valuable information about air pollution that will be sent to the municipality for informative purposes, after getting the AirGo users' consent. The data is anonymous and encrypted.

In this way the municipality has got an overview of the most polluted areas in inner city, which gives them the knowledge and power to make changes according to the data. In order to improve the urban areas, Gehl has been chosen as the third collaborator, which whom municipality is sharing the AirGo data, with AirGo's consent. With Gehl's knowledge and willingness to help reducing air pollution through urban design, Gehl has the needed skills to help realizing the plan of Copenhagen municipality, and thereby, be the third important collaborator in this project. (Reducing air pollution through urban design. n.d.)

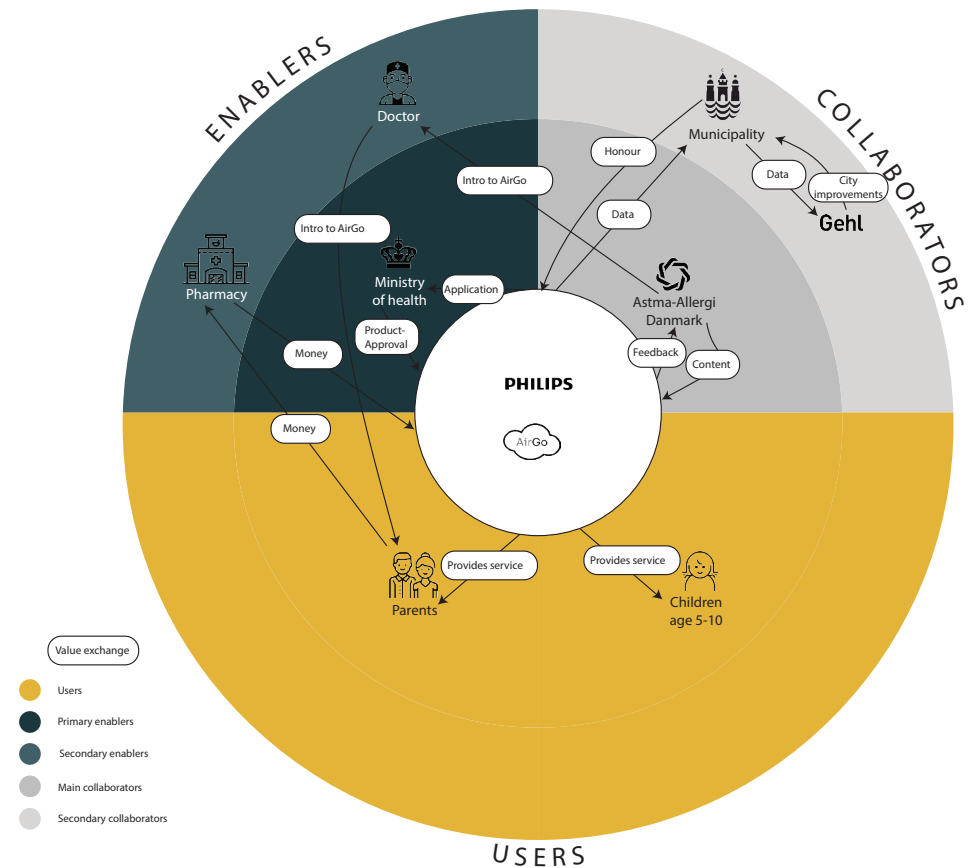
This collaboration is a part of the municipality's 2025 plan, to become the first carbon-neutral capital city by 2025. (The CPH 2025 Climate Plan n.d.)



# Value network map



Based on the stakeholder map, a value-network map was created in order to see the exchanged values between all the stakeholders. (Stickdorn et al., 2018, p. 60, 61) This gave the team a holistic overview of the relationships between the involved stakeholders and it illustrated the values that has been exchanged.



Model 19: Value network map

# Motivation matrix



It was decided to create a motivation matrix to understand the main actors' motivation towards the concept. It was important to show each actor's motivation, as this was essential for the success of AirGo. The motivation matrix visualized the relationship between the actors who were a part of AirGo and showed the actors' expectations when cooperating. (Morelli & Tollestrup, 2007).



Gives to	Philips Airgo	User	Municipality	Doctors	Pharmacies	Astma-Allergi Danmark	Ministry of Health	Gehl
Philips Airgo	- More revenue - opening up the market	- Wristband/app - Information - Customer service	Provide the data, to be used for improvement of Inner City		Information about: - Improvements, Development and Sales of AirGo	Information about: - Improvements, Development and Sales of AirGo	- Provides the product to be approved	
User	- Collect the data - Gives feedback - Increase sales	- Reduce asthma - Avoid air pollution - Share experience	Generate data	Information: - The effect of AirGo - Feedback	- Buy the product - Increase sales			
Municipality	Gives credit for the data received		- Gain data to improve CPH in regards to air pollution					Share the data and collaborate about improving Inner city
Doctors	Gives feedback: - User respons - Improvements	- Recommend the product - Instructions		- Help that people can be more healthy - Share experience of AirGo between colleagues				
Pharmacies	Gives feedback: - User respons - B2B market - Sales	Recommend the product			- Help people with asthma - Share experience between colleagues			
Astma-Allergi Danmark	- Create content to app - User feedback about the product - Improvements	Promote the product and gives information				- To inform people with asthma and help them with better solutions		
Ministry of Health	Approve the product to be sold in Denmark						- Improve the market of medical products for people with asthma - Support health	
Gehl			Corporating about improving the city					- Gain data to improve CPH in regards to air pollution

Model 20: Motivation matrix

# Distributed system



Distributed systems is by Coulouris (2011) referred to as a system, where hardware or software components located at networked computers coordinate their actions by passing messages. Computers, that are connected by a network can be physically separated by any distance. An important part of distributed systems is that they don't have a global clock - they don't depend on time, as it would ask for high accuracy of synchronized time between the computers - which has limits. The main purpose of a distributed system is to share resources. By the term "resource", several things could be mentioned: files, databases, data objects of all kinds, as well as hardware components, such as disks and printers. Often distributed systems can be constructed in the form of interaction of clients and servers. The term "server", refers to a running program, or process, on a networked computer, that accepts requests that are coming from programs running on other computers. Clients are making requests - which makes them active, and servers are only active when they receive requests (Coulouris et al, 2011).

## Internet of things (IoT)

The Internet of Things sometimes referred to as the Internet of Objects, is a system of connected devices through the internet. It is one of the most developing types of distributed systems today, and it is currently changing people's daily life entirely. The internet has already had an impact on education, communication, business, science, government, and humanity. IoT can gather, analyze, and distribute data that can be turned into information and knowledge (Evans, 2011).

The IoT architecture is build up by different layers of technology, depending on the service. The lowest layer is the sensor layer, also called a smart device (Patel & Patel, 2016).

In AirGo, this is the air quality sensor measuring real-time data for the user. Like most other sensors, the air quality sensor in the AirGo wristband requires to be connected to a gateway, which for AirGo is the Wi-Fi data network. The network layer is the second layer (Patel & Patel, 2016) and is what enables the data to be stored in the cloud database. The third layer is the management service layer, where all the data gathered by the wristband is processed, managed, and accessed. Various analytics tools can be used to analyze the raw data (Patel & Patel, 2016). This allows the users of AirGo to have a real-time picture of their data but also a real-time air quality map provided to them in the app. The last layer is the application layer that covers in which spaces or environments it is applied. This also covers privacy-protecting, authentication, application encryption, etc. (Patel & Patel, 2016). Application encryption in the AirGo concept could be central to looking into in order to encrypt the sensitive data, e.g., regarding the user's location to provide the user with data security (What is Application Encryption?, n.d.).

## Hacking of AirGo

Due to the findings from the "existing similar services" part the team found out that it would be important for the project to look into hacking, as similar services had have problems with this.

In a centralized system, the data is stored, updated and managed on a single location, rather than spread across many. That makes it an easy target for hackers. In a distributed system the data is distributed and located on several computers, therefore it is safer from hacking attempts, rather than a centralized system. (Medium, 2018)





According to a publication from the Technology University of Budapest, "IoT Hacking – A Primer", it is often experienced that many recent attacks on IoT devices and systems happen and that it can be often very insecure. The report also shows that a major part of the attacks end up with full control taken over through the IoT devices due to the fact that these devices are often weakly protected and cannot resist even the most basic attacks. (Papp, Tamás, Buttyán, 2019). Therefore, it is crucial in this case, that all devices that take any role in the service of AirGo, are all very well-protected from hacker attacks.

### Database

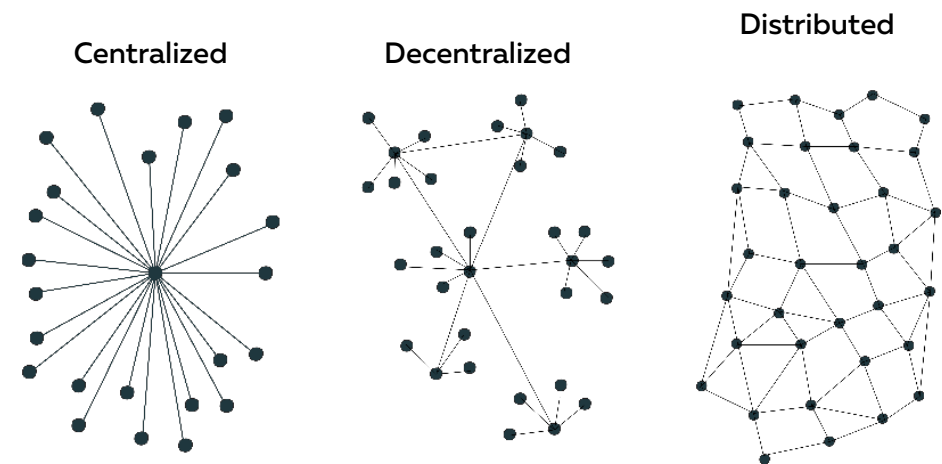
The cloud database is chosen as the team profoundly believes this could be how Philips stores data or would store the data for the AirGo concept. Many big companies use this kind of data storage, as it has many advantages. Cloud databases provide the company with greater accessibility when it comes to storing digital information, and they can easily share data based on needs (Widjaya, 2018)

### AirGo as a distributed system

AirGo highly depends on users' engagement, as the service was built upon the data gathered by users. The sharing of resources with other users enabled the users of AirGo to get an overview of the air quality in different areas of Inner-city without visiting the areas themselves. Thereby, the service was not solely designed as a distributed system seen from a social perspective but also from a technological perspective.

The illustration of the distributed system shows how the air quality is measured and stored temporarily in the wristband by using a sensor and storage.

When the wristband is turned on, a transmitter communicates with satellites. Using the satellites' location, the wristband is able to find the position of the user wearing the wristband on earth (Daniels & Huxford, 2001). This provides the wristband with both the location and air quality. The data is transmitted to the AirGo App, and the cloud database uses the internet. The user has access to the data gathered by the wristband through the app, and AirGo has access to the data through the cloud database. Through the database, the data can also be shared with other stakeholders e.g., the municipality.

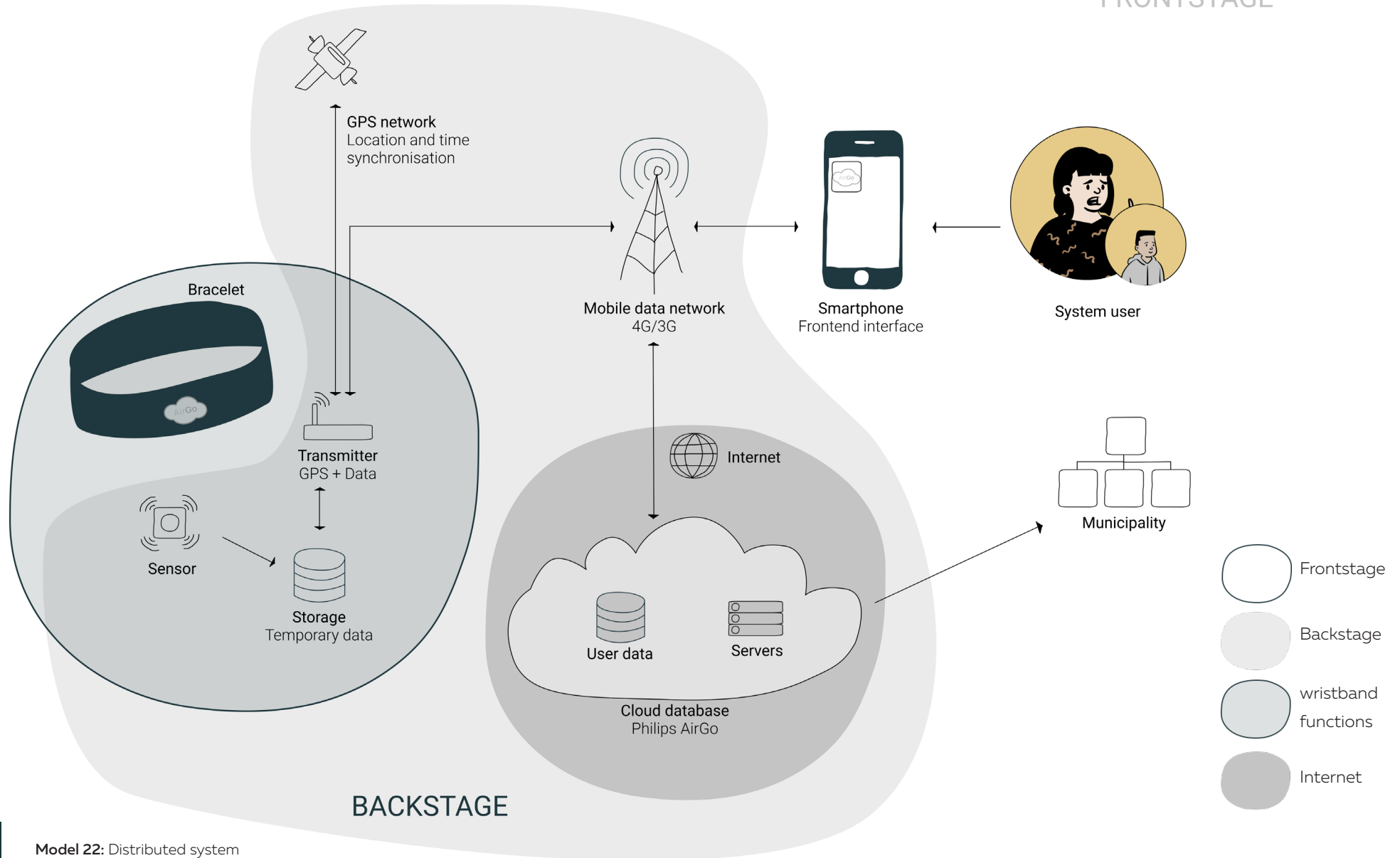


Model 21: Different types of system(What is a Decentralized System? 2019)

# Distributed system



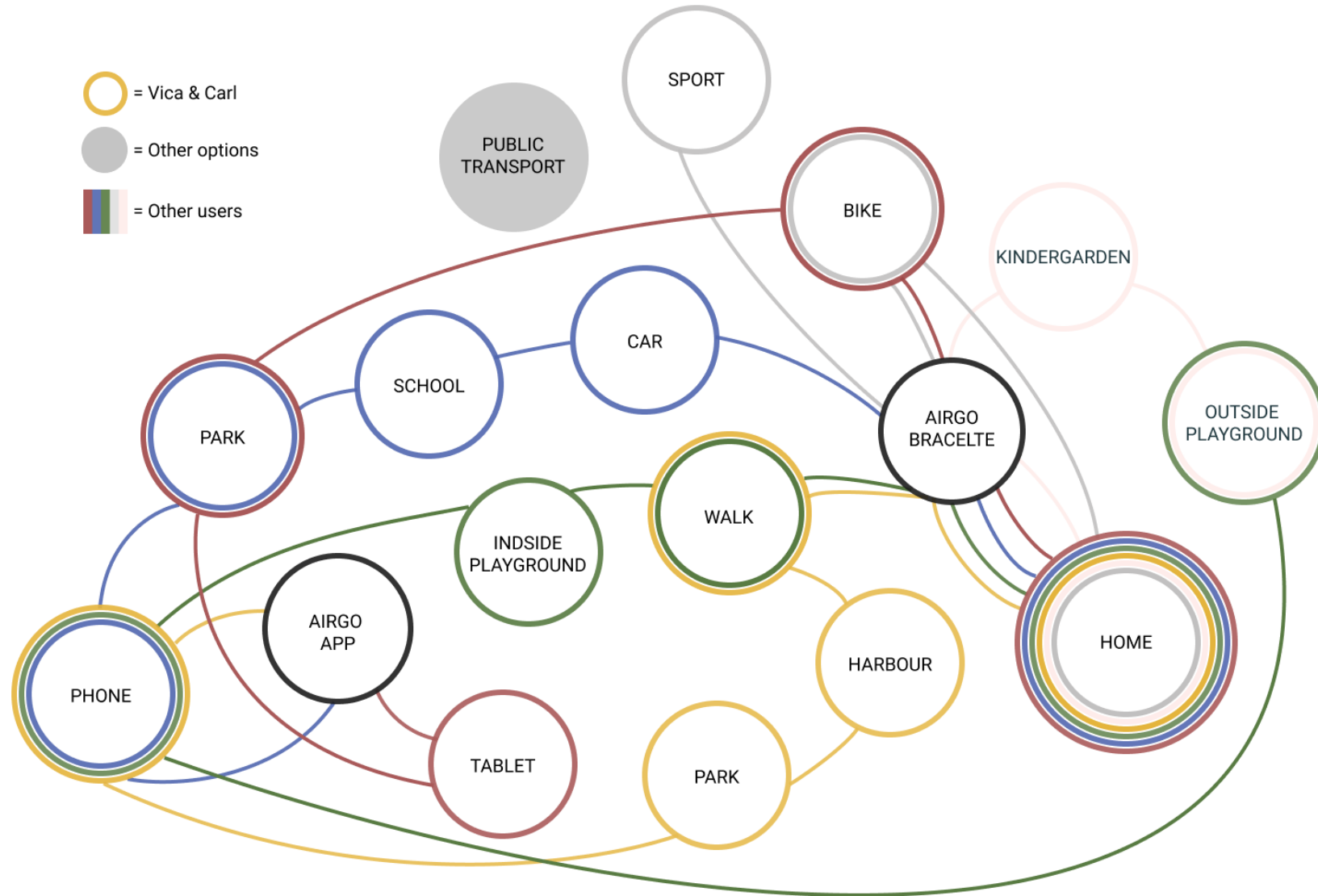
FRONTSTAGE



# Cross-channel ecosystem





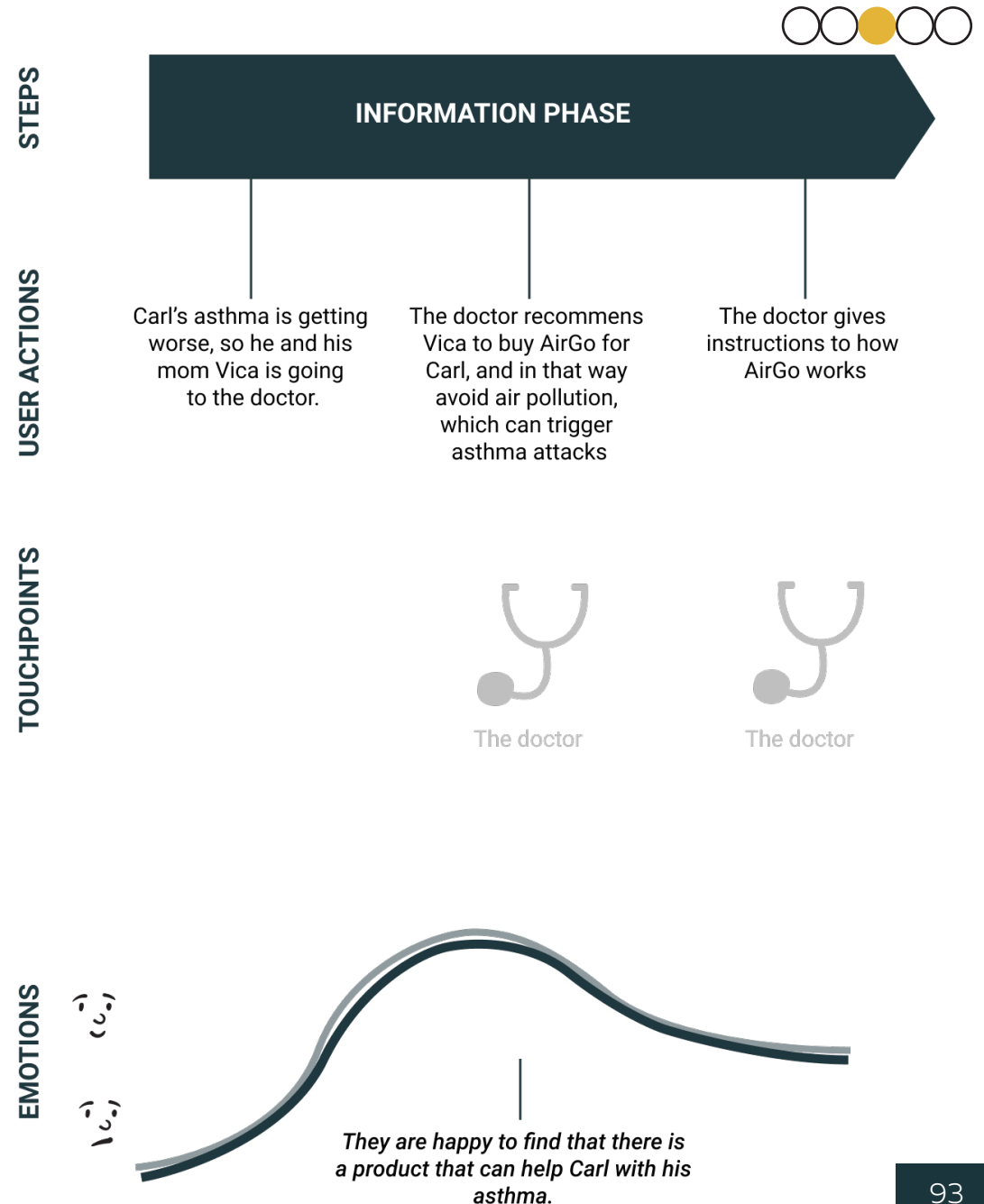
Through the development of AirGo, it was explored that the product could be used by different types of users, as well as it could be used for many different purposes. The team has been in contact with potential users throughout the process and found that they would use AirGo in different ways. One of them would e.g. let her child use the wristband every day and she would use the app every day. Another potential user would let her child use the wristband every day, but only use the app a few times a month. Therefore, a cross-channel ecosystem was developed to illustrate different potential user-journeys within the map in order to create a visual overview of the different ways AirGo could be used. A cross-channel ecosystem is a semantic construction that shows how actors are moving freely according to their goals and tasks. The actors can use both physical and digital channels depending on their activities and their individual goals. (Lindenfalk and Resmini, 2016).



# Customer journey

A customer journey map has been made in order to visualize the overall experience of AirGo, viewed from the perspective of the team's persona, Vica and her son Carl. Therefore, it is solely illustrating a specific part of the service and not the entire service. It was made to visualize the invisible and intangible experiences and in addition to that to investigate potential gaps that the target group might meet. Furthermore, an emotional journey has been added to the journey map with the purpose of representing the predicted feelings that they would experience when using the service. Overall, the team agreed to create this customer journey to develop a shared understanding of the target group while using AirGo (Stickdorn et al., 2018).

 = Vica  
 = Carl



Model 24: Customer journey



STEPS

PURCHASE PHASE

SETTING UP PHASE

USAGE PHASE

USER ACTIONS

Vica and Carl goes to a pharmacy and buy AirGo

When they are home, they open the bracelet and download the app

Vica created an account on the AirGo app and connects to the wristband

Vica and Carl go out for a walk. They go to a harbour to look at ships

When arriving the wristband lose its colors and starts vibrating

Vica opens the app and looks in the map to have an overview of areas that are less polluted

TOUCHPOINTS



Pharmacy



Application



Application and bracelet



Bracelet



Bracelet



Application

EMOTIONS



Vica is excited when creating the account and looks forward to try it out. Carl is not impressed yet.

Carl thinks it is cool that the wristband vibrate and lose the colors. Vica know why it happens and is sad about it.



STEPS



USER ACTIONS

They decide to go to a park nearby.

When arriving to the park, the wristband starts to light up again.

After some time they walk home and Vica opens the app and check "your day", whereafter they talk about air pollution

Carl lies in bed and listen to a bedtime story from the app

Vica goes to a Facebook Group for people with asthma

She makes a post where she recommends the product to other families with asthma

TOUCHPOINTS



Bracelet



Bracelet



Application



Application

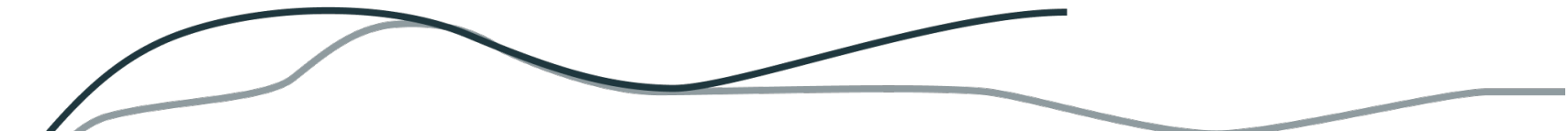


Application



Application

EMOTIONS



Vica is impressed about the function of the wristband, and want to share her experience with other families with asthma, that could benefit from it.

# Use cases



AirGo offers different solutions to learn about air pollution, as well as being aware of how much air pollution people are exposed to. Some of the primary solutions are shown in the following use cases (Morelli, 2002).

## Using the activity function

### Actors:

User persona (the child)

### Flow of event:

- The user wants to try an activity in the AirGo app.
- The user goes into the app.
- The user clicks on "Learn"
- The user clicks on "Activity"
- The user chooses "Air Pollution Experiment"
- The user follows the instructions in the app (show a recipe of water in a bowl, milk and light and refer to this video: <https://www.youtube.com/watch?v=acZeZfgZAR4>)

### Pre-condition:

The buyer-persona have created an account in the AirGo app.  
They have the materials to do the experiment.

### Post-condition:

The user learn more about air pollution from personal experience.

## Use of AirGo map

### Actors:

User persona (the parent)

### Flow of event:

- The user wants to see where the wristband has been throughout the day.
- The user opens the app.
- The user instantly sees the home screen.
- The user clicks "Map - your day" on the home screen.
- Here the user can see the live-updated map, that shows air-polluted areas in Copenhagen and where the wristband has been throughout the day.

### Pre-condition:

- The user has an AirGo account.
- The user has logged in their account.
- The child is wearing the wristband.
- "Show wristband location" in settings needs to be activated.

### Post-condition:

The user is aware of where the wristband has been throughout the day.



## Use of AirGo when doing sport

### Actors:

User with increased asthma when doing sports

### Flow of event:

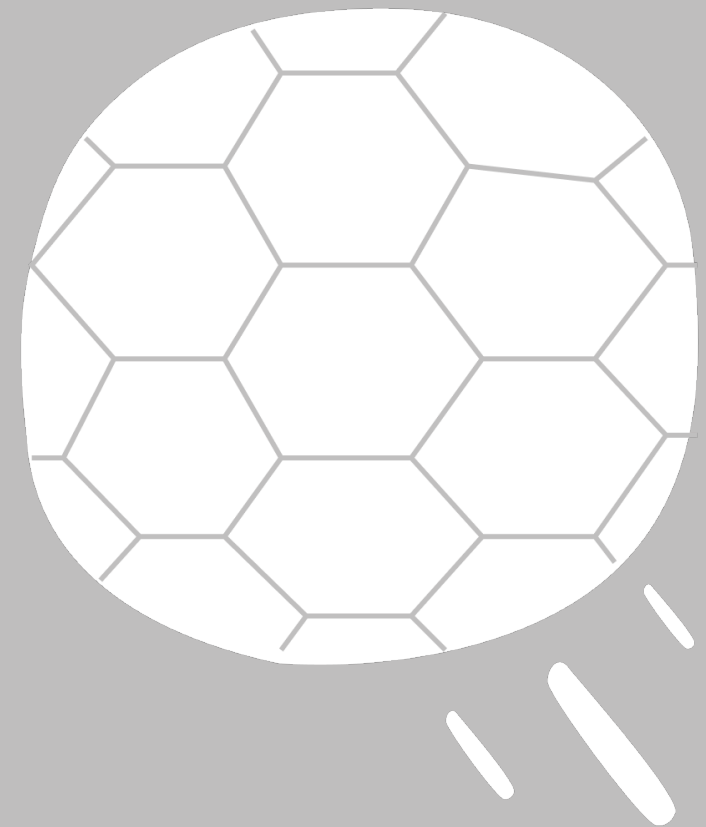
- The user is going for a run.
- The user takes on the wristband.
- The user is running.
- The user is aware of the color of the wristband.
- The user turns in another direction when the wristband is losing its colors and starts vibrating.
- After, the user takes off the wristband.

### Pre-condition:

The user has an Airgo wristband.

### Post-condition:

The user is aware of where the less polluted areas are

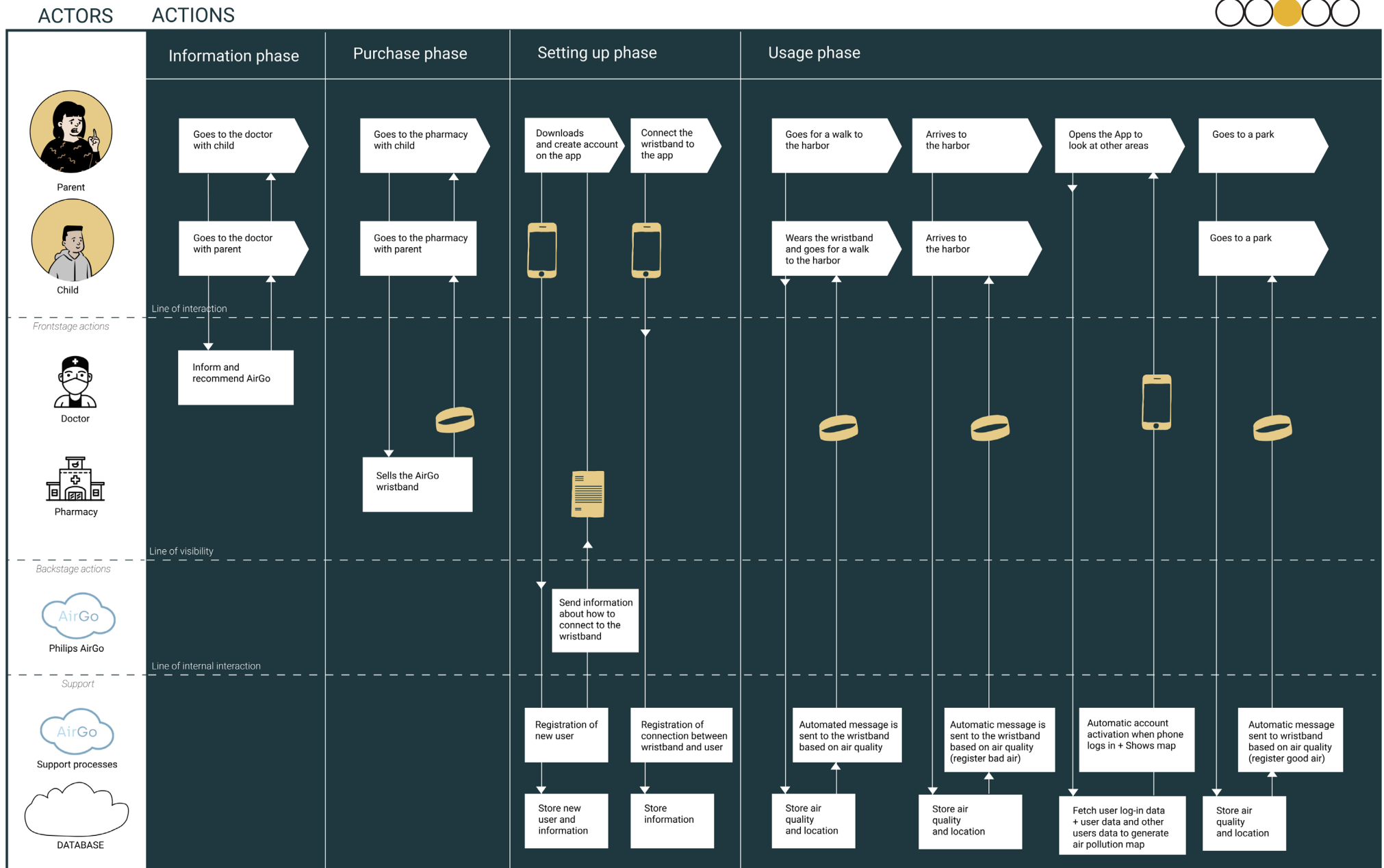


# Blueprint

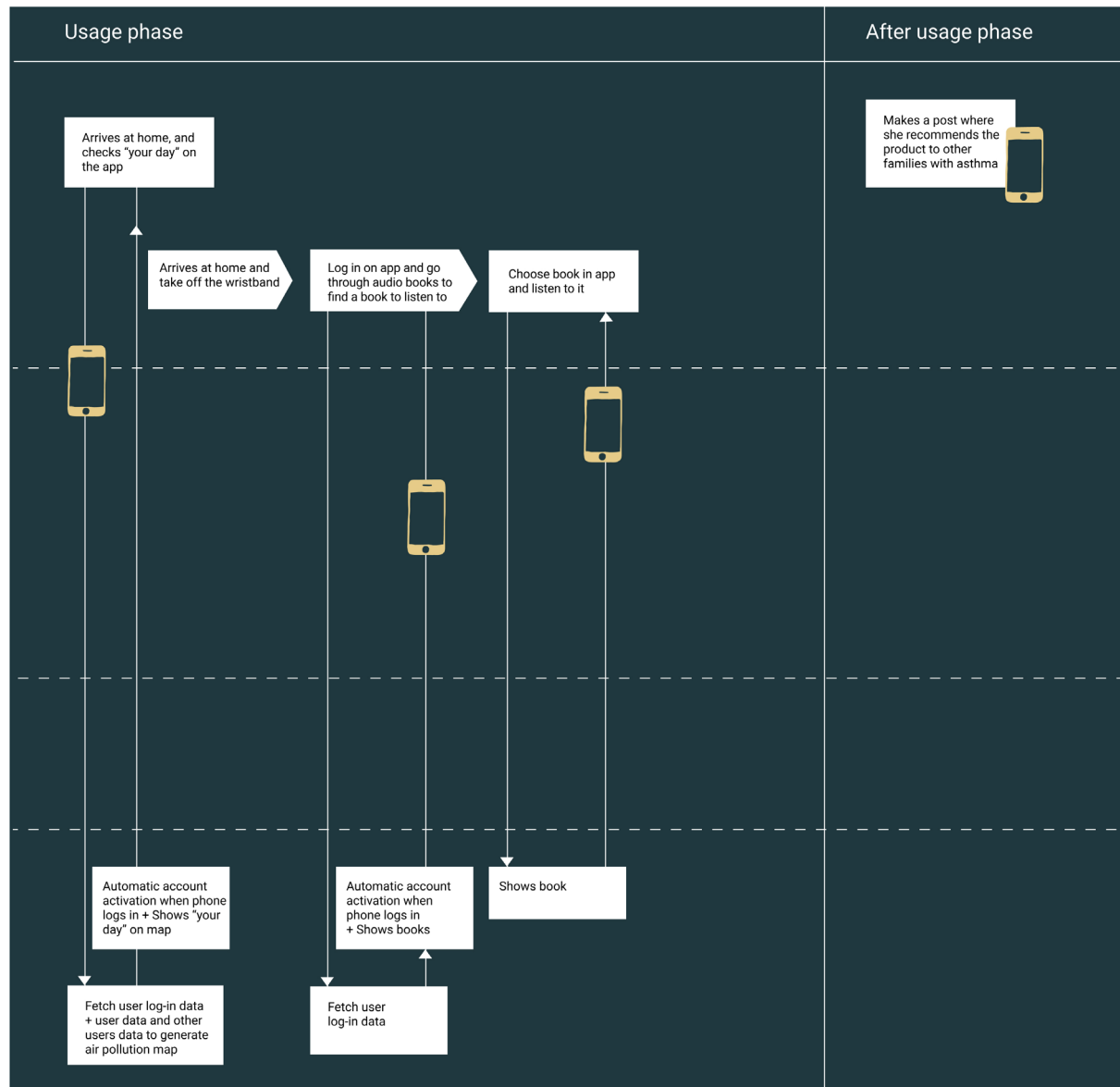


To develop a holistic view of the service, several blueprints were created to specify the individual aspects of AirGo. By creating a blueprint, which includes the frontstage and backstage processes, all elements in AirGo has been visualized. By doing this, it was possible to identify the most crucial elements and to see if some of the areas were overlapping (Stickdorn & Schneider, 2019).

The team created a blueprint to show the overall service experience of using the product. It shows the user's actions in the frontstage and the backstage processes that is taken place when using AirGo. The team used the perspective from the user-journey presented on page 93.



Model 25: Blueprint



# Prototyping and testing

The purpose of the prototyping and testing phase was to identify solutions for the challenges that previously has been identified (Dam & Siang, n.d.).

As mentioned in the ideation phase, a prototype video was made in order to test the concept. Based on the knowledge obtained from the previous phases, the team focused on the design of the app, whereas a flowchart and wireframes were illustrated before developing the testing tool, which was an app simulator.

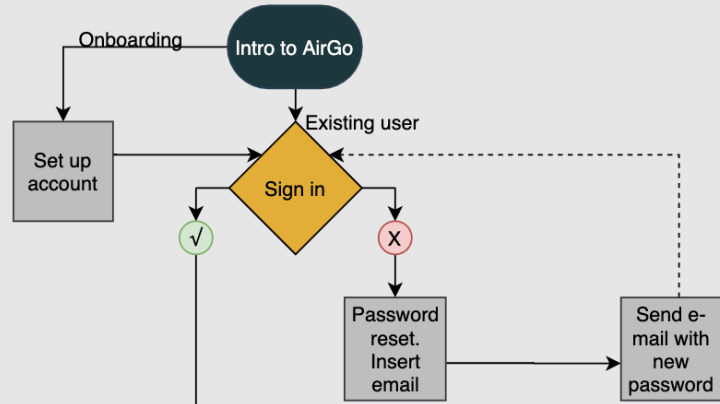
# Flowchart



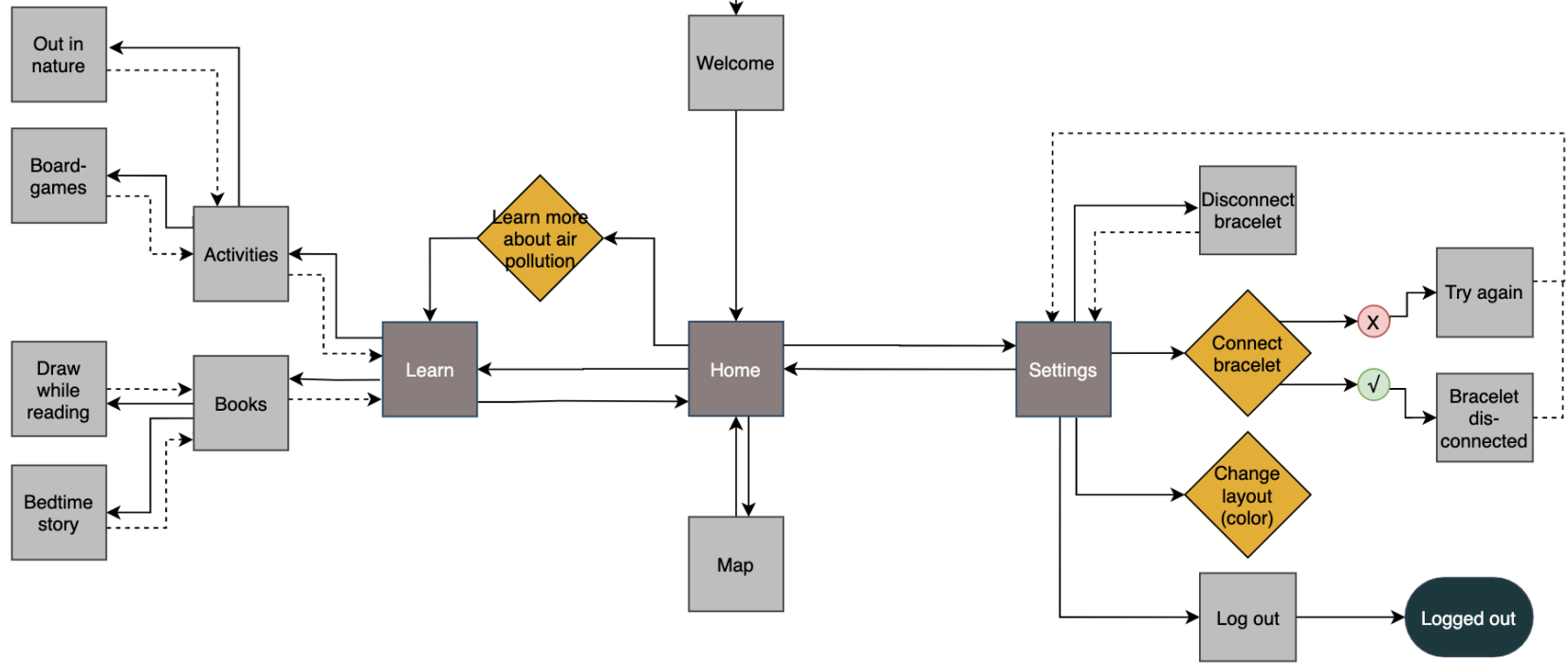
A flowchart has been made in order to visually represent the flow of the app, and in addition to that give an overview of the features it contains. The team has used the obtained knowledge from the interviews in order make the sequence of each steps simple to navigate in for both children and parents (Brown, 2018).

# SIGN IN

- Start/end
- Go back
- Action/process
- Action/process that can be accessed from all screens when signed in
- Decision
- Accepted
- Denied



# ALREADY SIGNED IN



Model 26: Flowchart

# Design Interface APP

Based on the learnings from the chapter “getting the communication right,” the team developed a design and structure for the app to match these criterias.

The structure of the app was designed from a mothers' and a children's perspective in order to make the app appealing for both users.

The main goal of the communication was to attract the users and make them want to use the product, instead of scaring them. Air pollution can be a sensitive topic, or seen in a negative light, therefore the team had to find a way to communicate the information well, without scaring the potential user. Expert interviews were used as the main source for inspiration when creating the prototype of the app. The findings from the expert interviews were considered to be a valuable source, as they have the professional experience in communicating positive and negative information to people. It was decided to communicate in a positive manner e.g. in the app, it was decided to show how much time the wristband has been in a polluted area, so instead of saying: “you’ve been exposed to bad air 20% of the time”, it should be: “you’ve been exposed to clean air 80% of the time”. In this way, there is paid attention to the positives, and encouraging people to spend more time in clean air, instead of scaring them with the information.

As the team was inspired by childrens' learning styles, it was important to include different ways of learning in the app. It was taken into consideration to use different senses, when developing the learning part of the app. The 4 learning styles were considered when developing the concept: visual learners, auditory learners, reading/writing learners as well as kinesthetic learners. (Grade power learning, 2018) The team tried to find the best ways to communicate in the app, to tackle and target each learning style.

Apart from that, it was decided to use a positive or playful manner in the app by adding visuals and trying to illustrate all the information in a simple way. Colourful illustrations were added, to create a positive impact on the viewer when looking at the app.



Welcome page

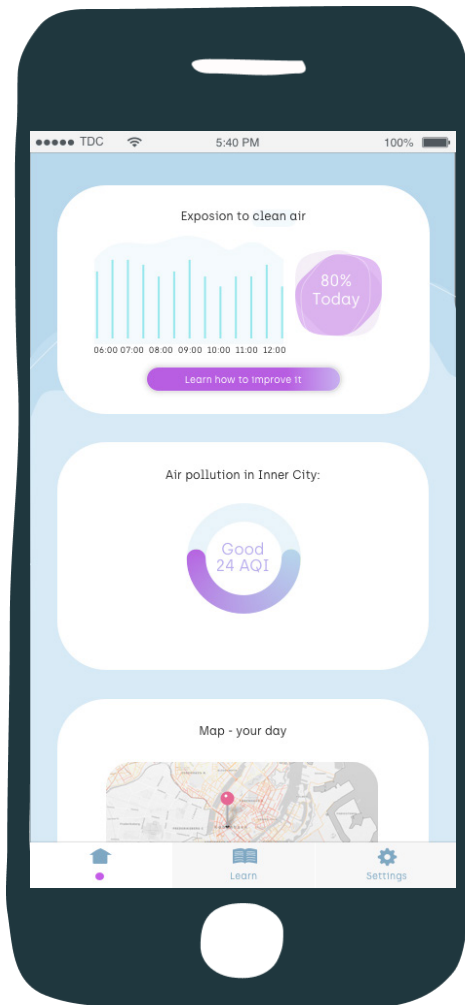


Sign in and welcome page



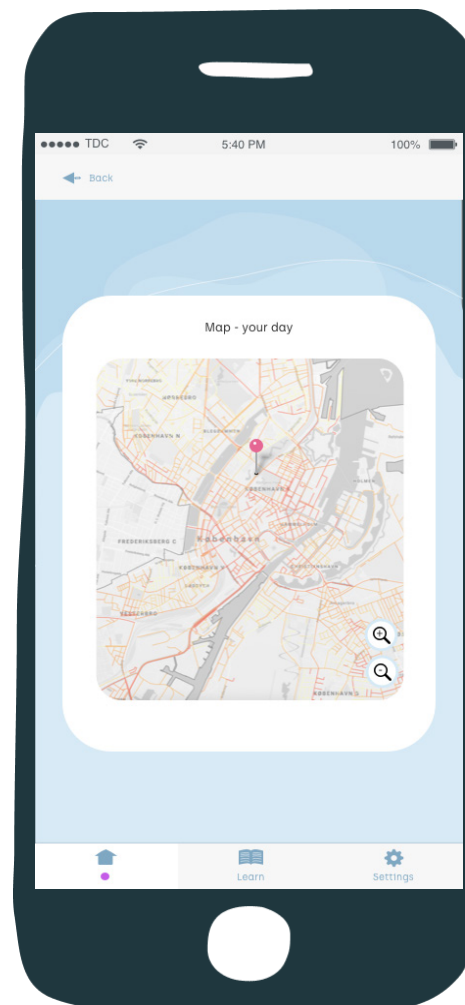


## Home



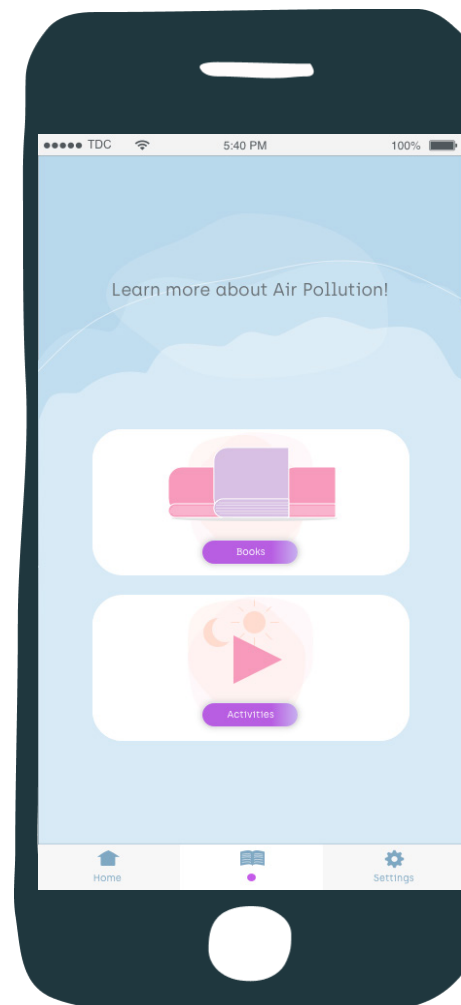
The main page the user will see when logging into their accounts

## Map



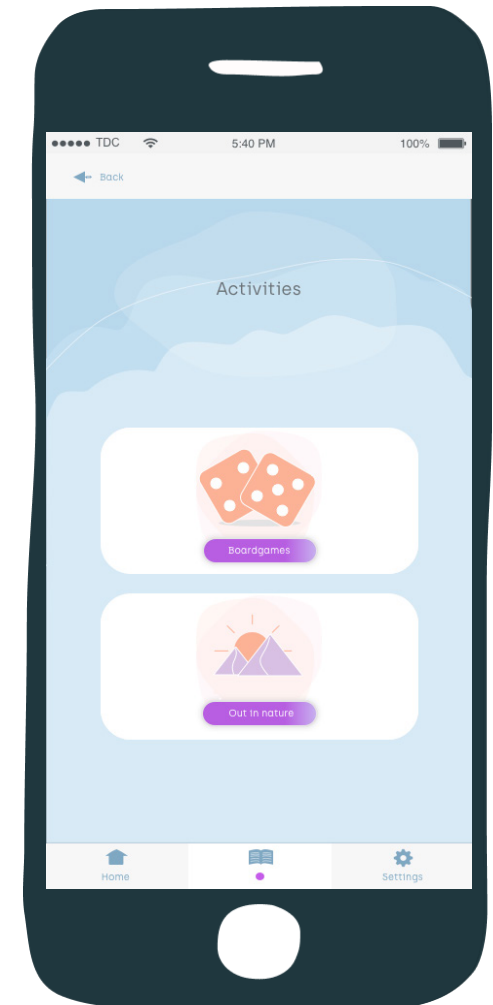
A map showing air quality in Inner City. If the user has chosen to track the wristband it shows the locations of where it has been that day.

## Learn



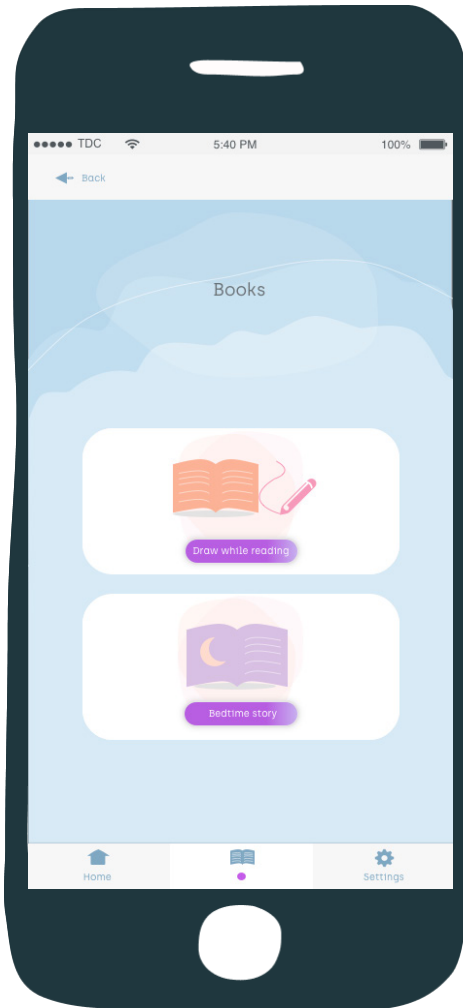
The user can choose how to learn about air pollution

## Learn



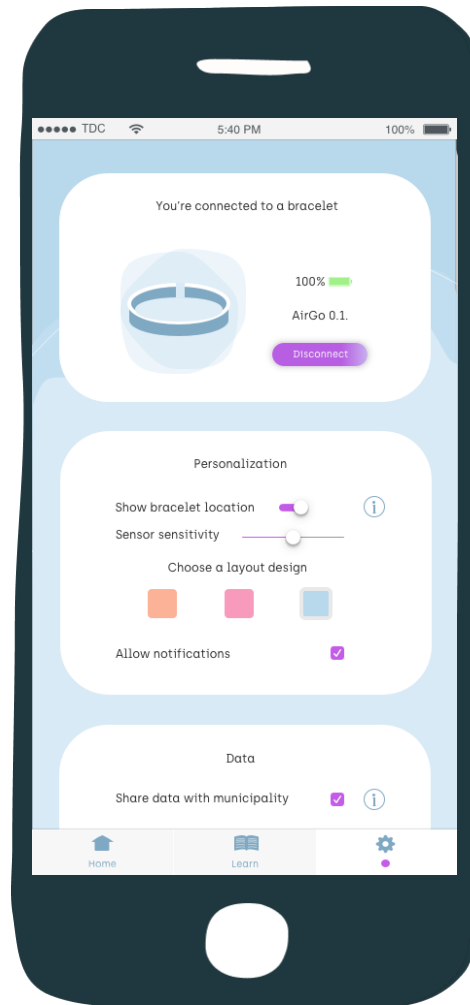
The user can choose different kinds of activities

## Learn



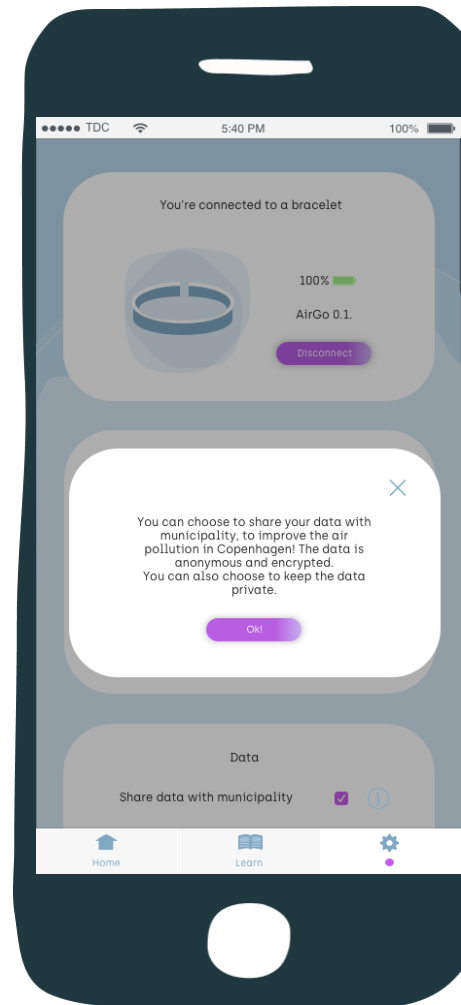
The user can choose different kinds of books

## Settings



Settings main page

## Settings



If the user click on the information symbol next to data, this message will pop-up

## Settings



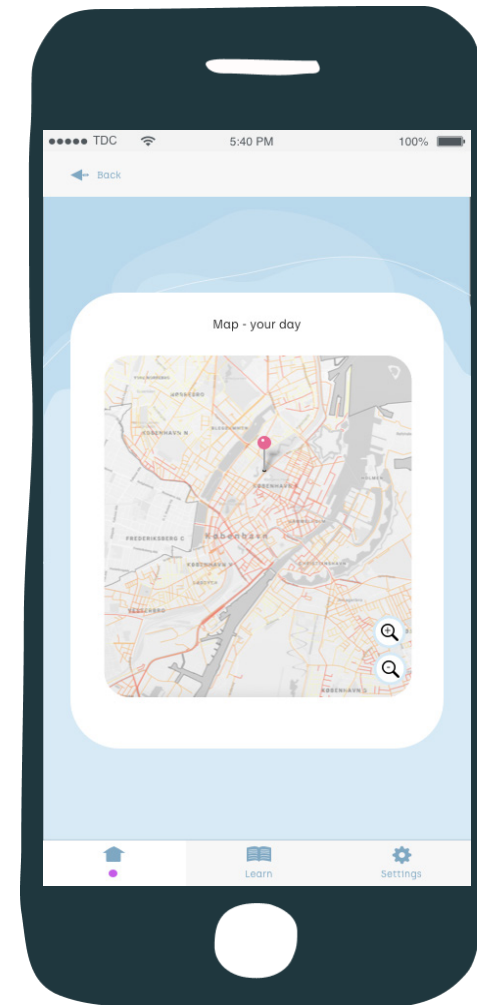
If the user click on the information symbol next to "show wristband location", this message will pop-up

# MAP



The map in the app of AirGo will show the amount of air quality in different areas of Copenhagen. All users of the wristband generate the data for the map. In "Settings", the users can choose to turn their own wristband location on/off based on their preferences. By turning it on, it enables the specific users to see where they have been when wearing the wristband. Hereby, it will show the users' routes on the map, while providing the user with an understanding of how the air quality is in the areas they have been.

The pin in the map shows where the wristband (the user) is currently located on the map.



# Prototyping App



After having the interviews with experts, it was more clear how to ethically communicate about air pollution to the AirGo service users, and what functions to include.

In order to test the app functionality, a prototype of an app was created. As the app plays an important role in the AirGo service - it helped to get an overview of the exposure to air pollution, as well as helping the user to learn more about air pollution.

Therefore, the team decided to prioritise the importance of testing the app functions, the way the information about air pollution is communicated, as well as the learning part of the app.

It was decided to create a simple prototype, to represent the main functions of it:

## **Home**

Which gives a holistic, personalized overview of air pollution exposure. The home screen is dedicated to all the important information, regarding informing about the wristband's exposure to air pollution: it shows a map, that portrays where the wristband's wearer has been, as well as in percentage, how much of the time in the day, the wearer has spent in clean air. It also shows the general air pollution index in the Inner City.

## **Learn**

This part of the prototype showcases the different learning opportunities: books, under which there's "draw while reading" and "bedtime story". In the learning part, there are also activities, under which there are more options, such as board games and out in nature.

## **Settings**

Settings part shows the user all the personalization functions, such as regulate the air pollution sensor sensitivity, to adjust for own personal needs, such as, if a person is daily exposed to air pollution, they might want to decrease the sensor strength. In this part of the app, it is also possible to choose if they want to share the data with the municipality for research purposes, or if they wish to keep it private.

After being created, the prototype was tested in the Marvel App, which provides the opportunity, to navigate through the app screens, by making them interactive. (MarvelApp n.d.) Here's the live prototype, that was represented to the test users: <https://marvelapp.com/e937d7h>

# Testing



It was decided to organize testing sessions, to test the app prototype. The purpose of the testing was to get feedback about the concept and the service experience. 3 users were tested in the process - 1 of the sessions took place in life, and 2 of them remotely - by using a video call.

Before the testing, it was decided to create guiding questions, that the testers would use when testing the users (appendix 15). It was important to ask open-ended questions, where the user could openly share their thoughts, without being nudged in some direction.

The questions were asked after the test person had looked at the interactive prototype, and went through different parts of it. There were some main topics, where the team wanted to gain more insights, therefore the questions were focused mainly on:

- The app functionality and layout.
- Implementation of child/parent mode.
- Overall usability.

## **Reflection:**

Due to circumstances, it was impossible to test the wristband part of the concept, which is a crucial part of the concept. Therefore, this testing has only partly tested the overall concept.

# Testing Findings



From the testing of the prototype, a lot of interesting findings were found. A clustering of the testing has been made in the same way as the interviews (appendix 16). The findings were clustered into four main categories: Design & Layout, Content, Child/parent-mode, and Use of the App.

In the Design & Layout category, it was generally found that the participants had an overall expression that it was a simple overview and easy to navigate. It was clear that the participants had different opinions on the design, and especially the colors. One of them liked it, but the other two wanted more bright colors and one of them mentioned that she related air pollution to the color green. One of them also mentioned that she wanted the app's interface to look more serious e.g. by avoiding using pastel colors. Additionally, some of them said that they wanted a more child-friendly look and more visuals for children. One of the participants found that it was hard to read the circle diagram about air pollution in Inner City.

In the Content part, all the participants liked the first page, as all the important information are collected there. One of them wanted a historical graph to be added, to see the weekly exposure to air pollution. All of them liked the informative boxes in the app, and that it has a positive angle of air pollution instead of a negative. Furthermore, one of the participants would like an explanation of AQI (air quality index). The participants see the activities as a good learning tool, but one of the participants misunderstood it and thought it was activities for parents and she also did not see the function of the books and would like to have movies instead. The same participant would like to have some motivational things in the app both for her and for the child. This could e.g. be by competing with others, and games for the children with points. Another participant liked the map where she could see the location of the wristband, and the opportunity to disconnect it. The same person was skeptical about the data and how valid it is.

The team asked the participants what they thought of implementing a child and parent-mode, that they could shift between. This question was asked, due to the findings from the expert interviews (appendix 13). This function would give the children an opportunity to use the app by themselves and at the same time to remove all informative elements that might cause fear for children. All the participants liked the idea of having the opportunity to switch between parent-mode and child-mode.

It was found, that the participants had different opinions on how often they would use the app. One of them would use it 1-2 times a day, another 2-3 times a week, and the last one 2-3 times a month. It was assumed that this difference was caused by the different levels of asthma in the families.

# Future

To improve AirGo, it was found that some things should be investigated further. It could be interesting to test children's reaction of colors in relation to the wristband, to see if the right decision was chosen due to how it works now, or if it should be changed to something different. Furthermore, it was found that the potential users interviewed found it interesting to implement a child/parent-mode.

To further improve the concept a closer collaboration with stakeholders should be made, and more experts should be included in the improvements.

Through the process of developing and designing AirGo, it was considered that this concept could be expanded. In the future design and functions in the app could be developed to meet other users' needs, as for example people with lung diseases, or people that just want to be aware of air pollution.

# Children as change agents

AirGo is a concept, that focuses on targeting both parents and children, which gives a good opportunity to reach directly to children.

In the app, the learning section is incorporated to educate both children and parents. In this way, children will be able to learn about air pollution from a young age and become change agents in the future, as they will be more aware of air pollution effects and causes. With AirGo the invisible becomes visible and makes it easier for the users to understand and react to something that is hard to grasp. By choosing to focus on people with asthma, they might get another understanding of air pollution, as they are affected by bad air quality in their everyday life. Furthermore, children are taught and informed from an early age, so they might be more aware of this in the future and more passionate about the topic, so they can inspire other people. It is important that children will become change agents in regards to a topic like air pollution, as they are the next generation.



# Reflections

# Evaluation and reflection

## SWOT

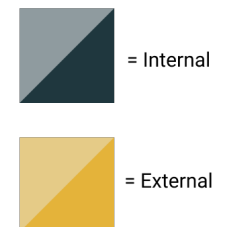
A SWOT-analysis was created to get an overview of AirGo's internal and external situation, whereafter the team would be able to estimate whether the product is feasible on the market. The strengths, weaknesses, opportunities, and weaknesses were addressed, whereas the most profound elements will be explained below (Andersen et al., 2015).

AirGo has several significant valuable strengths, which among others is that it is a part of a large company, Philips, that has a high brand value, and a broad knowledge of the topic (Mikulic, 2020). Additionally, AirGo is first mover and gets the opportunity to obtain valuable data. This data is also predicted as an opportunity for the company, since it adds a high bargain power that results in credit from collaborators and thereby more market visibility.

Another significant opportunity, is AirGo's potential for scalability. This means that AirGo might be able to expand its target group in the future, as explained earlier in this report.

The weakness "Firstmover" was added to the SWOT, as it might be challenging for Philips to develop this product, as there are no similar products on the market to learn from. Furthermore, the 'decreased brand value' was added as a weakness, because the brand value declined from 2018-2019 (Mikulic, 2020).

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> <li>- Brand value</li> <li>- Knowledge of asthma and air pollution</li> <li>- Obtains valuable data</li> <li>- First mover</li> <li>- International brand</li> </ul>	<ul style="list-style-type: none"> <li>- First mover</li> <li>- Decreased brand value of Philips from 2018-2019</li> </ul>
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> <li>- More focus on air pollution</li> <li>- Collaborators</li> <li>- No similar products on the market</li> <li>- Scalability</li> </ul>	<ul style="list-style-type: none"> <li>- Ethical issues</li> <li>- May cause fear</li> <li>- People might not see the need</li> </ul>



Model 27: SWOT

This was considered as a minor weakness, due to the fact that Philips's brand value gradually has increased from 2010 to 2018, and the decrease from 2018 to 2019 is not significant. However, it is unknown whether the brand value will continue to decrease or not.

The external threats was considered to be caused by people's lack of knowledge about air pollution and the ignorance of how to behave according to it, which was investigated through field research in the survey. The uncertainty of not knowing the importance of air pollution was therefore considered as a threat for AirGo, since it may be difficult to convince the target group to understand the purpose of the product.

Additionally, some participants from the interviews mentioned that the information about air pollution might cause fear. Due to the increased focus on air pollution as a trend, the team assume that people will become accustomed to the topic, which makes it less frighteningly

## Design process and learning goals

During the project, the team experienced the need to go back to previous phases multiple times, in different parts of the project, to be able to move forward with the project. In the first part of the project, it was uncertain what the team was going to design and what the team would find during the process that would be interesting to work further with.

Different areas had to be researched before moving on the ideation phase, why the process at the beginning of the project moved forth and back between the emphasize and define phase. After the team came up with an idea for a concept, it was decided to both move forward in the process by doing prototyping but also moving backward by going back to do desk research. The prototype confirmed the direction of the project. However, the team had to go back and do research to work further with the idea. Due to the fact that the team had to go back and forth between the phases, it was impossible to follow the initial timeline, and therefore a gantt chart was created.

Through the process of the project work, the team has learned multiple things. From the given learning goals, it was experienced how a service concept is connected and structured as a distributed system, and how different actors could support and participate in a project. However, in this case, under the circumstances, it was not possible to involve actors, as the project was related to the health industry and the people working in this field were very busy at the moment Denmark was in lockdown. Because of this situation, the team decided to use a user-centered approach for the project, however, the goal from the beginning was to apply co-design. It has been reflected upon how the project would have looked different and how the outcome could have changed if the group has used this approach through the project process.

The team succeeded in the personal learning goals, by applying knowledge from the first semester and effectively combine the members' knowledge from different educational backgrounds and work experience. Furthermore, different aspects from the current semester were used through the process of the project.

## Group work reflections

According to project management, this part changed when Denmark was in lockdown. It was impossible to have physical meetings so the team continued using online tools to communicate. This change forced some challenges in relation to the group work, as it was experienced that it was hard to express ourselves through video conversations and especially when expressing in other than our native language. It is assumed that it would have been much easier to work in a physical environment, than working online, but this was enormous learning for the group too. A lot of online tools were explored and used through the project work, and this gave the team some insights into other tools than normally chosen to work with. This learning is interesting in relation to future work, both in teamwork relations and working online in general.

## Validity and reliability

It was important to reflect on the validity and reliability of this project. Validity shows the accuracy of the findings, and the reliability is the consistency or dependability of the measurement strategy (Bjørner, 2015, p. 109). Is the data really presenting the reality? The team could have involved more participants through the project, to get a broader perspective of the potential users. It was not possible to involve any participants living in Inner city of Copenhagen, and it could have been interesting to get this perspective as well. However, the participants involved in the project lived in Copenhagen and used time in Inner City.

## Direction of project

This project took the direction of focusing on children with asthma because it was thought that it was easier to target someone who has a need in relation to air pollution. The team could have gone in the other direction, where the focus of this project could have been on a broader target group instead. Through the research, it was found that people, in general, do not know much about air pollution and might not see the need of having the information, which is why the team focused on a target group who is in higher health risk in regards to the topic of the design brief. With this said, the group is aware that the concept developed is not only a solution that could be implemented in Inner City of Copenhagen but could be expanded to other countries and cities with much air pollution. Furthermore, the target group could as well be expanded to people with other diseases in a higher risk of the affects from air pollution, as well as healthy people could use the concept in the future, to prevent sicknesses like asthma and other health issues.

The team cannot ensure that the data will be trustworthy, as data can always be manipulated (Barrett, 2020). It is, though, assumed that people will use the wristband as they are supposed to.

It should be mentioned that the team is aware that this concept is not scientifically proven. However, based on the research that shows air pollution can trigger tricker asthma, it is assumed that AirGo may be a beneficial tool for asthma patients.

# Conclusion

# Conclusion

This report covers a period of four months, from February to May 2020, where the team has been working with the design brief presented by Gehl Architects. The project was build up upon the Design Thinking method and present the process between Empathize, Define, Ideate, Prototyping, and Test. Through this iterative process, challenges were found, and research was gained through several methods. The design brief given started with the focus of a broad problem statement, which the team later in the process changed to focus on a more specific challenge. Through the empathize phase, desk research and field research have been made, and it was found that people, in general, do not know that much about air pollution and do not know how they should use the information if they had it. Furthermore, it was found that air pollution can trigger an asthma attack, and it was already found that children are more exposed to air pollution because they are still developing their brains and bodies. Therefore, it was decided to target children with asthma, as the team found that this target group could benefit from a product like AirGo, and they might succeed in reducing their asthma symptoms by using this product.

At the beginning of the process, the team explored both Amager and Inner City, which were the two given areas to choose between. Desk research was done in chosen areas of the two presented areas, and the team agreed to proceed with Inner City.

The outcome of the design challenge resulted in the development of the service concept AirGo. A user-centered approach was used to develop this service, as this was found as the most beneficial approach for this project and the current situation.

AirGo consists of a wristband, which is connected to an app. The purpose of the service is to make children with asthma aware of air pollution and how it can affect them. The learnings the children will get from using AirGo will encourage and inspire them to become change agents, because they start gaining knowledge of air pollution and start to be aware of the most polluted areas. Their parents have the opportunity to follow the children's day and have an overview of how much air pollution they are exposed to. It was essential to the team, to communicate the information positively, to avoid causing fear, as this was found as a challenge during the process. Another challenge was the ethical issue, that was found in relation to the GPS function in the wristband. The team found a solution to this, by making a function in the app, where parents, in consent with their children, could switch the location of the wristband on and off. This was found as a useful function after the testing of the app with the participants.

The stakeholders in the AirGo service concept was carefully selected and chosen on the background of research. It was reflected upon how the different stakeholders could benefit from being a part of AirGo and how the system would work across all parts of the service.

When taking everything into perspective, the team has develop a service concept that can empower and inform citizens to become change agents. The team estimates AirGo, which is a first mover on the market, to become a useful service for both children and parents in order to live a healthier life.

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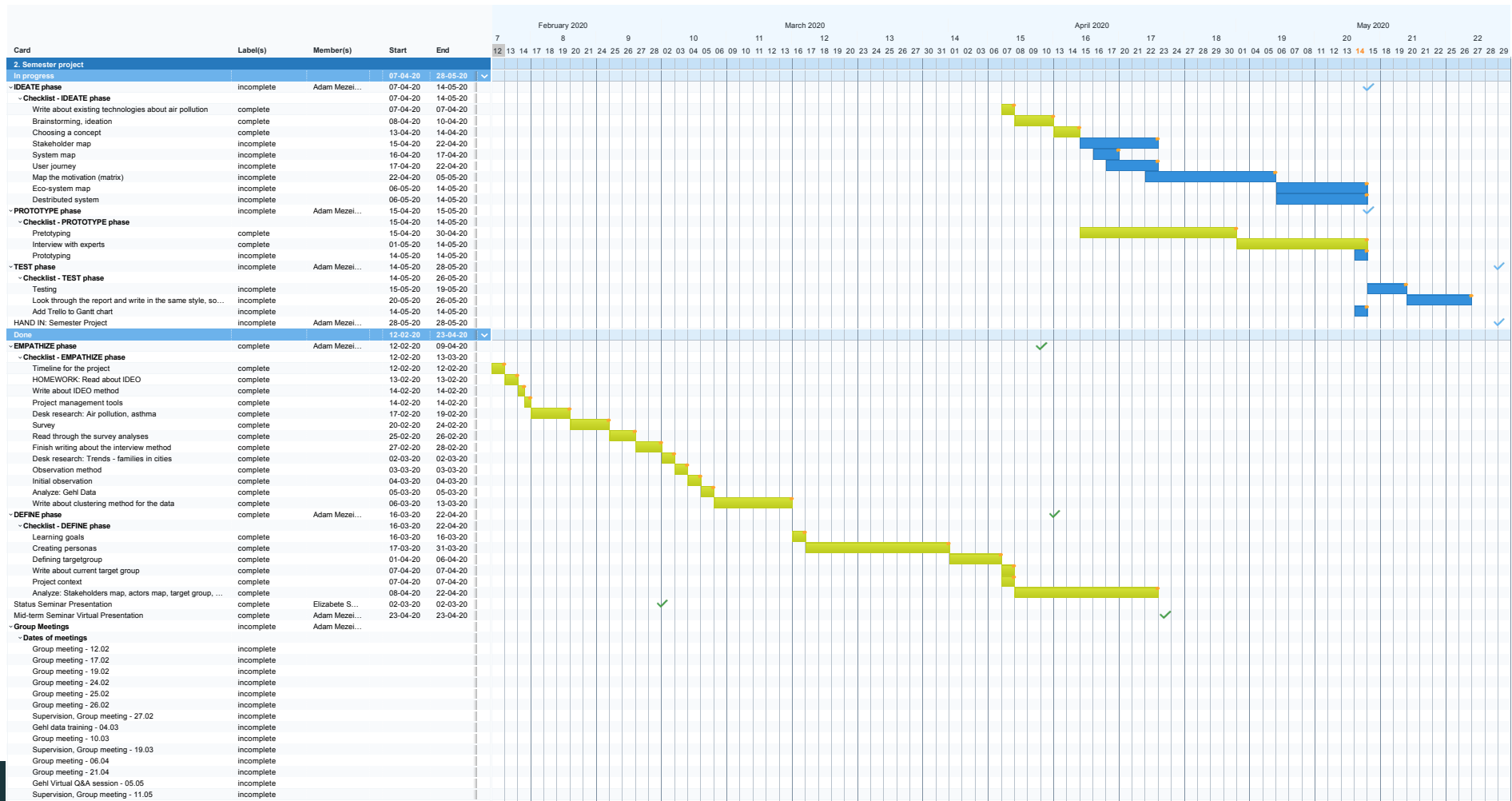
# APPENDIX

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# 1. Gantt chart

This Gantt chart supports project management and helps to have a better overview of the project timewise, generated from the tasks listed in Trello.





## 2. E-mail to daycares

The e-mail below represent a example of the 12 e-mails that were sent to the daycares in inner-city. All the mails was identical, why only one example is shown.

On the next page is all the e-mails we got in respons from the daycares in the periode of time where we were working on the project.

**Fra:** Mette Jakobsen <mjako19@student.aau.dk>

**Dato:** onsdag den 4. marts 2020 kl. 11.53

**Til:** [REDACTED]

**Emne:** Projekt af studerende på Aalborg Universitet(KBH)

Kære Idrætsbørnehaven Hylet,

Vi er en gruppe Service Design studerende fra Aalborg Universitet i København, som er ved at skrive projekt omkring luftforurening i København.

I den forbindelse har vi særligt fokus på børn, og håber at I har mulighed for at besvare et par spørgsmål.

Vi kunne godt tænke os at vide om luftforurening er noget I tænker over, når I vælger hvor I skal på tur med børnene?

Samt hvilke steder (parker, skove, strande eller andet) I ofte besøger når I er på tur med børnene?

Derudover vil vi høre om vi må kontakte jer senere i forløbet for yderligere information, hvis dette bliver aktuelt?

Vi håber at høre fra jer, og ønsker jer en rigtig god dag!

Med venlig hilsen,

Camilla, Elizabete, Adam, Julie & Mette  
Service Systems Design, Aalborg Universitet

## Christianshavn Asyl

on 04-03, 12:14

Mette Jakobsen

Svar til alle

Hej Mette

Det lyder som et spændende projekt.

Jeg vil gerne hjælpe jer med at svare på de spørgsmål I har sendt.

Vi tager rigtig meget på tur med vores børn her i Christianshavns Asyl og det gør vi uden overhoved at tænke på luftforurening.

Vi bruger nærmiljøet rigtig meget – vi ligger lige op af voldens grønne områder hvor der er flere legepladser, Naturskole mm. Vi går også ture på Christianshavn og omegn. Vi har vores egen bus som hver dag kører ud med 12 af institutions 33 børnehavebørn. Her besøger vi skov, strand, parker, Naturskoler, byens legepladser, zoo, rideskolen, kulturelle tilbud – alle mulige steder der kunne give vores børn et lærerigt legemiljø eller hvor vi har noget på hjertet vi gerne vil præsentere for børnene.

Håber I kan bruge svaret.

## Blikfang

Projekt af studerende på Aalborg Universitet(KBH)



Int. inst. Blikfang

ti 31-03, 10:12

Mette Jakobsen

Svar til alle

Kære Mette

Vi blev – som alle andre - ramt af corona og har været travlt optaget af at organisere og rapportere til vores forvaltning.

Hvis det stadig er aktuelt med jeres interview, vil jeg gerne høre mere om hvordan I vil gribe det an.

I kan ringe på [redacted] eller skrive på [redacted]

Mvh Mette Mechlaoui [redacted]

børnehaven hylet [redacted]

to 05-03, 14:19

Mette Jakobsen

Hej med jer,

Det har vi i hvert fald.

Vores institution ligger midt i byen, så selvom vi er udmærket klar over at der er meget forurening i vores nærområde, er det desværre ikke noget vi tænker yderligere over når vi vælger legeplads/ture. Vi besøger ofte legepladserne i HC Ørstedsparken (begge to), legepladsen i Kongens have samt legepladsen på Hausers plads. Derudover prøver vi at komme i skoven en gang i mellem, dog sker det ikke så ofte som vi ønsker det. Håber det er besvarelse nok. I er velkommen til at kontakte os igen hvis I har yderligere spørgsmål.

På Idrætsbørnehaven Hylets vegne,

# 3. Survey questions – first draft

The first survey was directed towards families living in inner-city of Copenhagen, as this was the chosen area for the project.

**The message sent out together with the survey:**

*Hi,*

*Are you a parent living in Inner City of Copenhagen (København K)?  
And do you have 2 minutes to answer this survey? It would be a big help for us these days, as we do not have that many options to get data for our project :-)*

*All the best,*

*5 master students from Aalborg University in Copenhagen*

**SURVEY:**

- How many children do you have?
- How old are your children?
- Where do you take your children in your spare time?  
(choose more than one)
  - Parks
  - Green areas
  - Inside playgrounds
  - Outside playgrounds
  - other? – option to write
- Follow up question: Why do you choose to take them there?

- Do you miss some more green areas in Inner City?
- Do you choose NOT to go to some areas in the city with your children?  
If yes which areas and why?
- What do you, in general, know about air pollution?
- Is air pollution something you think about in your everyday life – if yes, how?
- How do you think air pollution affects children?
- What do you think about being able to be informed/find information about air pollution e.g. in specific areas around the city?  
options:
  - a) It would not be relevant for me and my family – and not something we would use.
  - b) I am not sure what I/we should use it for
  - c) It could be relevant for me and my family
  - d) It is definitely relevant for me and my family and something that we would use

Please fill in your contact details, if we can contact you further on in the process of the project. We would appreciate that! :-)

e-mail/phone:

# 4. Survey questions - Final

The second survey was directed towards all families living in the Copenhagen area. Furthermore, we made people aware of the possibility to answer in Danish if they felt more comfortable with this.

## The message sent out together with the survey:

Hi,

This survey is relevant for you as a parent living with your children in Copenhagen. We are interested in your opinions and experiences of living in Copenhagen with your children.

The survey is in English but you are welcome to answer in Danish if you are more comfortable with that :-)

All the best,  
5 master students from Aalborg University in Copenhagen

## SURVEY:

Your zip code?

- |               |                |
|---------------|----------------|
| - København K | - København NV |
| - Vesterbro   | - Valby        |
| - Nørrebro    | - Sydhavnen    |
| - Amager      | - Nordhavnen   |
| - Østerbro    | -Frederiksberg |
| - Other?      |                |

Your age?

- 16-25 years
- 26-35 years
- 36-45 years
- 46+

How many children do you have?

- 1
- 2
- 3 or more

How old are your children?

(it is possible to choose more than one option)

- 0-3 years
- 3-6 years
- 6-9 years
- 9+

Where do you take your children in your spare time?

(it is possible to choose more than one option)

- Parks
- Green areas
- Forrest
- Indside playgrounds
- Outside playgrounds
- Other?

Why do you choose to bring your children to these places?  
(distance, area, other children etc.)

---

Do you sometimes bring your children to inner city?

- Yes
- No

IF YES, in which context do you bring your children to inner city?

---

Do you choose NOT to go to some areas in Copenhagen with your children? If yes, which areas and why?

---

Is airpollution something that you, in general, think about when moving around in Copenhagen with your children?

- Yes
- No
- Other

How do you think air pollution affects children?

---

What do you think about being able to get information about air pollution e.g in specific areas?

- a) It would not be relevant for me and my family and not something that we would use
- b ) I am not sure what I/we should use it for
- c) It could be relevant for me and my family
- d) It is definitely relevant for me and my family and something that we would use

Please fill in your e-mail, if we can contact you further on in the process of the project. We would appreciate that! :-)

---

Thanks for answering the survey. We really appreciate that you took your time to help us! :)

# 4. Survey findings

## Introduction:

The survey has been answered by 20 respondents, which is not representative but due to circumstances of Covid-19, it was not possible to obtain more answers. Nonetheless, a thorough analysis of the survey has been made to give an estimated idea of the target group, which will be used to form personas.

Given that the survey contains a large amount of qualitative open answers, some answers have been placed into categories to ease the process of comparing the answers with the aim of obtaining more profitable results. A further explanation of this will appear during this chapter.

The analysis of the survey is mostly based on the respondents' answers to the question below:

"Is air pollution something that you, in general, think about when moving around in Copenhagen with your children?"

This question had three possible answers: YES, NO and OTHER. The respondents who chose OTHER, and answered "To some degree", "Both yes and no[...]" and "sometimes[...]", is categorized as a YES, because they show a certain knowledge of air pollution.

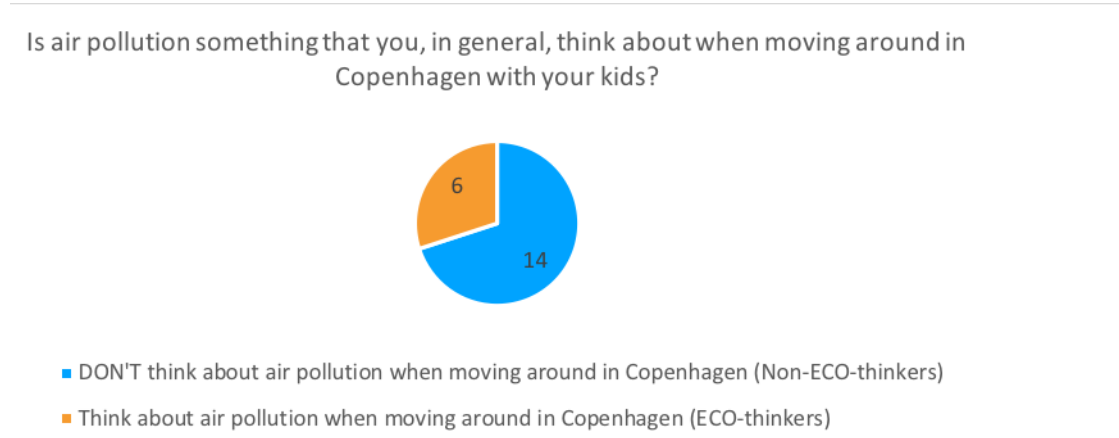


Figure 1

Figure 1 shows the distribution of the answers of the ones who think about air pollution when moving around in Copenhagen with their children and the ones who don't. It can be seen that 14 respondents out of 20 don't think about it. It is tantamount to saying 70% don't think about it. Therefore, it was interesting to make a deeper investigation of the disparity of the respondents who think about it and the ones who don't, because of a hypothesis saying that the two groups may have different behavioral patterns.

The people who think about air pollution will from now on be grouped as the ECO-Thinkers and the ones who don't will be the 'Non-ECO-thinkers'.

### What do the respondents in general know about air pollution

Based on figure 1, a hypothesis has been made saying that the respondents who don't think about air pollution when moving around in Copenhagen with their children, the non-ECO-thinkers, are more likely to have less knowledge about air pollution. To test this hypothesis, it has been analyzed how the two groups: 'EGO-thinkers' and 'Non-ECO-thinkers,' answered this question:

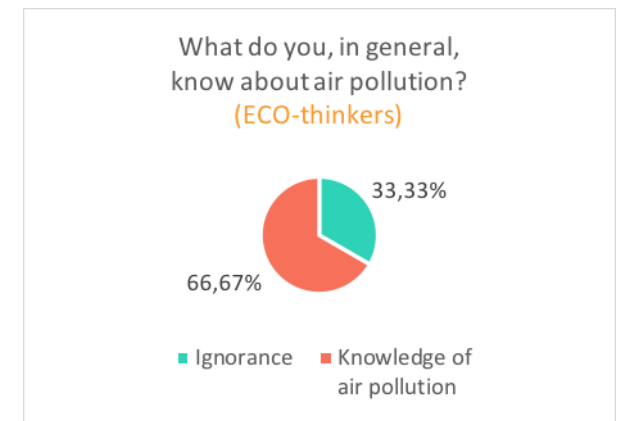
"What do you, in general, know about air pollution?"

Given the fact that this question led to a wide variety of open answers, two main categories have been made in order to be able to compare the answers and classify them. The two categories are:

1. Ignorance
2. Knowledge of air pollution

The classification of the answers will be visualized next to each graph in order to present the analytical approach.

In figure 2, it can be seen that two thirds of the ECO-thinkers have knowledge of air pollution and one third doesn't know much about it. Contrary to figure 3, whereas more than half of the respondents don't know much about air pollution.



Total amount of answers:	6		
Not so much, but ret ti ude bicycle as much as possible	Ignorance	2	33,33%
Not much.	Knowledge of air pollution	4	66,67%
I would say I know a little			
I am educated in public health			
At det er værst i byerne/tæt befolkede områder			
Copenhagen is bad			

Figure 2

In order to clearly visualize the comparison of the ECO-thinkers' and the non-ECO-thinkers' knowledge of air pollution, figure 4 has been made. Through this graphical comparison of the two groups, it is clear that the ECO-thinkers have a greater knowledge of air pollution than the non-ECO-thinkers. Hereby, the hypothesis can be proved.

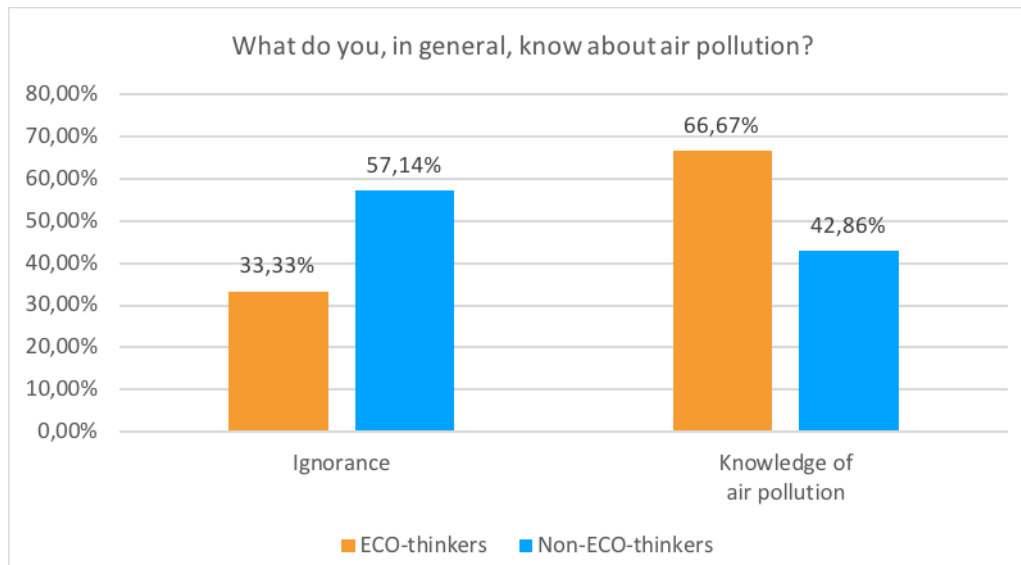
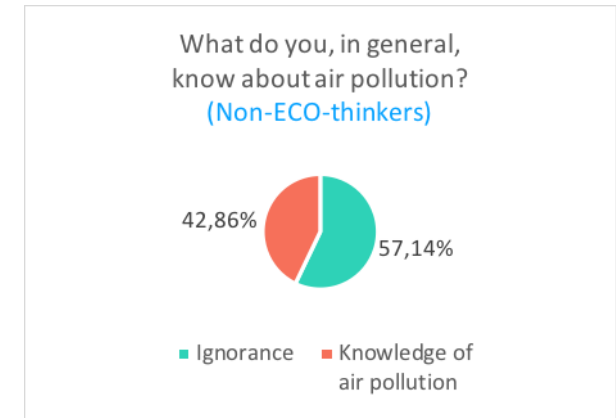


Figure 4

### How do the respondents think air pollution affects children?

As a result of the previous proven hypothesis about the general knowledge of air pollution, it is interesting to investigate further whether the two groups are aware of how air pollution affects children or not. To analyze the respondents' knowledge of the question, their answers have been categorized. If they have some knowledge of how air pollution affects children, they will be categorized in the group: "knowledge of air pollution". Contrary, if they indicate that they don't know how air pollution affects children, then they will be categorized in the group: "ignorance". Figure 5 shows a great disparity of how the ECO-thinkers are more aware of how air pollution affects children than the non-ECO-thinkers are.



Total amount of answers:	14		
Tænker ikke over det	Ignorance	8	57,14%
nothing really			
?			
Not much			
Not much			
Very little	Knowledge of air pollution	6	42,86%
Nothing			
Little			
Enough, but not deeply into it			
That you should minimise exposure to it			
Something you shouldn't seek	Knowledge of air pollution	6	42,86%
That there is a high level of air pollution in the inner city			
That it is worse in the city.			
At det er dårligt omkring søerne særligt			

Figure 3



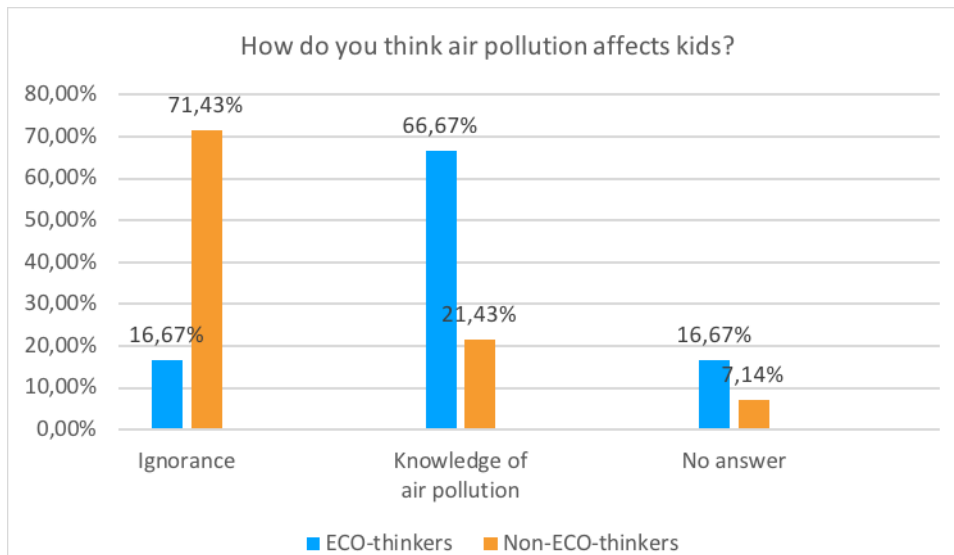


Figure 5

This is a remarkable representation of the two groups since it visualizes that half of the respondents who answered the given question don't know much about how air pollution affects children. Therefore, this can be seen as a great opportunity for further work.

As just mentioned, in the process of creating figure 5, all open answers have been classified into 2 categories. The classification can be seen in figure 6. This was, again, due to the fact to make it possible to analyze and compare the data.

Question	Answer to the question:	Category	Amount of answers	
How do you think air pollution affects kids?	Hopefully not too much /	Ignorance	1	16,67%
	It affects us all and therefor also kids	Knowledge of air pollution	4	66,67%
	Its hard to avoid when living in inner city			
	Det har da helt sikkert en dårlig indflydelse på alles helbred, både børn og voksne			
	Lile the rest of us, it's bad for them. Even worse for them actually.			

Figure 6: ECO-thinkers

Question	Answer to the question:	Category	Amount of answers	
How do you think air pollution affects kids?	Might be more tired because of lack of fresh air	Ignorance	10	71,43%
	Nej			
	I don't know, since it's not something I think about			
	I think it is unhealthy but also think and hope that air pollu			
	Probably			
	?			
	Pas			
	It might do but I feel I can only do so much			
	I'm guessing: not so great?			
	I hope that children are not affected.			
	No good	Knowledge of air pollution	3	21,43%
	Long term lung capacity			
	Dårlig lungefunktion imens vi bor her. Forsvinder når vi fly			
	No answer	1	7,14%	

Figure 6: non-ECO-thinkers

### Do the respondents bring their children to inner city?

Due to the fact that inner city is a very polluted area, it is interesting to investigate if, especially, the ECO-thinkers bring their children to inner city or not. A hypothesis would be that there would be more Non-ECO-thinkers going to inner city compared to ECO-thinkers. In figure 7 a comparison has been made. It shows that all ECO-thinkers bring their children to inner city, but it is only 64,29 % of the Non-ECO-thinkers that brings their children to inner city. This means that the hypothesis is unproven.

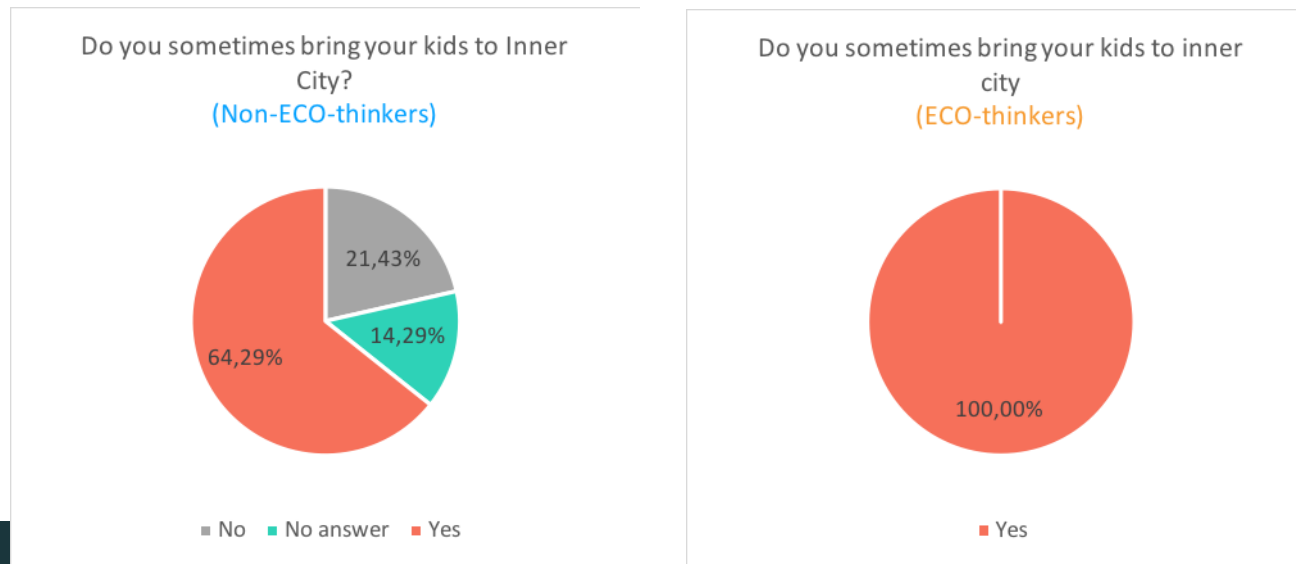


Figure 7

In addition to the above it needs to be investigated whether the areas the respondents come from play an important part or not. For that reason, two additional figures have been made. Figure 8 indicate that distance does not matter inasmuch as one third of the Non-ECO-thinkers lives in inner city and two third live in Amager. Not to mention, the ones who answered that they bring their children to inner city do not all live nearby.



**Figure 8**

Figure 9 is proving the statement above, which is that distance does not have a great significance since all the ECO-thinkers choose to go to inner city even though they live in other areas themselves.

Hereby, it can be concluded that the respondents do not deselect to go to inner city with their children because of distance, but it is more likely due to something else and unknown.

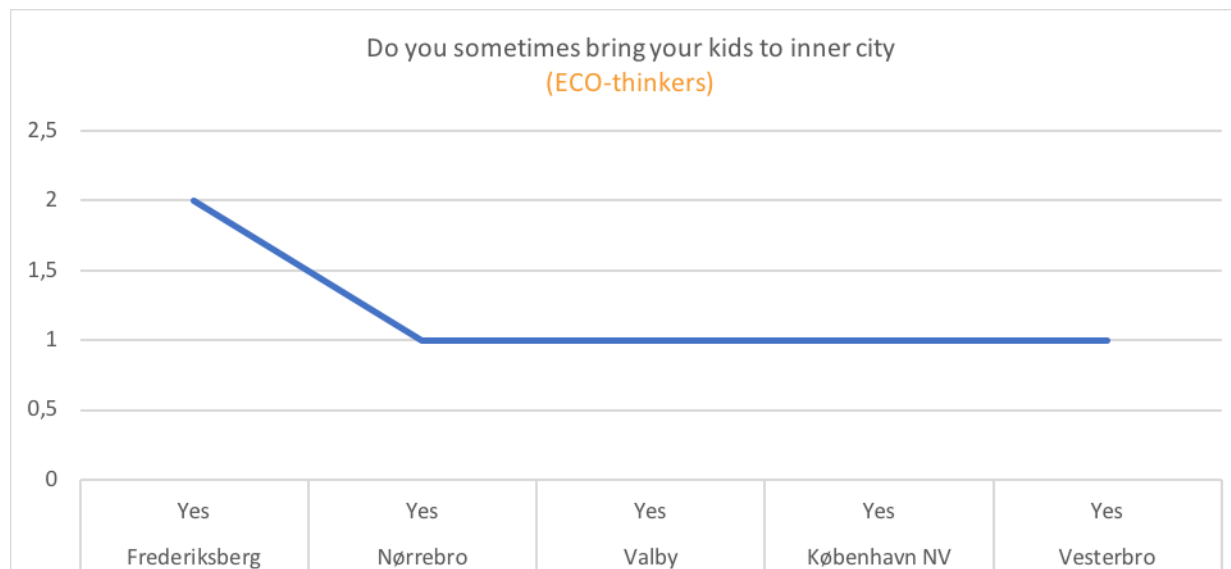


Figure 9

### Where do the respondents take their children in their spare time?

To understand how the respondents use their spare time with their children, figure 10 has been made. The red lines indicate that these are suggested multiple choice answers within the survey, and the green lines are open answers written by the respondents themselves. The figure illustrates all the given answers and their most frequent activities. Parks, outside playgrounds and green areas are the most used activities. The results may be colored by the fact that these three answers also are suggested answers in the survey, but it still give an indication of the target group's preferences.

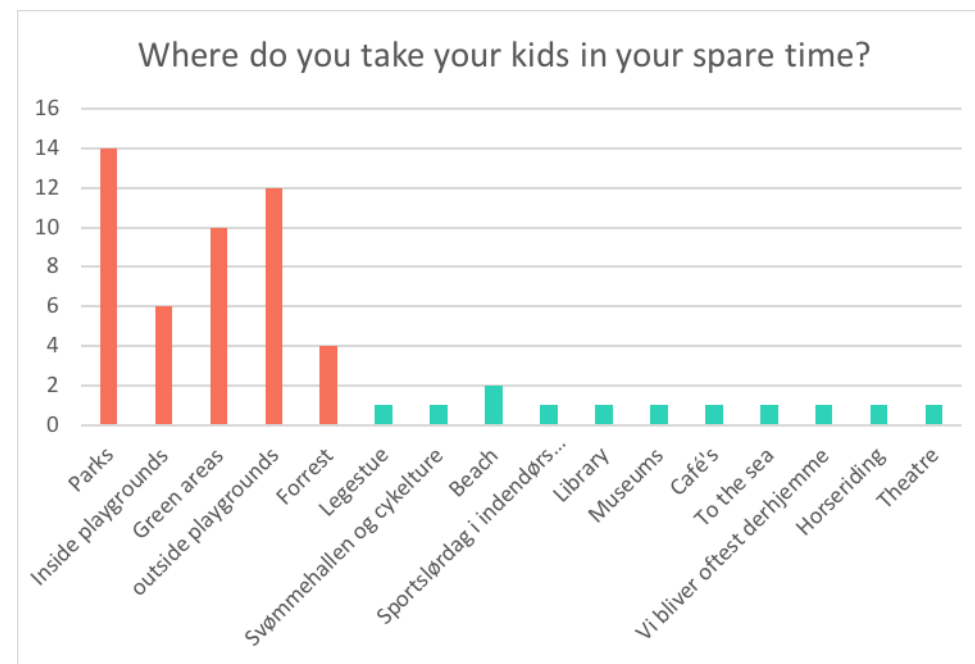


Figure 10

As mentioned above, the most frequent activities are parks, outside playgrounds and green areas. Therefore, it is interesting to analyze the age groups of the respondents that are going to the three mentioned places. It has, of course, been taken into consideration that most of the all respondents are in the age of 26–45 years old.

From figure 11 and 12, it can be concluded that the ones who take their children to parks and outside playgrounds in their spare time, primarily, are between 26–45 years old.

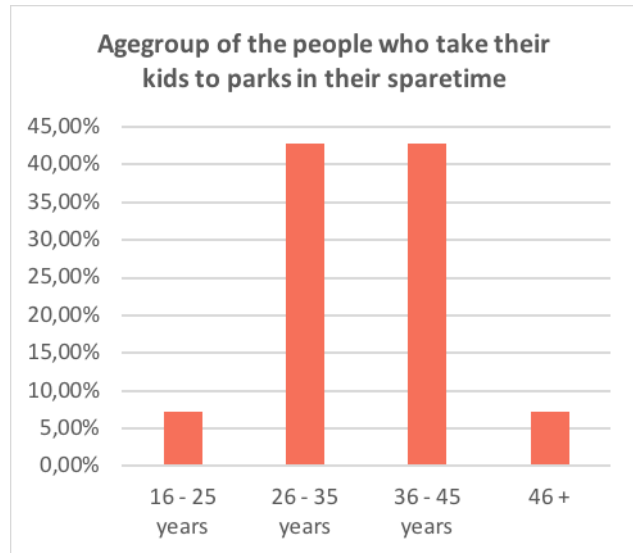


Figure 11

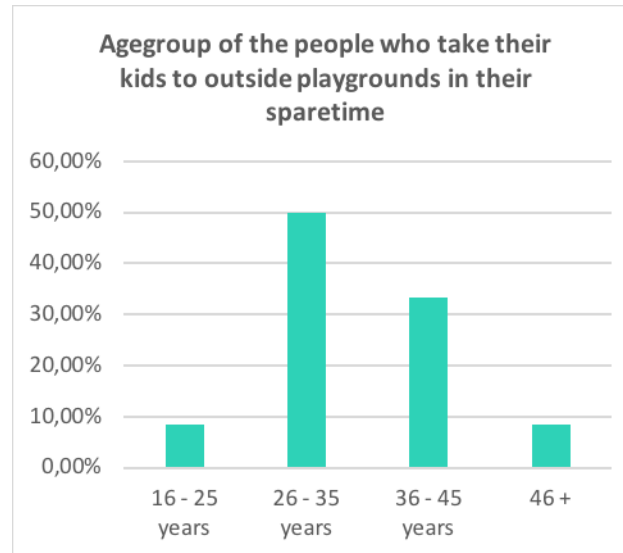


Figure 12

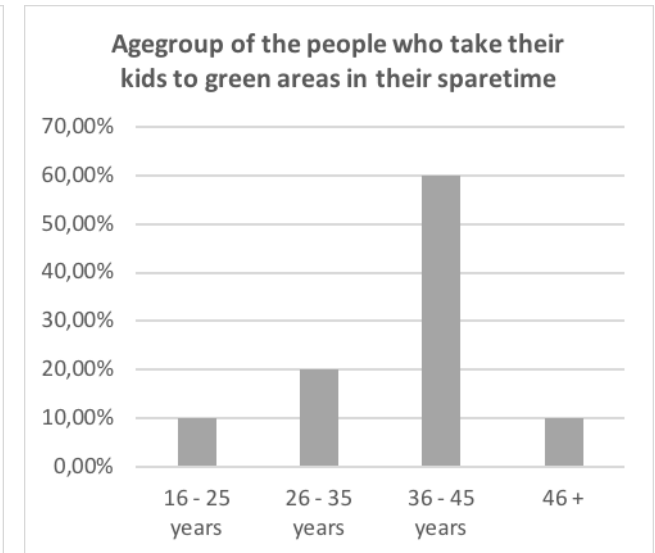


Figure 13

Figure 13 visualizes that it is primarily people between 36–46 years old who visit green areas.

The graphic illustrations of the age groups of people spending their spare time with their children within the areas are indicators of the respondents' preferences. It would have been relevant to check if the data was representative by observing these three types of areas, but it is not possible due to circumstances.

### What do the respondents think about being able to get information about air pollution e.g. in specific areas?

This question has been asked, because it is important to inquire if this information is something people would like or if this would be something that scare them away. Their answers will be a guideline to how to communicate a future idea.

When asking the respondents if they want information about air pollution or not, they strongly disagreed. To compare their answers, it is interesting to divide them into the groups of Non-ECO-thinkers and ECO-thinkers again.

What do you think about being able to get information about air pollution e.g in specific areas?

(Non-ECO-thinkers)

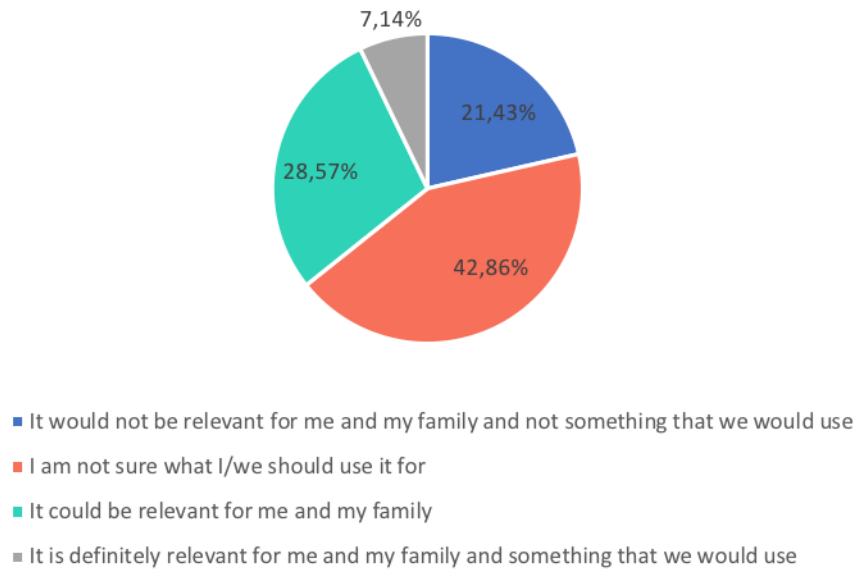


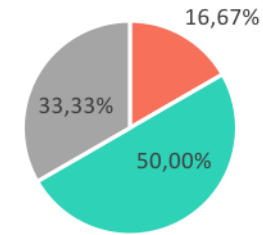
Figure 14

When changing perspective into the ECO-thinkers' point of view, they are more positive and open for the idea of being able to obtain information about air pollution in specific areas, which can be seen in figure 15. One third of the ECO-thinkers would definitely use the information, and 50% think it could be relevant. Only 16,67% are uncertain what to use it for. It has become very straightforward that there is a large difference when comparing the Non-ECO-thinkers with the ECO-thinkers.

To illustrate the difference between Eco-thinkers' and Non-ECO-thinkers' thoughts about being able to get information about air pollution in specific areas, a comparison has been made (Figure 16). From the graph it can be seen that the ECO-thinkers are staying positive about the idea, contrary the Non-ECO-thinkers. There are only 3 out of 20 (15%) who are certain about that this information would not be relevant for them. Hereby, it can be concluded that there can be a potential market for the remaining respondents, which count as 85% of the total respondents.

What do you think about being able to get information about air pollution e.g in specific areas?

(ECO-thinkers)



- I am not sure what I/we should use it for
- It could be relevant for me and my family
- It is definitely relevant for me and my family and something that we would use

Figure 15

What people think about being able to get information about air pollution

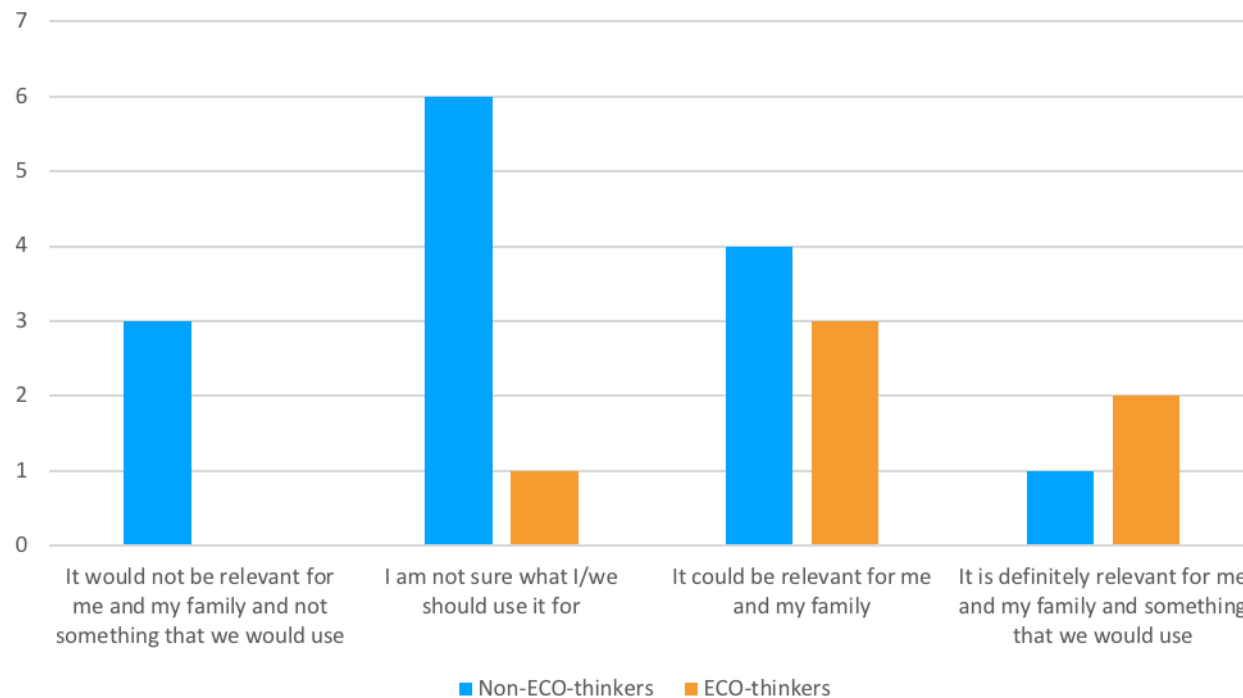


Figure 16

## Conclusion

From the survey of the 20 respondents, conclusions can be made. First of all, it has been measured that 14 respondents out of 20 do not think about air pollution when moving around in Copenhagen with their children. Therefore, they are being categorized as the Non-ECO-thinkers in this analysis and count as 70% of the respondents. This can be worrying considered that young children are more affected by air pollution than adults.

When comparing the ECO-thinkers with the Non-ECO-thinkers, there is a remarkable difference, which will be summed up here. The ECO-thinkers do, in general, have a greater knowledge of air pollution and how air pollution affects children, than the Non-ECO-thinkers. Based on this, a hypothesis has been made saying that the ECO-thinkers would not take their children to inner city due to the bad environment, but this has been proven wrong. All the ECO-thinkers bring their children to inner city, contrary the Non-ECO-thinkers, where it is only 64,29% who bring their children to inner city. In addition to that, it has been investigated if the respondents deselect to go to inner city with their children because of distance, but due to research, it has been explored that distance does not play a part in this decision.

Another interesting conclusion has been made from the survey. It has been clarified that most of the respondents in the age of 26-45 prefer to spend time with their children in parks and outside playgrounds, and the respondents between 36-45 prefer to go to green areas as well. This give an indication of the respondents' preferences that can be useful knowledge for further research.

In the end of the survey, the respondents were given the question if they would like to be informed about air pollution in certain areas. It has been discovered that there is a fundamental positive attitude towards being able to receive this information. This indicates that there can be a potential market for creating projects regarding air pollution for 85% of the total amount of respondents.

Based on this analysis, an estimated idea of who target group is, has been made.

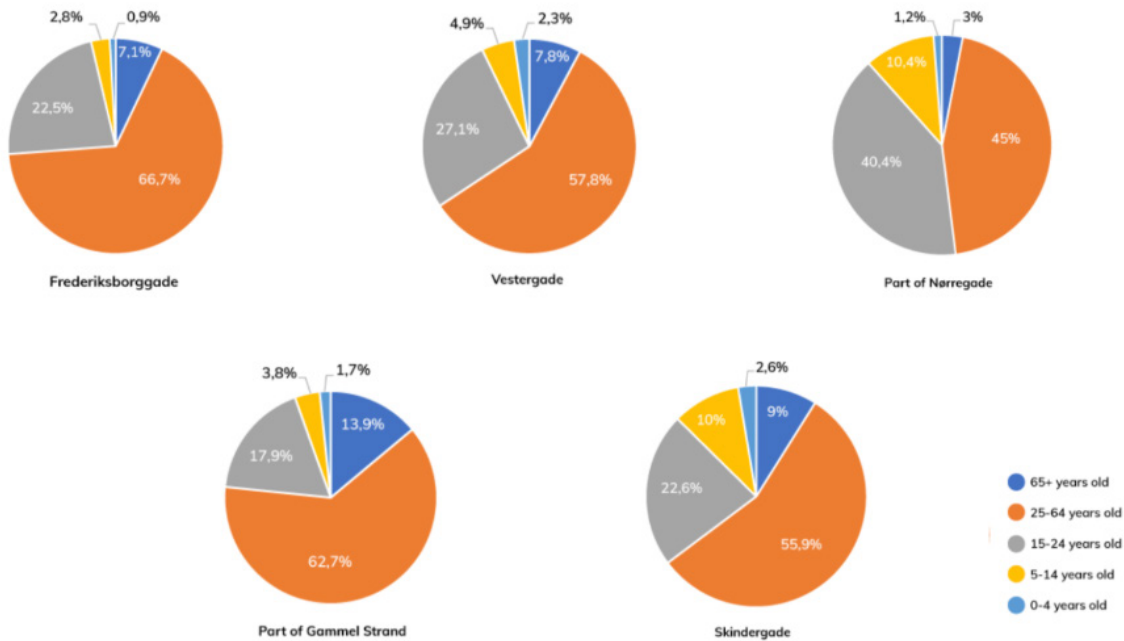


# 6. Gehl data collection

On 5.march the team took part in data exploration in collaboration with Gehl. All Service Systems Design students(2019-2021) were taking part in collecting data. Data was collected by using a special tool - app, provided by Gehl. During observations, observers were divided on different locations throughout Inner City and Amager. In the app each observer had to note down how many people are in the area, what age, and what are they doing. The data exploration gave insights in both Amager and Inner City, of people's behaviors and age groups.

After the data collection, the team chose to focus on data sets from Inner City, as that is the teams' chosen interest area in the 2.semester project. The data could provide meaningful insights and help in the further steps of the project.

Which areas are the most visited by different age groups?



**Figure 17**  
As it is visible in fig 17, people are the most actively visiting the Inner City areas at around 13:40. Between 16 and 17, there is a sudden activity, which might be people getting home from work, similar situation we can see at around 18, which also could be associated with work or other activities. and what are they doing. The data exploration gave insights in both Amager and Inner City, of people's behaviors and age groups.

When people are visiting areas the most?



**Figure 18**

As we can see in the figures, the 2 most visited areas by children age 0-14 are Skindergade(12,6% in total) and Nørregade(11,6%).

However, if we look only at children age 0-4, the most visited areas are Skindergade with 2,6% children age 0-4 from all the visitors, and Vestergade, with 2,3% from all the visitors.



**Figure 19**

In fig 19, is an overview of the most visited streets by children, and whether they were moving or staying stationary. During the data collection, google measured the air quality on the street level in the city of Copenhagen. Here is a visualization on the same map with the pollution level, in order to see an overview of the most polluted areas and children's distribution in the areas.

# 7. Interviewguide (English)

Thank you for your participation!

In the interview, we will ask questions regarding air pollution and your everyday life as a family. Your answers may contribute to improve and find solutions, in regard to air pollution in the Copenhagen area.

Practical information:

In this interview you will see that some questions require longer answers than others. You are welcome to answer the questions when you have time, and not necessarily all at once. It is good if you take your time answering the questions. In this way we will get the most reflecting answers, that we can use for our further work with the project.

Please write your answers in this document and return it to the person you got it from.

Deadline is Monday afternoon the 6th of April.

If you have any questions regarding the interview, do not hesitate to contact us.

Privacy:

We respect your privacy, and if you prefer to be anonymous, let us know. No information or answers given by you will be used outside this project, as it only serves the purpose of gathering data for this project.

## Introduction:

- What is your gender?
- What is your age?
- What is your profession?
- Where do you live in Copenhagen?
- How many children do you have?
- How old are your children?
- Are your childrens' in daycare?
- How is your kid's health and does it affect your daily life (diseases)?
- How does your family look like? (are you e.g. divorced, married, boyfriend/girlfriend, etc.)?

## Day and life:

- Try to describe, in details, a typical day in your life as a family (Mornings, how do you transport your children to daycare and how do you commute to work? How do you use your spare time with your children?)
- Try to describe when spending time outside with your children how that normally goes. (where do you go, do you go to the same place every time, why do you go there, etc.)

## Air pollution:

- What is the first thing you think of when you hear the word "air pollution", and why?
- Children breathe more rapidly than adults and because of this air pollution has a bigger impact on children. What are your thoughts? Did you know it?
- If you were informed about air pollution how would you use it in your everyday life?
- Would you like to learn more about air pollution?

## Wrap up

- Do you have anything else on your mind?

Thank you for taking your time to participate. We really appreciate it.  
Camilla, Adam, Mette, Elizabete og Julie.

# 7. Interview guide (Danish)

Tak for din deltagelse!

I interviewet vil vi stille dig spørgsmål omkring luftforurening og din dagligdag som en familie. Dine svar vil være med til at give os input og idéer til at finde en løsning i relation til luftforurening i København.

Praktisk information:

I interviewet vil du støde på spørgsmål, der lægger op til både lange og korte besvarelser. Du behøver ikke at svare på alle spørgsmål af en omgang, men er velkommen til at benytte betænkningstid indimellem, så vi får dine mest uddybende og reflekterede tanker omkring spørgsmålene.

Skriv gerne dine svar her i dokumentet under spørgsmålet, og send det retur til den samme person du har modtaget det fra.

Deadline for besvarelse er mandag aften d. 6/4.

Hvis du har nogle spørgsmål angående dette interview, er du meget velkommen til at kontakte os.

Privatliv:

Vi respekterer dit privatliv, og derfor er du naturligvis velkommen til at være anonym, i det omfang at dit navn ikke vil figurere i den endelige rapport for projektet. Der er ingen af de informationer eller svar du giver, som vil blive brugt udenfor dette projekt, da formålet udelukkende er at samle data hertil.

## SPØRGSMÅL:

### Introduktion:

- Hvad er dit køn?
- Hvad er din alder?
- Hvad er din stilling?
- Hvor i København er du bosat?
- Hvor mange børn har du?
- Hvor gamle er dine børn?
- Går dine børn i institution?
- Hvordan er din(e) børns helbred? (Er der nogle sygdomme?)
- Hvordan ser din familie ud? (Skilt, gift, kæreste mm.)

### En dag i jeres liv:

- Beskriv i detaljer en typisk dag i jeres liv som en familie (hvordan er jeres morgener, hvordan transportere i jer til arbejde/institutioner og hvordan bruger i jeres fritid?)
- Beskriv hvordan I som familie normalt bruger jeres tid udenfor (hvor tager I hen? Tager I altid samme sted hen? Hvorfor?)

### Luftforurening:

- Hvad er det første du tænker på når du hører ordet "luftforurening" og hvorfor?
- Børn trækker vejret hurtigere end voksne og luftforurening har derfor også en større effekt på børn. Hvad tænker du om det? Vidste du det?
- Hvis du blev informeret om luftforurening, hvordan ville du så bruge det i din dagligdag?
- Kunne du tænke dig at vide mere om luftforurening?

### Afslutning:

- Har du noget andet du vil tilføje? (Tanker, spørgsmål, el. lignende)

Tusind tak for din tid. Det betyder rigtig meget!

# 8. Interview answers

## Participant 1

- Hvad er dit køn?

kvinde

- Hvad er din alder?

40 år

- Hvad er din stilling?

Manager

- Hvor i København er du bosat?

Frederiksberg

- Hvor mange børn har du?

3

- Hvor gamle er dine børn?

10,6 & 2 år

- Går dine børn i institution?

1 i skole, 1 i børnehave og 1 i vuggestue

- Hvordan er din(e) børns helbred?

(Er der nogle sygdomme?)

De har det fint. Den ældste astma ( ved sport) den anden tror vi har nogen form for astma, men der er ikke bekræftet

- Hvordan ser din familie ud?

Gift i 11 år.

- **Beskriv i detaljer en typisk dag i jeres liv som en familie (hvordan er jeres morgener, hvordan transportere i jer til arbejde/institutioner og hvordan bruger i jeres fritid?)**

Vi går eller cykler til skole og børnehave. Vi tager os de mindre gader i svømmehalskvarteret og krydser Nylandsvej. Derfra cykler moren til arbejde i indre by. Faren tager evt. bil til Nordhavnen eller arbejder hjemme.

- **Beskriv hvordan I som familie normalt bruger jeres tid udenfor (hvor tager I hen? Tager I altid samme sted hen? Hvorfor?)**

Vi kan godt lide at løbe i Frb. Have og Søndermarken. Hvis vi skal en tur til indre by eller Frb. tager vi som udgangspunkt cykel, bus eller metro. Hurtigere og billigere. I weekenden tager vi gerne en tur i bilen til en skov eller strand cirka maks 40-50 km væk fra byen.

- **Hvad er det første du tænker på når du hører ordet "luftforurening" og hvorfor?**

Tænker på biler og trafik og at luften er fyldt med snavsede partikler.

- **Børn trækker vejret hurtigere end voksne og luftforurening har derfor også en større effekt på børn. Hvad tænker du om det? Vidste du det?**

Jeg var ikke bevidst om at luftforurening er endnu mere negativ indvirkning på børn, men det er klart at det er noget jeg bliver bekymret over grundet mine børns astma.

- **Hvis du blev informeret om luftforurening, hvordan ville du så bruge det i din dagligdag?**

Så ville jeg blive endnu mere bevidst omkring problematikken og i endnu mere større udstrækning bruge min cykel eller Metro

- **Kunne du tænke dig at vide mere om luftforurening?**

Ja det kunne være interessant at vide hvor forurenede KBH er.

- **Har du noget andet du vil tilføje? (Tanker, spørgsmål, el. lignende)**

Tusind tak for din tid. Det betyder rigtig meget!

Camilla, Adam, Mette, Elizabete og Julie

## Participant 2

### What is your gender?

Female

### What is your age?

28, soon turning 29

### What is your profession?

Account manager

### Where do you live in Copenhagen?

Amager

### How many kids do you have?

1

### How old are your kids?

14 months

### Are your kids in daycare?

Was supposed to join this month, but during this corona lockdown, it is postponed.

### How is your kid's health and does it affect your daily life (diseases)?

Healthy.

### How does your family look like? (are you e.g. divorced, married, boyfriend/girlfriend, etc.)?

Married.

## Day and life

Try to describe, in details, a typical day in your life as a family (Mornings, how do you transport your kids to daycare and how do you commute to work? How do you use your spare time with your kids?)

We commute by car to get to work, and in the spare time we go for walks with the kid or drive out for example to Dyrehaven. For the moment we are doing a lot of walking, and when there isn't a lockdown we go to play areas (also indoor - in Amager) or go to Østerbro, where my parents live - so I also go there quite a lot. We're also going to the town a few times, just shopping. When I was on maternity leave, we would just go for walks, but now we are using car again when I'm working.

### Try to describe when spending time outside with your kids how that normally goes. (where do you go, do you go to the same place every time, why do you go there, etc.):

It a lot depends on the weather. When we go to Inner City, for shopping it is mainly in areas where there are shopping centres, like Magasin, Illum, Fields. We also go to waterfronts, and Amager Strand. Sometimes down to Amagerbrøgade, but it is quite noisy, so trying to avoid it. We mainly go to the small streets in Amager and in Østerbro, we go on the big street by the fairies, but we need to go from there, to the inner Østerbro, because my parents live there.

### Air pollution:What is the first thing you think of when you hear the word "air pollution", and why?

Cars, the exhaust from cars. I am trying myself to avoid busy streets, also because of both. I and my husband have asthma, and that's mostly why. Even though my mom works for an

environmental agency, I don't know too much about air pollution.

**Kids breathe more rapidly than adults and because of this air pollution has a bigger impact on kids. What are your thoughts? Did you know it?**

I had no idea. But it is worrying because of course, it could cause more harm to them in the future.

**If you were informed about air pollution how would you use it in your everyday life?**

I don't think you can make the busy roads less busy necessarily, but I would myself avoid certain streets when I walk with the stroller. I already try to do it, but obviously I don't know if it is a polluted street or not.

**Would you like to learn more about air pollution?**

Yeah, that could be interesting.

**Do you have anything else on your mind?**

No, I really never thought about air pollution. I just always thought going out is the best, and then of course avoiding streets with a lot of cars.

Thank you for taking the time to participate. We really appreciate it!  
Camilla, Adam, Mette, Elizabete og Julie.

### Participant 3

**- Hvad er dit køn?**

Kvinde

**- Hvad er din alder?**

43 år

**- Hvad er din stilling?**

Jordemoder

**- Hvor i København er du bosat?**

Valby

**- Hvor mange børn har du?**

2

**- Hvor gamle er dine børn?**

Pige på 9 og dreng på 13 år

**- Går dine børn i institution**

Begge går i skole. Den yngste går også på fritidshjem.

**- Hvordan er din(e) børns helbred? (Er der nogle sygdomme?)**

Ingen sygdomme

**- Hvordan ser din familie ud? (er du for eksempel skilt, gift, kæreste osv.)**

Gift med Kasper, som er uddannet journalist og arbejder semi freelance som tekster/oversætter.

### **En typisk dag i jeres liv som en familie (hvordan er jeres morgener, hvordan transportere i jer til arbejde/institutioner og hvordan bruger i jeres fritid?)**

På hverdage står vi op og vækker børnene kl 6.50. Der er forskelligt, om det er min mand, eller mig, der afleverer børnene i skole, da vi begge har skiftende vagter. Vi har ikke bil, så vi cykler altid i skole. Jeg arbejder i Roskilde og cykler til Valby St og tager toget til Roskilde. Min mand arbejder nogle dage hjemme og andre dage er han på kontoret. Han cykler også altid på arbejde. Om eftermiddagen cykler vores store søn selv hjem fra skole. Han spiller håndbold to gange om ugen. De andre dage sidder han mest ved computeren og spiller, når han kommer hjem fra skole. Vi henter vores datter på fritidshjem ml 15-16.30. Har hun veninder med hjem, leger de meget forskelligt både inde og ude. Har hun ikke en legeaftale, laver hun ofte noget kreativt, når hun kommer hjem og får ofte lov at se/spille iPad kl. 17 indtil spisetid ml. 18-19. Én dag om ugen går hun til svømning.

Jeg har ingen egentlige fritidsaktiviteter, da jeg er på fuld tid og arbejder i 12 timers vagter fra enten kl. 7-19 eller 19-7 samt vagter hver anden weekend. Min mand spiller volleyball én gang om ugen og med kampe i weekenden. Vores datter puttes ca. kl 20.30 og vores søn ca. kl. 21.30 på hverdage. I weekenderne er det ca 22.00-22.30. Efter puttetid arbejder min mand nogle gange, hvis han har en deadline. Ellers går resten af aftenen ofte med oprydning i køkkenet, madpakker, vasketøj, ser en serie eller to på HBO eller hører lidt lydbog før sengetid.

### **Beskriv hvordan I som familie normalt bruger jeres tid udenfor (hvor tager I hen? Tager I altid samme sted hen? Hvorfor?)**

I hverdagen får vi sjældent tid til ture, men cykler som sagt til alt. Da jeg arbejder hver anden weekend, har vi ofte kun "planer" i min friweekend. Vi bor i hus med en lille have, men har børn, der ikke rigtig gider udelivet i haven i længere tid af gangen, så når vi skal have "frisk luft", tager vi ofte på cykeltur i omegnen af KBH. Vi har flere gange cyklet ud til "Vestegnens. Glemte Kæmper" og slæbt både venner og familie med på cykelture dertil. Ellers er det ture til Amager Fælled, Tippen, Valby Parken eller rundt om Damhussøen, når det kun skal være en kort tur.

### **- Hvad er det første du tænker på når du hører ordet "luftforurening" og hvorfor?**

Jeg tænker på bilos og at det er værst i byerne. Har engang hørt, at en storryger, der bor på landet har renerer lunger end en ikke-ryger, der bor i centrum af KBH. Den påstand, tænker jeg tit på, når jeg tænker på luftforurening, men ved ikke om det er sandt.

### **Børn trækker vejret hurtigere end voksne og luftforurening har derfor også en større effekt på børn. Hvad tænker du om det? Vidste du det?**

Har slet ikke tænkt over, at den øget resp.frekvens øger effekten på børn, men det giver meget god mening.

### **Hvis du blev informeret om luftforurening, hvordan ville du så bruge det i din dagligdag?**

Jeg tror ikke det vil have den store effekt i hverdagen, men det kunne godt være interessant ift de cykelture vi tager på.

### **Kunne du tænke dig at vide mere om luftforurening?**

Ja, men jeg tror desværre kun at jeg vil agere ud fra det i et begrænset omfang. Afslutning

### **Har du noget andet du vil tilføje? (Tanker, spørgsmål, el. lignende)**

Nej





# 10. Workshop (pre ideation and ideation)

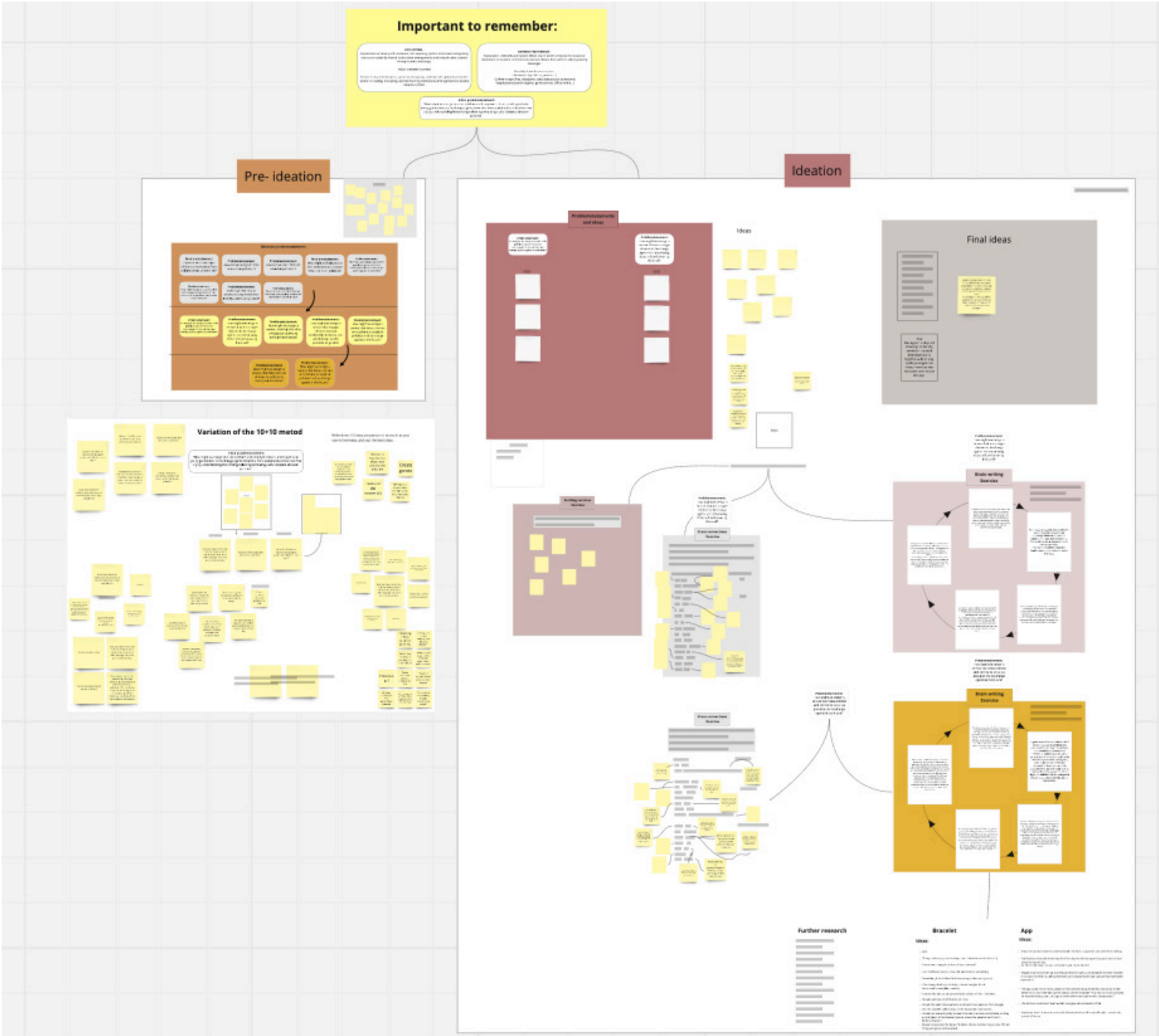


Figure 23

# Pre- ideation

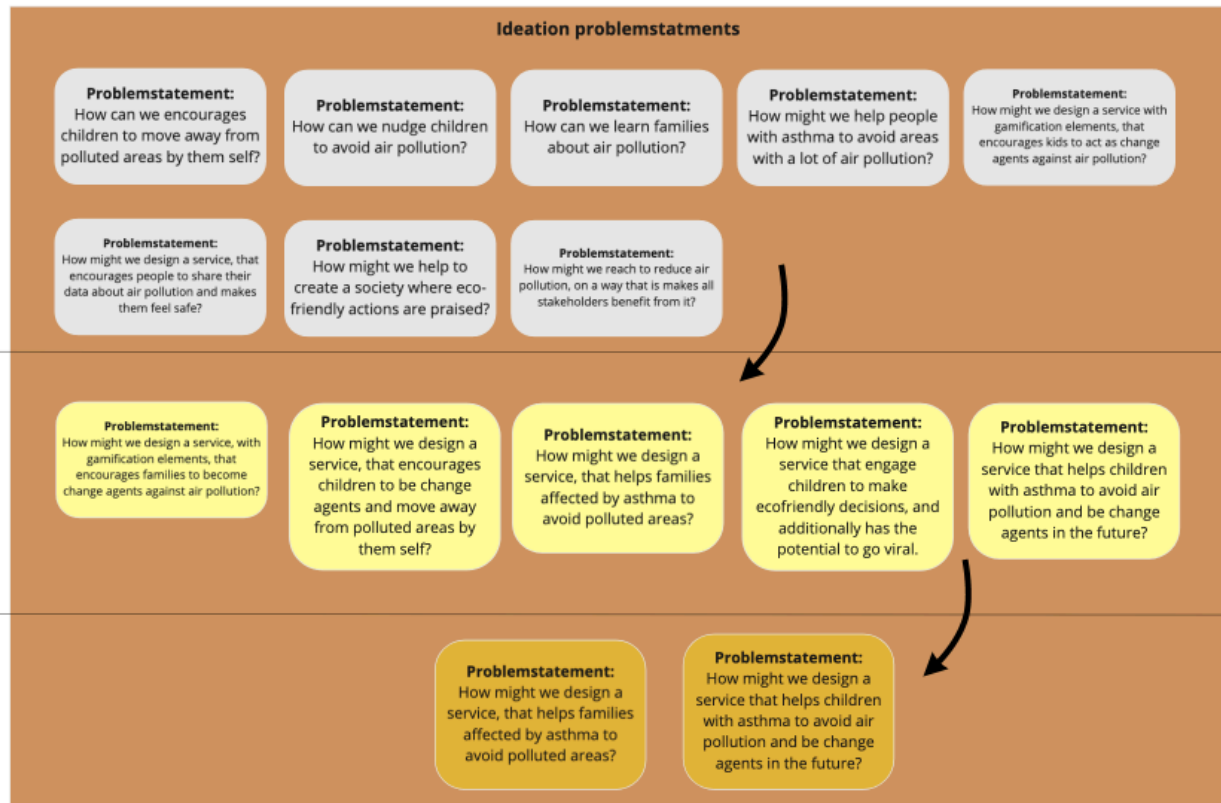
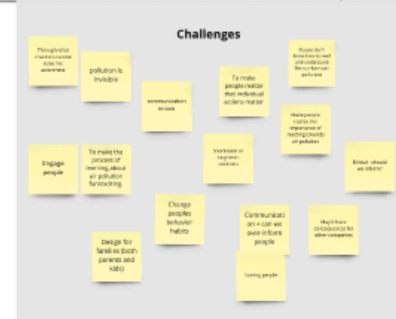


Figure 24

# Variation of the 10+10 metod

Write down 10 ideas per person or as much as you can in 5 minutes, pick out the best ideas.

**Initial problemstatement:**  
 "How might we design services to inform and empower citizens, and in particular young generations, to be change agents towards a more sustainable and carbon-free city by understanding/interpreting/collecting/producing useful datasets about air pollution?"

- Game for children, to become change agent against air pollution - in an app ??
- Glasses , like VR glasses that show air pollution, when you put them on
- Robots on the streets that measure air pollution...
- Competition to bike in the city.. the more you bike, the higher chance to get a price - use some device to measure how much bike
- Create a mascot- or something like that, that stands up for fighting air pollution
- Super hero theme for children, be the Air-man, or something like that to fight air pollution



- Do something similar on the streets as people are doing now(placing teddies in the windows to make kids happy and excited for going for a walk).
- Sensors in watches that shows how polluted the areas are
- Create games
- Tasks on the streets (#)
- GPS sensors that directs the family the drive more eco friendly

Tamagotchi	Bike to school	Campaigns e.g. with super heroes e.g. artists
Game about how to understand air pollution numbers	Tik Tok	Look at their super heroes and be inspired

- Choice of Julie:** Plan your day-in-inner city. So its not obvious that is about air pollution but it will encourage kids to be part of the planning.
- Choice of Adam:** Robots on the streets that measure air pollution...
- Choice of Mette:** Game for children, to become change agent against air pollution - in an app ??

- An app where there is a planning tool, where all different solutions are shown, so that you can drag and drop them to your 'day' and it will show how you can do it best.
- What activities are happening in inner city?
- Where is there less air pollution in inner city at the moment?
- A guide to daycares located in inner city/ how to use inner city in the best way.
- An app or website
- Plan your day-in-inner city. So its not obvious that is about air pollution but it will encourage kids to be part of the planning.
- Guiding elements on the streets to avoid air pollution.
- A brochure?

- Super hero theme for children, be the Air-man, or something like that to fight air pollution
- Tamagotchi
- Choice of Camilla
- An app where kids can write down their everyday activities against air pollution, meet up with everyday talk in the house hold or when they are together with their family.
- They will be the ones who know most and can teach their parent about air pollution. They will show the way
- Activities when having a birthday that are air pollution natural

- Choice of Elizabete:**
  - Game within the universe - maybe like with vr glasses(think about guitar hero) where they do task
  - Tik tok dance against air pollution, and needs to be a good catchy song !!
  - Create a universe about air pollution for kids
  - Superhero goes to kindergartens and talks about air pollution
  - It is a superhero universe, and we also create super hero clothes for children , with against air pollution theme
  - The main character a dog, who can smell air pollution(think of police dog) but like a cartoon-like
  - create it like a story-telling thing, about a perfect universe, where there's always clean air and everyone is happy

- Informing things outside in parks etc.
- Use daycares as the informer and learning "platform".
- Something for people working out in the nature?
- Nudge people to go in other directions away from air polluted areas.
- Create
- The green

Figure 25



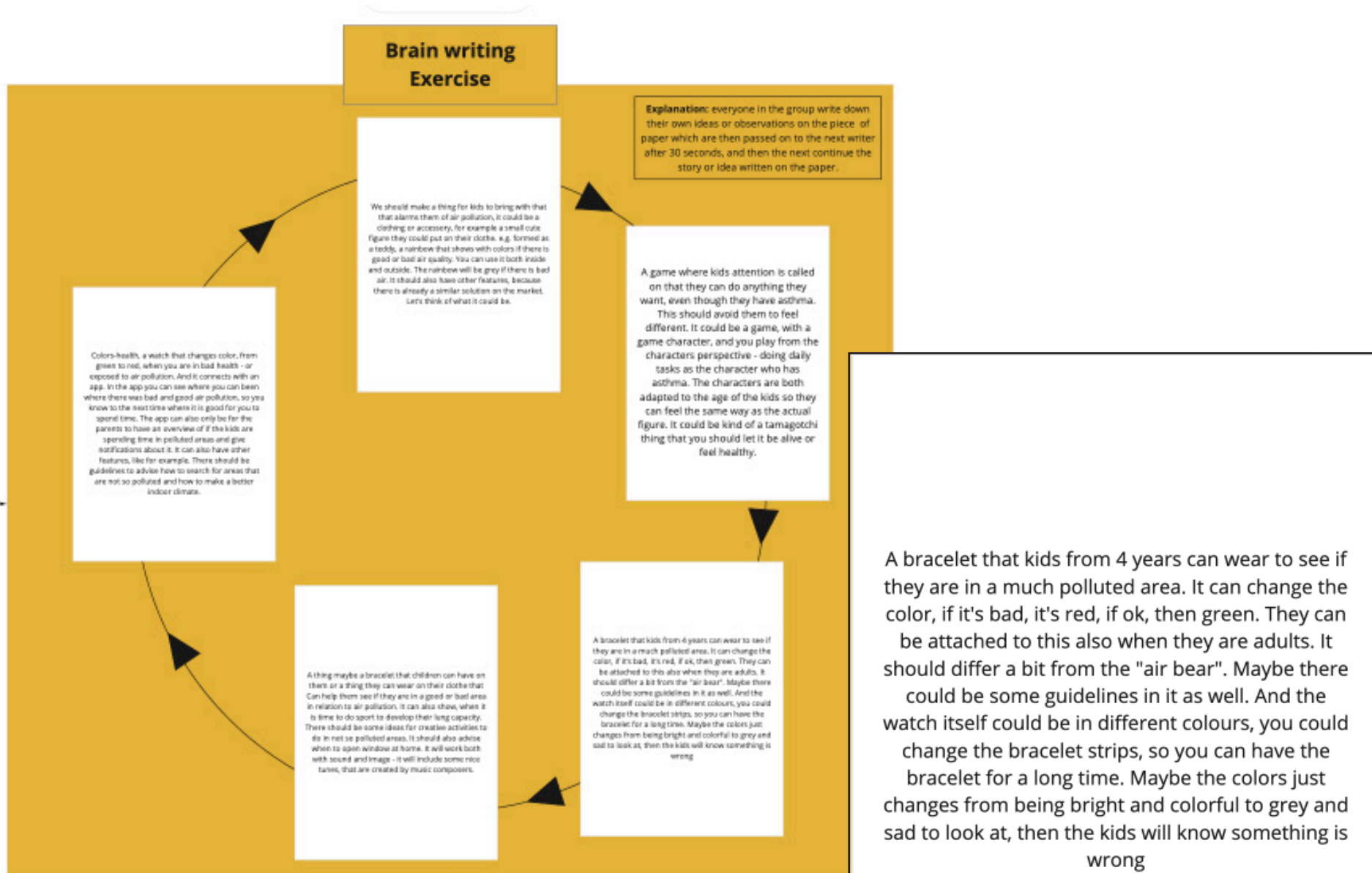


Figure 27

# 11. Pretotyping questions

## QUESTIONS:

What does it mean to have asthma for your child/other family members with asthma? Is the asthma really bad, or is it okay? (To find out if there is a difference in how people are affected and if they would use the concept).

Could you see your family use a product like this? (Do not think about price etc.)  
if not, why?

How old do you think a child should be, to understand the use of this wristband?

What age group do you think would find this product useful/relevant.

What do you think about, if this product should be able to track where the child is in relation to show where there is good and bad air quality?

Do you think that you and your family can learn something about air quality by using this product?

Is there anything that you think would be relevant to implement in the concept? (features)

Is there something that you would recommend us to have in mind, when we develop this product?

Is there something that is really interesting to your kid right now? (hobbies, idols etc.).

# 12. Pretotyping findings

## PARTICIPANT 1

Mom to a daughter (3,5 år) with asthma and a husband with asthma.

**Interviewer:** Hey

**Participant:** Haløj

**Interviewer:** Du fik set videoen ik?

**Participant:** Jo det gjorde jeg.

**Interviewer:** Okay, så vi har lidt spørgsmål da vi er usikre på hvordan det endelige koncept skal være. Så vi har lidt spørgsmål, da der stadig er mange ubekendte for os.

Første spørgsmål er: Hvad betyder det for jer som familie, at i har astma i familien?

**Participant:** Det betyder for os ihvertfald at når vi skal ud i byen, skal vi overveje hvor lang tid vi er der og at vi altid har medicin med. Det skal vi have ligegyldigt hvor vi tager hen. Så der er nogle overvejelser. Blandt andet hvis vi skal til svigermor og svigerfar, de har dyr og gulvtæppe, så skal vi overveje det. Så kan man også tage sådan noget, antihistamin, det kan dæmpe det for mange patienter, fx også hvis man har lidt pollen allergi. Så det giver vi julia (deres mindste datter) og Kris (hendes mand) tager det også inden de tager afsted så det ikke bliver for slemt.

**Interviewer:** Hvor slemt er det deres astma?

**Participant:** Vi har ikke slem astma i familien, men det jo nok til at vi overvejer hvor vi tager hen og hvad vi skal.

**Interviewer:** Da du så den her video, kan du se dig selv eller jeres familie bruge og få nytte af det her produkt?

**Participant:** Ja og nej, jeg tror mere det er fordi Julia er så lille og hun er kun 3,5 år jo, så jeg tænker ikke helt hun er sådan helt stor nok til det. På sigt, jo sådan så hun har en eller anden fornemmelse af hvornår hun vil få det skidt - og kan jeg være nogle andre steder sådan så jeg ikke bliver skidt. Det kan jeg godt se.

**Interviewer:** Hvor gammel tror du at børn skal være for at kunne bruge og forstå sådan et her armbånd?

**Participant:** Hvis vi begynder at snakke med Julia om det nu så vil hun jo hurtigere få en forståelse for det. Men hvis de ligesom også skal kunne tage "action" på hvad det betyder, så tænker jeg sådan lige før start skolealder. Det er mit bedste bud.

**Interviewer:** Hvordan har du det med, hvis det her produkt skulle kunne trace hvor dit barn var i forhold til om der var god eller dårlig luftkvalitet?



**Participant:** Det kommer an på om de tracker det for min skyld eller for app'ens skyld eller udbyder. For hvis det var for mig og hvor mit barn have været, så ville jeg have det rigtig fint med det. Så ville jeg jo også selv have en ide om hvor er de gode legepladser at gå hen, hvor der er mindst forurening i luften. Men hvis det havde været for appens skyld, så kunne det godt være det betød at jeg ikke var interesseret i at bruge armbåndet, for jeg synes ikke at andre har behov for at vide hvor mit barn er henne - ud over mig selv.

**Interviewer:** Hvad var det jeg tænkte på. Du har det okay med at du kan se hvor de har været og du tænker heller ikke at når de bliver ældre, at børnene fx. ville have et problem med hvor de var henne?

**Participant:** Nej, for jeg tænker at så er vi jo ude i start teenage år, måske, og så må man jo bare have en snak om hvorfor man har det. Og på det tidspunkt vil man jo gerne stadig have en ide om hvor de er henne. Der er hun jo stadig for lille til bare at tulle rundt.

**Interviewer:** Tror du at du og din familie kunne lære noget omkring luftforurening ved at bruge det her produkt?

**Participant:** Ja det tror jeg da egentlig helt sikkert. Der ville jo så være nogle steder man aktivt ville kunne vælge fra, og nogle steder man aktivt ville kunne tilvælge, som man måske normalt ikke ville gøre fordi man er jo så vanedyr, så man er jo vant til at komme nogle steder og nogle forskellige legepladser for vores vedkommende. Men hvis man finder ud af at der er nogle hvor luftkvaliteten er bedre så ville vi jo vælge det i stedet for.

**Interviewer:** Men også i forhold til hvis man nu kobede det her op på noget læring. Ville man kunne koble det at de have været nogle steder hvor der havde været dårligt luft op på noget lærings materiale? Ville de kunne få noget ud af det eller ville det udelukkende være at i som familie lærte hvor man ikke skulle gå hen?

**Participant:** Men jeg tror børnen, de er også hurtige til at afkode hvad er det der det der armbånd siger, så jeg kunne sagtens forestille mig at der ikke skulle meget til og så ville de gå derhen hvor de vidste at det var bedst. Det tror jeg ikke der skal så meget til ihvertfald. Det var først når de blev lidt ældre, så ville man jo gå hen der hvor man egentlig bare gerne vil hen, eller der hvor venner skal hen. Men hvis det er mindre børn så er jeg slet ikke i tvivl om, at så ville de vælge de gode steder

**Interviewer:** Er der noget du tænker der kunne være relevant at implementere i konceptet? Noget der mangler eller det kunne være en fed ting der lige også var der?

**Participant:** Om det skal kunne noget mere?

**Interviewer:** Ja noget hvor du tænker at nu når i alligevel tracker hvor man går hen, så kunne det være smart man kunne se det her eller at det blev koblet op på noget læringsmateriale eller at der var noget spil, altså at der var nogle andre ting man kunne bruge nu når man alligevel havde det her armbånd med de her informationer?

**Participant:** Det ved jeg ikke. Der er jo mange børn de kan jo godt lide konkurrence eller at optjene nogle point. Så kunne man jo som forældre, hvis man nu havde et barn der ikke ønskede at gå, at man kunne optjene nogle stjerner hvis man havde været god til at søge de gode steder hen, så kunne man bruge det som en eller anden, det jo fy ord at sige belønning, ting hvor man nu har gjort det godt, og du har passet på dig selv, så kunne man måske få en eller anden ting derhjemme - det kunne man da godt gøre.

**Interviewer:** Er der noget du tænker at vi skal huske når vi udvikler det her produkt? Du fortalte fx det der med at man ikke kan have armbånd på i børnehaver. Er der nogle andre ting hvor du tænker at det skal vi også bare lige huske at tænke over i forhold til det her?

**Participant:** Jo mere simpelt udseendet ser ud, så tror jeg det ville være mere attraktivt speltmødrene også at købe, og måske også hvis det er lavet af øko materiale. Hvis det passer til det der hummel tøj man har købt. Men det ved man da at det betyder noget at det ikke er i sådan en pangfarve, der skriger imod himmelen. Men også at man kan skjule at man har et barn der har behov for nogle ting. Det kunne jeg godt forestille mig betød noget.

**Interviewer:** Så designet er måske mere til møderne end det er til for at barnet synes det er fedt at have på?

**Participant:** Ja det tror jeg. Men man kan jo gå begge veje. Enten skal det nok tiltale møderne eller familier ved at det ser meget simpelt ud og man ikke føler sig udstillet eller så skal det tiltale børnene ved fx at der er Anders And på – skulle jeg lige til at sige, så det er fedt at have på. Det ved jeg ikke helt, hvad det var der ville være smartest.

**Interviewer:** Okay. Det er også meget i forhold til børnene og designet: er der noget de går meget op i lige nu og noget der virkelig interesserer dem?

**Participant:** Ja men altså Elsa, Gurli gris eller hvad er der mere, Paw patrol. Jeg ved ikke, det er jo alt det der hitter. Glimmer, lyserød, lilla – hvis man er en pige. Jeg ved ikke lige hvad drenge interessere sig super meget for i den alder. Johannes (deres mindste dreng) kan godt lide Elsa stadigvæk.

**Interviewer:** Jeg har faktisk ikke flere spørgsmål, jeg jeg kunne godt tænke mig at komme tilbage til: hvis i skulle købe det, hvem ville du så allerhelst have at det var designet til? Til børnene eller designet til at du, som du fx også snakkede om at man ikke flager med at ens barn har et behov.

**Participant:** Hvordan det skulle se ud for mit vedkommende? Der er måske også det element i det at det måske bare skulle være simpelt for at få børnene til at forstå at det ikke er legetøj. Deres astma spray er jo heller ikke fyldt med alt muligt på. Jeg kunne godt forestille mig at jeg ville foretrække at det bare var helt clean, så de forstod at det ikke var noget man skulle lege med, det var bare noget man havde på som hjælp. Julia ville nok synes det var bedst.

**Interviewer:** Tusind tak.

## **PARTICIPANT 2**

Mom to a son (9) with asthma when doing sport.

**Interviewer:** Godt, så nu har du set filmen. Gav det mening?

**Participant:** Ja, absolut.

**Interviewer:** Okay, det var godt. Nu vil jeg stille dig nogle spørgsmål i forhold til konceptet og videoen, for at få feedback til udvikling af konceptet. Så det første spørgsmål er: Hvad betyder det for jeres familie at have astma? Du har en søn som har astma i forbindelse med sport, ikke?

**Participant:** Ja, han har konstateret astma, men de (lægerne) tror det er børneastma indtil videre og at det godt kan forsvinde med tiden.

**Interviewer:** Ja okay, så han har astmatisk bronkitis? Er det slemt, eller?

**Participant:** Nej, det er heldigvis blevet bedre med årene. Øhhh, vi fik det nok konstateret da han var 6-7 år og han fylder snart 10 år.

**Interviewer:** Er der nogle af dine to andre børn der har det?

**Participant:** Nej, ikke konstateret.

**Interviewer:** Okay, nu når du har set videoen, altså kunne du se jer som familie bruge et produkt som det her?

**Participant:** Mmh, ja. Altså jeg tænker faktisk selv at man måske ville synes det var godt og vide om "gud, går jeg egentlig i sådan et område nu?" det tænker jeg faktisk selv over når jeg er ude og løbe rundt om søerne, for der har jeg hørt at der skulle være meget air pollution. Kunne det egentlig også påvirke ens evne til at være bedre til at løbe, hvis der nu ikke var så meget (læs: air pollution). Så både til en selv faktisk og selvfølgelig også hvis man har nogen, som kunne tage mere skade af det.

**Interviewer:** Ja okay. Øhm, så det vil sige, at du godt kunne finde på at købe det til dine børn hvis det var? Så du også kunne forebygge de her to andre, hvis de skulle være så uheldige at udvikle astma.

**Participant:** Ja, fordi de er jo i risikoen helt klart, så ja absolut.

**Interviewer:** Okay, øhm så hvor gammel tror du at et barn skal være for at kunne forstå hvordan det her armbånd virker?

**Participant:** Uh, det er jo rimelig simpelt. Altså, det lyser når det er godt og det lyser ikke når....?

**Interviewer:** Ja, altså du skal forestille dig at det bliver helt gråt og kedeligt at se på, hvis det er dårligt.

**Participant:** Arh, ja det tror jeg, det burde de da kunne øhh når de starter i skolen der ved 6 års alderen.

**Interviewer:** Okay ja.

**Participant:** Men om de så ved, eller har evnen eller tør hvis de går rundt med nogle venner at agere på det, det er jo så noget andet. Men jeg tror nok de kan forstå at hvis den er grå er det dårligt og hvis den lyser er det godt.

**Interviewer:** Okay, så hvis det skulle miste farven i et område, hvor der faktisk ikke var så god luftkvalitet, så ville du ikke være sikker på at de faktisk ville reagere på det?

**Participant:** Ja, eller tør og sige og være den nederen type at sige "her kan jeg ikke være" eller.

**Interviewer:** Okay så, det er jo lidt det samme, men hvilken aldersgruppe tænker du det her produkt ville være relevant for eller brugbart for?

**Participant:** Hmm, altså hvis det er, som sagt ville det være godt til de yngre børn, hvor man som bekymret forældre kan holde øje med de områder de bevæger sig rundt i, hvis de har alvorligt astma. Øhh, men som sagt, jeg kunne også finde på at bruge det selv.

**Interviewer:** Okay, og hvad tænker du om, altså fordi for at den kan måle det her luftforurening, så skal der jo være en sensor i, så det vil sige at hvis nu man trackede hvor dit barn gik henne. Hvad ville du synes om det?

**Participant:** Der findes jo allerede nu sådan nogle gps armbånd for forældre der vil holde styr på deres børn. Det kunne jeg aldrig finde på at sætte på mit barn. Man skal have frihed, altså under ansvar. Men øh, hvis det nu er at det er til et godt formål, hvor man kan forklare barnet hvorfor de har den, så tror jeg ik umiddelbart at mine børn i hvert fald ville have noget imod at jeg vidste hvor de var henne i den alder de har nu. Måske når de er 14-15.

**Interviewer:** Okay, så hvis det er mindre børn så ved man ofte også hvor de befinder sig? Og så er det lidt nemmere og..?

**Participant:** Ja, ja.

**Interviewer:** Okay, nu skal jeg lige se hvad vi har. Øhmm, men ja, hvad så i forhold til hvis det er. Altså fordi, hvis du har et armbånd på, så er du med til at indsamle data til det her, så er der jo et firma som får dataen. Har du noget i forhold til det?

**Participant:** Nej, øh jeg ved jo generelt mange er sensitive for sådan noget. Jeg er ikke sensitiv, hvis jeg ved at det eventuelt går til noget godt formål og jeg går ud fra man skal skrive under at de ikke skal bruge det til noget mere end udvikling af deres produkt øh, så nej det ville jeg ikke umiddelbart, men der er nok mange der ville have det.

**Interviewer:** For man kan også sige, man kunne også gøre det sådan så man, altså man trackede hvor meget luftforurening børnene havde været i, så du bare fik øhm på telefonen en besked om at dit barn har været udsat for 80% af dagen at være i luftforurenede områder, men så ville du ikke kunne se hvor det var henne. Ville du så føle du manglede den information?

**Participant:** Nej, det.. Ja okay, så kan jeg jo selvfølgelig ikke lære mig hvorhenne han ikke skal gå. Men så ville jeg bare spørge ham hvor henne han havde været i dag. Det skal jo ikke være sådan at det skal styre hele hans liv hvor henne han kan gå, men man kan jo prøve at undgå de mest polluted areas.

**Interviewer:** Ja okay. Tror du at I som familie ville kunne lære noget af at have sådan et armbånd her?

**Participant:** Mmh, ikke bare hvordan man skal bruge det i forhold til sin astma, også altså vi tænker jo meget på miljøet generelt. Måske finde ud af hvor meget de her biler egentlig forurener. Og hvad kan barnet lære af det til fremtiden og måske bruge det til noget godt i hvad ved jeg, sit arbejde eller i sin uddannelse. Så ja, absolut.

**Interviewer:** Ja.

**Participant:** Det giver jo virkelig en øjenåbner, fordi jeg tror ikke man selv har tænkt, eller jeg har ikke. Jeg har jo som sagt bare hørt det der hvor meget forurenede der er rundt om søerne med når man løber der, så det burde jo egentlig være der over det hele (læs: forurening) også her hvor vi sidder nu.

**Interviewer:** Ja, er der noget som du tænker kunne være relevant for os når vi udvikler konceptet. Noget som vi skal huske på, eller have i mente?

**Participant:** Ja, øhh. Nej, altså har i gået helt ind i design og sådan noget, eller hvordan?

**Interviewer:** Jamen det skal jeg nemlig spørge dig om. Altså, er der nogle features som du for eksempel tænker vil være super smart at implementere i sådan et her produkt?

**Participant:** Altså det skal jo være meget sådan. For eksempel har min dreng et armbånd fra et løb ude på Amager Fælled der hedder Tough-est. Det har han haft på i over et år nu (griner).

**Interviewer:** Sådan et som man får når man er på Roskilde og sådan noget?

**Participant:** Ja, altså sådan et gummibånd i grøn. Fordi han bare synes han er så sej med det.

**Interviewer:** Arh, ja okay.

**Participant:** Det har han bare sagt, at det skal han have på i, jeg kan ikke huske hvor lang tid han sagde. Men han skulle have det på i rigtig lang tid (griner). Jeg synes måske ikke at det er så smart, men han synes det er cool og jeg ved ikke om det er fordi han så viser noget til sine venner eller hvad det kan være. Øh, så ja det skal da være pre-teenage venligt til den aldersgruppe jeg i hvert fald tænker på.

**Interviewer:** Ja okay. Og du tænker ikke at det, altså at det er forstyrrende kan man sige, at det er designet til børn. At de så ikke finder det seriøst, eller måske ikke ser det som noget seriøst? Eller hvad tænker du om det?

**Participant:** Nåååå. Nej, jeg tænker at når det skal bruges så meget, så skal det være noget som han selv synes er cool. Det skal ikke se ud som et medicin armbånd eller noget

**Interviewer:** Nej okay. Mmh, ja så der er ikke noget du ville tænke sådan "ej I skal lige huske det her" eller? I forhold til aldersgruppe, design. Var der noget du kunne sådan forestille dig der ville være behjælpeligt i den app der så er relateret til armbåndet?

**Participant:** Altså, den skal jo være virkelig simpel. Altså det skal jo næsten være som du nævnte, hvor der bare står 80%, 12% og den som i selv havde tegnet en bil eller et træ hvis det er rigtig godt. Så den skal jo være virkelig nem og overskuelig, fordi jeg også skal kunne vise barnet det. App'en skal jo egentlig ikke uddanne mig, den skal jo uddanne barnet. For det er jo den person, som trods alt skal leve med det.

**Interviewer:** Og hvad så, hvordan lære dine børn? Altså lære de, nu er der jo mange der lære godt igennem iPads og den slags. Hvordan ser du det?

**Participant:** Jamen det er jo at det skal visualiseres både med tegnes, siges og måske noget musik til. Altså det skal ind med alle de forskellige sanser.

**Interviewer:** Okay. så kommer der lige et der er lidt mere ligesom før. Er der noget som der virkelig interesserer dine børn lige for tiden? Nu kan du jo tage dem alle 3. Er der noget som virkelig hitter, nogle idoler eller?

**Participant:** Altså den yngste på 2, det er bare youtube. Alt kører på youtube. Alle sangene. Dem på 6 og 9 der ville man tro det var forskelligt, men ham på 6 ser op til ham på 9, så han gør alt det samme som storebror. Så er det er jo desværre FortNite og Roblocks og Youtube klip. Ham på 9 ved allerede hvilke youtubere han skal følge.

**Interviewer:** Okay, så det er generelt meget online?

**Participant:** Ja, det er det.

**Interviewer:** Okay.

**Participant:** Ja og TikTok...

**Interviewer:** Er der noget du vil tilføje? Noget du tænker?

**Participant:** Umiddelbart øh. Altså jeg var jo med i de første interviews i lavede og jeg havde faktisk ikke helt forstået hvad det var for noget og hvad det mon ville munde ud i. Jeg havde troet måske at det var noget med de her skilte der er rundt omkring som tæller cykler, at man så ville lave noget af det samme som viste air pollution. Så jeg synes at det her er meget spændende. Øh og et godt redskab måske. Men som sagt, man skal måske ikke bare tænke på barnet og astma, men kan udvikle det mere til hvad ved jeg idrætsudøvere og til ældre i de her coronatider, som måske har nogle sygdomme hvor det ikke er så godt at være i de områder. Ja.

**Interviewer:** Okay. Mange tak

**Participant:** Værsgod.

### **PARTICIPANT 3**

Mom to a daughter (1 year) with asthma and her and her husband had asthma as children.

**Interviewer:** Okay godt, så nu har du set filmen. Gav det mening?

**Participant:** Ja.

**Interviewer:** Så vi har nogle spørgsmål her for ligesom at udvikle konceptet og for at få en ide om hvad der er godt for jer forbrugere. Hvad betyder det for jeres familie at have astma?

**Participant:** Min datter har astmatisk bronkitis og får medicin for det to gange om dagen.

**Interviewer:** Og det ved man så ikke om det udvikler sig til rigtig astma?

**Participant:** Nej, altså det kan man først sige når hun bliver noget større. Men fordi at hun har været ret meget påvirket af det, så forestiller de sig at det er fordi hun har astma.

**Interviewer:** Okay.

**Participant:** Og min mand og jeg har også haft astma som børn begge to.

**Interviewer:** Er det slem astma?

**Participant:** For hendes vedkommende?

**Interviewer:** Ja.

**Participant:** Hvad skal man sige, når det er i udbrud er det slemt. Så har hun rigtig svært ved at slippe af med det igen. Men for eksempel som nu, så er der jo ikke noget. Hvis hun for eksempel er forkølet eller sådan noget, så er det som om at det ligesom tager over og så raller hun rigtig meget på lungerne og hoster, så der kan det godt blive ret slemt.

**Interviewer:** Okay, altså kunne du se jeres familie bruge et produkt som det her?

**Participant:** Både og. Øhmm, jeg synes det er sindssygt smart at der ligesom er noget lærerigt i det for børn, men jeg tror også det kan skabe sådan lidt frygt i dem, at når de så nærmer sig en bil "åh nej nu skal jeg skynde mig væk", eller så bliver jeg syg, eller et eller andet. Men jeg synes til gengæld også det er smart at man sådan kan se, at der er nogle områder som man skal undgå, så både og.

**Interviewer:** Okay, og hvad altså. Hvor gamle tror du at børnene skal være for at forstå armbåndet? Hvornår begynder de at forstå hvordan det fungerer?

**Participant:** Jeg tror de skal være en 6-7 år tror jeg. Ikke yngre. Hvis vi for eksempel satte det på min datter på 3 år, for det første ville det bare være sejt at det lyser og skifter til gråt, og det ville hurtigt blive irriterende for hende at gå med, for det er jo ikke så lang tid af gangen de gider have smykker på når de er så små. Så der tror jeg ikke det ville give mening på samme måde. Det ville nok hurtigt blive væk eller et eller andet. Men et skolebarn tror jeg ville kunne forstå det.

**Interviewer:** Og også kunne reagere på at det mister farven for eksempel? Altså, tror du at de ville flytte sig til et andet område, når armbåndet viser at de er et område med dårlig luftkvalitet? Altså at de vil gøre noget, eller..?

**Participant:** Nej, det ville de nok ikke. Midt i en leg ville de måske ikke engang lægge mærke til om det lyste eller mister farven. Det er måske sådan lidt svært. Der tror jeg faktisk de skal kunne forstå konsekvensen før de handler på det, eller hvad man siger. Så der skal de måske være teenagere først for at kunne forstå, tror jeg.

**Interviewer:** Ja okay. så det er sådan lidt forskelligt i forhold til hvilken aldersgruppe du tænker? De ville godt kunne forstå det i en alder af 6-7 år, men måske ville de først tage action på det når de...

**Participant:** Ja, det tror jeg. Igen fordi, er man lige igang med en leg som er mega god, men finder ud af at her kan man ikke være på grund af for meget forurening, så vil det måske også hurtigt blive til at de andre børn ikke gad at lege, fordi at jamen så kan vi ikke være herovre. Eller "jeg vil ikke lege med dig, fordi du bor inde i byen hvor der er meget forurening", så det tror jeg måske kunne give nogle popularitet problemer. Hvor at hvis man som 12 13 14 årig er lidt nemmere for dem at sige, at vi kan ikke være hos dig, men vi kan være hjemme hos mig i stedet for, eller et eller andet.

**Interviewer:** Okay. Hvad tænker du omkring, hvis man skal kunne se når dit barn har armbåndet på, hvis man så skal kunne se hvor der har været meget luftforurening, så er man jo nødt til at tracke hvor barnet har været. Hvad tænker du om det? er du okay med det, at det bliver tracket hvor hun for eksempel går hen, for at fortælle dig og for at samle data generelt hvor der er meget luftforurening.

**Participant:** Altså det ville jeg synes ville være okay i forhold til når de er små. Jeg tror måske selv at når hun kom i 8.-9. klasse så ville hun sådan synes det var lidt irriterende at være overvåget hele tiden. Øhm, både og igen. Altså jeg synes jo som mor til et barn som skal cykle eller gå hjem selv fra skole, der ville det være fedt og vide hele tiden hvor barnet er henne ik. Men jeg kan også godt se at det senere hen ville blive sådan lidt.

**Interviewer:** Ja, bruger i nogle af de her apps der hedder Find eller sådan noget på iPhone, hvor man kan se..?

**Participant:** Nej, ikke rigtig.

**Interviewer:** Okay, nej. Okay, tror du så at i som familie kan lære noget af hvis i brugte et produkt som det her? Altså i forhold til luftforurening.

**Participant:** Altså det ville man jo nok på en eller anden måde, men jeg tror også at det ville blive en bekymring faktor. At lige så snart man så for eksempel havde været inde i centrum, så kunne man se at luftforureningen formentlig ville stige og så ville man også være mere påpasselig med at tage derind og det kan man selvfølgelig blive nødt til, hvis man har et barn der lider af voldsom astma. Men jeg tror stadigvæk også at det ville skabe en unødigt bekymring på en eller anden måde, at man ville blive så fakta bevidst at man ville gå og tænke for meget over tingene hele tiden.

**Interviewer:** Ja. Okay. er der noget som du tænker ville være relevant at implementere i et koncept som det her? Altså, enten i app'en eller i forhold til nogle features på et armbånd eller..

**Participant:** Altså, hvis det for eksempel skulle henvende sig til børn så skulle designet nok være smart, for at de gider have det på. Hvis det bare er sort for eksempel, så bliver det hurtigt kedeligt ik. Eller hvis der for eksempel var en glad smiley og en sur smiley i stedet for at det lyser, men ellers ved jeg det ikke lige.

**Interviewer:** Nej okay. Det her er lidt det samme egentlig. Er der noget du tænker vi skal have i mente sådan i forhold til hvad børn kan, eller ikke kan. Er der noget vi skal tænke over sådan?

**Participant:** Hmm. Det synes jeg er svært, hvad det sådan lige skulle være. Det ved jeg faktisk ikke lige.

**Interviewer:** Nej, det er bare i orden. Okay, er der noget dine børn finder meget interessant for tiden? Idoler, eller spil eller?

**Participant:** Paw Patrol ser den ældste. Den yngste kan godt lide Bamse og Kylling. og Popsi og Krelle. Men ellers er hun jo så lille, så det er lidt svært at sige.

**Interviewer:** Er der noget som du ellers vil sige?

**Participant:** Held og lykke. Ellers ikke noget lige umiddelbart.

**Interviewer:** Tak.

**Participant:** Selv tak.



## PARTICIPANT 4

Both parents have asthma. The child is 15 months old. Interview with the mom.

**Interviewer:** So I was wondering if you've seen the video?

**Participant:** I did! And it's really cool.

**Interviewer:** Okay, great! I'm just gonna ask you a few questions about the video and more about you. So one of the questions, what does it mean to have asthma to you and your family? Is asthma really bad or is it okay?

**Participant:** Both I and my husband have asthma. Mine is not medicated and is very mild. And my husband's asthma is medicated. He's had it since he was born. And I've had it because of allergies. So we've got 2 different types.

**Interviewer:** Okay, and medicated means using medication?

**Participant:** He's using an inhalator. I'm not because mine is very mild. But I do have one in case of a sudden need.

**Interviewer:** Okay, and could you see your family use a product like this?

**Participant:** Mmm, yeah, maybe when we are going out for walks I could imagine doing it. The thing is - it would be basically sold to everyone - the product?

**Interviewer:** Well we are focusing right now on people with asthma, as we found out it affects people with asthma more. And this product would be more for children, with asthma or if the child should be protected from getting asthma via air pollution. The child would wear it.

**Participant:** Yeah, that's cool - I could see maybe not me so much, but maybe my husband would wear it. I could also imagine my dad wearing it.

**Interviewer:** No, no, I meant - it's more... We're focusing on children - so it would be for the child, but the parent would use the app to monitor how much time the child was spending in a polluted area.

**Participant:** Aah, okay, I see! And how would it... From what age?

**Interviewer:** We are still figuring out the age, for example, how old do you think a child should be to understand the use of this wristband?

**Participant:** Well currently my daughter is what, 15 and a half months, so she's not old at all. So she would not understand it. I think it would first be maybe from 5 years old or something. 5 or 6. But if it is possible to attach it to stroller or something, for that first 3 years. For example - for us to know, then that would be cool. And again use an app to see - where did I walk today - okay, it was this and this bad, perhaps. Or how good it was. Because we do walk a lot with the stroller for the first year. And then for the first 3 years primarily, they still use to the stroller for when we go out

**Interviewer:** Okay, what do you think about, if this product should be able to track where the child is in relation to show where there is good and bad air quality?

**Participant:** Yeah, I think so. And then at least I would know if... let's say, both I and my husband has asthma, right, so she is in a risk zone of getting it. So maybe if we keep her from those areas right now, we might be lucky that she might not get it. With not exposing her to it. So in that sense yes. We would definitely use it I think.

**Interviewer:** And do you think you would learn more about air quality by using this product?

**Participant:** Yeah, definitely.

**Interviewer:** Is there anything you think would be relevant to implement in the concept, like some features?

**Participant:** So I think the light stuff works fine, for maybe when the kid is a little bit older, but if it is something that could be used for a younger age it should maybe just be like a vibration - maybe on the phone, as the child won't be able to do much about it, because they probably won't understand it either. So I think that's the only thing. To maybe have different settings maybe vibration or if it should have a dual function, basically. But yeah that's the only thing with the bracelet - when the kid understands the need of it. And I'm not sure when they understand it, but I can only imagine that's when they start school - so maybe 5 or 6 years old.

**Interviewer:** Okay, and is there something that you would recommend us to have in mind when we develop this product?

**Participant:** The only thing is - no sounds. Like if it is used from an early age, it doesn't wake up the baby.

**Interviewer:** Okay, I know your kid is very small but is there something that's very interesting to her now?

**Participant:** Well she loves walking around. Like she started walking around 5 months ago or something. So she runs around everywhere, but that's always with us in like park areas. So that's her interest... or like playing with a ball, or like running when she sees a dog. But all kids are very different, right.

**Interviewer:** Okay, so that's actually it. I just wanted to ask you a few questions.

**Participant:** Yeah, it's very cool though. Especially for like us, who do have a risk for her maybe getting it.

**Interviewer:** That's great that you like it. And we will work on it more, to develop it. And we were actually thinking to connect it with doctors, so the doctors would actually recommend it, and you could buy it in a pharmacy.

**Participant:** That would be really cool. And I think that would actually work. At least to maybe prevent asthma. So we would know that... because you know, it is basically in the first year in babies life that they develop these different things, right. So that is also when we have to be most careful with what we expose them to. It's the same with like introducing foods, so they don't get allergy. So I definitely think it should be something that could be recommended or even be sold as one of these baby accessories, that can be then used for the rest of their lives. Because then at least we can be aware of our surroundings in the first year and avoid walking in an area that is exposed to a lot of exhaust and pollution.

**Interviewer:** Great! Thank you very much.

**Participant:** You're welcome!

**Interviewer:** And you can text me if something more comes on your mind.

**Participant:** Yeah, will do!

**Interviewer:** Have a nice rest of the week!

**Participant:** Same to you! See you!

**Interviewer:** Bye!

# 13. Experts findings

## Questions about the concept – stud. med

### Do you think it would be an interesting product?

Yes, it could inspire young people how to avoid areas that might worsen their condition when/if they are diagnosed with a respiratory disease. It could also help “normal” healthy people to become aware of these polluted areas.

### Can you imagine recommending a product like this?

Yes, I could, but I think I would only recommend it for a shorter period at a time, depending of the severity of the respiratory disease, as I think it would be easy to become addicted to it.

In our modern day, if you live in a big city, you can't totally avoid polluted air, so you should be careful that the bracelet doesn't “take over” and regulate your behavior in a way that is harmful and makes it difficult to act in normal daily actions in other places in your life. It could have a backside effect and promote unhealthy behavior in different parts of your life, like for instance working less out in the city or staying away from social gatherings if you can't avoid pollution and so forth.

It would be a good way to regulate “unsafe” behavior, that could enhance your symptoms, when your disease is at its worst though.

### Are there some regulations of what you can recommend or not?

Perhaps there could be different levels of pollutions, that make the bracelet go dark. In cities the pollution will automatically be higher than in the countryside. So, different sensitives in the bracelet might be an idea.

There could also be some kind of “time-management”, where for instance you are “allowed” to be in a polluted area for 3 hours in a day or something, and then the bracelet will stop glowing when that time is nearly done. But still, this should be done with caution.

It could also be incorporated in an app on you smart-watch or phone, that you can look at during the day, like for instance the “Health-app” on iPhones. In this way it would be less visible during the day, but still deliver helpful information.

### Does the product make sense in relation to the already existing services?

I'm not aware of a similar product. It could be a help, if used correct.

### **How can we communicate it in the right way to avoid children getting scared about receiving information about air pollution?**

Always tell the truth. The child should be able to understand what the purpose of the bracelet is, that it is only a help and nothing more. It should understand that many people every day live in pollution. It is not ideal for anybody, and perhaps this bracelet might help them avoid some of the pollution, but they won't be able to avoid all of it, which is okay for now, even though they have a respiratory disease. They should never start smoking though.

### **Do you think it would be a good idea to implement games that can teach the children about air pollution? or should we keep it simple and "serious"?**

Games are a good way to educate children and make the process of learning serious stuff fun, as long as the message is delivered with the truth in it of course.

## **Questions about the concept – Expert in Pharmacy**

### **What do you know about asthmatics, what do they really need?**

The main consideration for asthmatics is to control the disease ("maintenance"), which means that there are no symptoms during the day or night, physical activity is not restricted, the use of anticonvulsant medication is not required, and lung function is normal. The most important thing to achieve this is the proper use of medicines and inhalers, regular monitoring of respiratory functions and the identification and avoidance of environmental allergens. I think the last point is of great importance, because while asthma medications are effective, the goal is, of course, to use them as little as possible and thus avoid side effects.

### **Is there a scale or other measure by which the doctor can monitor whether the patient's condition has worsened or improved?**

The condition of asthmatics is determined by your doctor based on the following:

- frequency of symptoms and asthma attacks
- occurrence of nocturnal symptoms
- with respiratory function tests (eg mean peak flow (PEF), FEV1, forced vital capacity (FVC))

Based on this, the severity of asthma as well as its control is categorized.

### **Are pharmacists taught about this or, if so, how are they taught whether air pollution affects the development or worsening of asthma?**

So asthma is an atopic disease that manifests itself in the form of episodic asthma attacks.

"Atopy" refers to a predisposition to congenital allergic hypersensitivity to environmental effects.

So, predisposition and repeated allergen exposure is a type I allergic reaction or atopic disease (such as eczema, asthma, allergic rhinitis...). Air pollution is one of the provocative factors that plays a significant role in the frequency of asthma attacks.

### **Do you think this is an interesting product?**

I think the product is interesting and I see potential in it. It reminds me of a bracelet that measures the intensity of UV radiation, and I also find it very practical and useful.

### **What do you think about selling this product in a pharmacy / do you think it is possible to sell this product?**

I think it fits smoothly into pharmacy products, I see no obstacle to being sold in a pharmacy with the right information. And I see it as a great opportunity for patient-care and health education.

## **Questions about the concept – Education in health**

### **How is the communication to kids in relation to health?**

Kids often talk about symptoms (what they feel by themselves), not signals (what it is figured with the help of other people or equipment). They can tell if they feel pain, difficulties in breath, for example. Of course the degree of accuracy and given details of the information depends on their age.

### **Do you think they will learn from this product?**

They can learn how the environment is linked to their state of health and how technology can be useful in these situations, however, the parents or their responsible must explain how it works and why it is important properly.

### **Should it be “serious” or implementing games?**

Either way can work, for younger children gamification may be more effective, due to the fact they usually care about playing the most, one good example is that kids often forget their coats or backpacks because they were playing. The sense of responsibility is not well developed.

### **How can we communicate it in the right way to avoid the children getting scared?**

The communication, in a general sense to, include a great age range, must be clear, explained with details, and with daily life examples, in a sense that even a non-alphabetized person can understand and explain to others. For example: instead of using the name of the CO<sub>2</sub> compound, use dirty or bad air, instead of just saying that high air pollution cause bad breathing, show some easy example like a lightened candle burning a small piece of paper and explain that the dark air that was released can goes to the lung, which we need to make the air goes in

and out, and make the breath really hard because of it, saying that cars and some other machines do the same in the city and we need to be careful and check if the quantity of "bad air" is too high. Also explain that the air is mostly good where there are more trees and plants because they produce good air". Don't use fear or sentences like the following to make the children check the tool, such as: you can lose your lungs if you don't check the air pollution, you can die if you don't take care, or make the kid feel he/she is weak. The use of difficult and technical words must be avoided. The aim is to empower them to be aware of the environment and how it can help minimize the asthmatic crisis.

What is the age-period you think of the kids they could have it?

I would say that the recommended age should be from 5 years old.

## Questions about the concept – Pharmacist

### Do you as a pharmacist think it would be an interesting product?

Her er jeg meget i tvivl om, hvad produktet egentlig skal gøre godt for. Normalt vil en læge udskrive receptpligtigt medicin til behandling af astma og ikke "bare" anbefale medicinsk udstyr som "Air Go".

Jeg er ikke bekendt med, at astmapatienter påvirkes ekstra meget af luftforurening (selvom jeg medgiver, at det giver god mening). Jeg tænker derimod, at et device som registrer pollen ville give mere mening, da mange astmatikere også er allergikere.

Jeg kan have svært ved at se, at børn ret faktisk ville opdage, at de befinder sig i et forurenede område ved brug af armbåndet. Det kræver meget sygdomsforståelse og opmærksomhed på sygdommen, hvilket jeg tror, de færreste børn har – især, hvis de er ude at lege, er sammen med deres venner o.l.

### What do you think about selling it in pharmacies / could you see it be sold in pharmacies?

Hvis sådan et produkt skal sælges på et apotek, kræver det en tydeliggørelse af den sundhedsmæssige gevinst for brugeren.

Jeg tror ikke, at produktet vil gavne børn med astma, men teenagere eller voksne, som kan tage mere ansvar for egen sygdom vil måske have gavn af det, hvis der er belæg for, at astmatikere oplever positiv effekt ved ikke at opholde sig i forurenede områder.

Hvis jeg skulle anbefale et sådant produkt til en gruppe, ville jeg gå efter patienter med nedsat lungefunktion, f.eks. rygere og/eller KOL-patienter. Det er min vurdering, at denne type patienter i særlig grad vil kunne drage fordel af informationen om luftforurening.

# 14. Families in Copenhagen

## Familier i København efter familietype og bydele 1.1.2013, 2012 og 2011.

	Ægtepar/ registre- rede par	Sam- levende/ sambo- ende par	Par i alt	Enlige mænd	Enlige kvinder	Enlige i alt	Ikke hjemme boende børn	I alt		
								2013	2012	2011
<b>1. Indre By</b>										
Uden børn	3261	2549	5810	10385	10589	20974	41	26825	26777	25957
Med børn	2567	1264	3831	274	1382	1656	0	5487	5302	5138
1 barn	1051	766	1817	218	910	1128	0	2945	2872	2773
2 børn	1189	421	1610	52	391	443	0	2053	1955	1908
3+ børn	327	77	404	4	81	85	0	489	475	457
I alt	5828	3813	9641	10659	11971	22630	41	32312	32079	31095
<b>I alt</b>										
Uden børn	28061	27907	55968	113549	109079	222628	512	279108	275400	272507
Med børn	32828	13704	46532	2906	17928	20834	0	67366	65644	63579
1 barn	12892	8349	21241	2303	11129	13432	0	34673	34059	33132
2 børn	14434	4482	18916	502	5089	5591	0	24507	23591	22585
3+ børn	5502	873	6375	101	1710	1811	0	8186	7994	7862
I alt	60889	41611	102500	116455	127007	243462	512	346474	341044	336086

Kilde: Københavns Folkeregister.

# 15. Prototyping testing

## QUESTIONS

What is your first impression of the app?

What do you like about the app?

Is there anything that you don't like?

Do you have anything to be added or improved?

Do you think about if the app had a parent-mode and a kids-mode?

What do you think about the navigation? Was it easy to navigate?

What are your thoughts about the design and layout?

What, if anything, surprised you about the experience?

What, if anything, caused you frustration?

How frequently would you use this product?

[Option 1:] Never

[Option 2:] Very Rarely (once per month)

[Option 3:] Rarely (2-3 times/month)

[Option 4:] Occasionally (2-3 times/week)

[Option 5:] Frequently (1-2 times/day)

[Option 6:] Very Frequently (3+ times/day)

On a scale from 1 to 5 (1=not at all likely, 5=very likely), how likely are you to recommend this product to a friend?



# 16. Prototyping findings

## PARTICIPANT 1

**Interviewer:** Hvad er dit overordnede indtryk af app'en?

**Participant:** Den er simpel og overskuelig og man får et samlet overblik med det samme på forsiden.

**Interviewer:** Hvad kan du godt lide ved app'en?

**Participant:** Igen, at den er overksuelig og simpel, og så er den god informativ. Det er godt med de der bokse med information, både med hvor man har været, men også der hvor der forklares hvad de forskellige ting betyder når man slår det til/fra.

**Interviewer:** Er der noget du ikke kan lide ved app'en?

**Participant:** Fint med det blå i forhold til farverne, men jeg tænker mere nogle grønne farver, hvis jeg skulle sige noget. Den er fin informativ, men jeg synes den skal være mere børnevenlig, med noget visuelt for børnene. Mine børn er også mere vant til apps end jeg er (griner).

**Interviewer:** Har du nogle tilføjelser til forbedringer?

**Participant:** (Er besvaret ovenfor)

**Interviewer:** Hvad tænker du om hvis man kunne skifte fra forældre til børnemode?

**Participant:** Det synes jeg helt sikkert er en god ide.

**Interviewer:** Hvad tænker du om selve navigationen i app'en? Var det nemt at navigere i?

**Participant:** Ja, det synes jeg.

**Interviewer:** Hvad er dine tanker omkring designet og layoutet?

**Participant:** (Dette er besvaret i starten).

**Interviewer:** Var der noget der overraskede dig ved app'en?

**Participant:** Meget positivt med at man kan lærer noget af app'en. Det er super godt. Også rigtig godt at I har den positive tilgang til det, fremfor den negative. Det synes jeg særligt er vigtigt når man skal blive ved med at bruge den. Børn har også brug for at få af vide hvor gode de har været. Man kan jo godt snakke med dem om den dårlige side af det, men det er ikke det der skal være fremhævet.

**Interviewer:** Var der noget der frustrerede dig ved app'en?

**Participant:** Jeg tænker at hvis man slår bracelet lokation fra, hvordan kan jeg så stadig se hvor mit barn har været henne? Derudover forstår jeg ikke helt den med "Air pollution i Inner City" Er det så hvad der er nu? Eller hvor jeg har været?

**Participant:** Hvis du havde produktet, hvor tit tror du så at du ville bruge app'en?  
Sjældent (2-3 gange om måneden)

Interviewer: Kan du forklare lidt mere om det?

**Participant:** Det er ikke noget jeg ville gøre hver eneste dag, for jeg har ikke lyst til at styre mig selv eller børnene så meget. Jeg ville give mit barn armbåndet på hver dag, men for at tage lidt afstand til det, så ville jeg holde øje et par gange om måneden.

## PARTICIPANT 2

**Interviewer:** What is your first impression of the app?

**Participant:** I think it looks quite nice. It's a welcoming page first and foremost, it looks very nice and easy. Do you have to make a log-in or can you connect with Facebook?

**Interviewer:** We created this prototype for the returning user, so for a first-time user, there would be an onboarding screen. And we haven't discussed if you could connect through Facebook, etc. but I think that's definitely something that we would consider and I think it's a good idea!

**Participant:** Cool! It just makes it a lot easier. No, I think it's good! It gives me a clear indication of air pollution, like what it is now and what I have been exposed to - clean air at least. I like that it shows me the clean air and not so much what I've been exposed to bad air. I think it's better to show the clean air. It starts more optimistic this way. I also like the colours, if that's gonna keep at least. I think the activities and books are quite cool, at least for when the kid gets a little bit older - it's a good way for them to learn as well. I also like I can disconnect the bracelet if I need to. I think it's really good.

**Interviewer:** What do you like (the most) about the app?

**Participant:** I like the first page and I like activities obviously, I really like the exposure to clean air and I like the location basically - where the bracelet has been that day. And the activities and books are really cool.

**Interviewer:** Is there anything that you don't like?

**Participant:** No, actually not. The only thing - maybe a little explanation of the AQI.

**Interviewer:** Do you have anything to be added or improved?

**Participant:** I think you made it as user friendly as it should be, so I think anyone will be able to figure out how to make this work. The only thing - connection wise, if it's connected to the app doesn't the bracelet lose a connection, when it gets farther away...

**Interviewer:** Do you think about if the app had a parent-mode and a kids-mode?

**Participant:** I think that would be really good. Especially also, when my kid is older, she might want to have her own phone and want to see it herself, but obviously don't want her to change any settings. I could have a password, that she doesn't have.

**Interviewer:** What do you think about the navigation? Was it easy to navigate?

**Participant:** Yeah, I feel so. It seems pretty easy, user friendly.

**Interviewer:** What are your thoughts about the design and layout?

**Participant:** I quite like it, I think it's very clean and easy. It is not too much going on - as you understand it. I think it's perfect for the use, we are going to use it for. It's user friendly for the end-user.

**Interviewer:** What, if anything, surprised you about the experience?

**Participant:** Well, right now I'm not sure correct the data is. (laughs) I like that you could do the activities, I did not expect that you could do that. Also if you're bored on the bus, it's nice to go on there and do something.

**Interviewer:** What, if anything, caused you frustration?

**Participant:** No. Not at all.

**Interviewer:** How frequently would you use this product?  
Frequently (1-2 times/day)

**Interviewer:** On a scale from 1 to 5 (1=not at all likely, 5=very likely), how likely are you to recommend this product to a friend?

**Participant:** Yes, definitely, the ones who I know who have kids with respiratory diseases, or asthma tendencies, or allergies in general.

**Interviewer:** Nice! Do you have anything else to add?

**Participant:** As you said last time, maybe it would be really nice to get hospitals, doctors on board too?

**Interviewer:** We actually did! We did expert interviews, and then developed this prototype based on their suggestions

**Participant:** Oh, that's cool! I think that's definitely that I would like to come from my doctor, like if I do have a kid with respiratory issues or tendencies maybe to develop it. Like they do tell me already, for example, the more you breastfeed - less chance it will be that she will develop asthma, for example, or allergies. But it could be cool to also be told: "So you know, if you stay away from certain areas, that would help - and then you could use this product." I think that would be cool.

### **PARTICIPANT 3**

**Interviewer:**

Hvad er dit overordnede indtryk af app'en?

**Participant:**

Det ser meget ud, og det ser simpelt ud at finde rundt i for en voksen.

**Interviewer:**

Hvad kan du godt lide ved app'en?

**Participant:**

Jeg kan godt lide kortet, og at kunne se hvor jeg har været henne, og at der er en graf hvor man kan se at der er flere dage man kan se på.

**Interviewer:**

Er der noget du ikke kan lide ved app'en?

**Participant:**

Nej, det med tanken om at man kan lave noget udenfor det er lidt fint. Men jeg kigger lige igen. Grafen over inner-city kan være svært at aflæse. Ellers tænker jeg at det jeg kigger ud i er meget spændende. Det er kun den der cirkel, der er svært at forstå.

**Interviewer:**

Har du nogle tilføjelser til forbedringer?

**Participant:**

Det kunne være fedt at have en historik, så man kunne se om man havde været god ved sig selv. Hvordan har min uge været. Det er lidt lige som det der med at man kan se at man har fået 1000 skridt.

**Interviewer:**

Hvad tænker du om hvis man kunne skifte fra forældre til børnemode?

**Participant:**

Hvis et barn skal læse det, især store børn. Jeg ser den til voksne kun. Det ville give mening også at formidle til børn, fx med en kage eller billedligt. Noget grøn og rødt. Jeg kan ikke se at det som det er nu er noget der skal bruges til børn, men det ville så nok give mening med en børneversion, måske med et spil. fx anton der tjener stjerner eller point fordi han har bevæget sig i et godt område. Så føler de at de har fået noget, eller måske lidt et konkurrenceelement. Hvis du har været god ved dig selv så får du en ekstra stjerne.

**Interviewer:**

Hvad tænker du om selve navigationen i app'en? Var det nemt at navigere i?

**Participant:**

Ja det giver mening. Hvis jeg var mig så ville jeg sætte air pollution in inner city øverst og så grafen nedenunder, da det er vel det som det handler om. og så hvis man havde noget historik.

**Interviewer:**

Hvad er dine tanker omkring designet og layoutet?

**Participant:**

Den er lidt fesen i farverne. I min verden så er det noget der er vigtigt, og når det er vigtigt så skal det være i klare farver, og hvis det er pastel farver matcher det ikke helt det jeg har forestillet mig. Det er jo en seriøs app, og måske farverne symbolisere noget andet. Layoutet ser ud som det skal. Bøgerne ser lidt sjove ud, og armbåndet er lidt svært at se at det er et armbånd.

**Interviewer:**

Var der noget der overraskede dig ved app'en?

**Participant:**

Nej, ikke synderligt. Jeg kan godt lide at der er aktiviteter, der ville jeg gerne kunne trykke ind på for at finde ud af hvad de lå bag det. En god måde man måske kunne visualisere det på var måske ved at man have en masse støv (fx som man har når afløser køn). Hvordan det starter med at være kompakt og så jo længere tid der går så opløser det sig og bliver usynligt, ligesom luftforurening, og med biler. Boardgames er lidt mere uklart, først troede jeg først at det var til mig, så jeg ikke skulle kede mig i naturen til forældrene. Og så kan det være de kun bliver låst op hvis man er ude hvor der er rent ruft. Jeg har ikke fået unlocked mit spil så må jeg gå hen hvor der er rent luft. Jeg så det som hyggeligt ikke læring.

**Interviewer:**

Var der noget der frustrerede dig ved app'en?

**Participant:**

Nej, men jeg ville gerne vide hvad man skal bruge bøgerne til. Hvem vil fortælle noget seriøst inden man skal i seng? Jeg tror ikke jeg ville bruge at tegne mens de lyttede til en bog, så hellere animationsfilm eller små videoer.

**Interviewer:**

Hvis du havde produktet, hvor tit tror du så at du ville bruge app'en?

**Participant:**

En gang i mellem (2-3 gange om ugen)

Især hvis der var noget jeg kunne gå ind og tjekke, eller hvor jeg kunne se at jeg kunne blive bedre i morgen fx. Eller hvis man kunne konkurrerer lidt imod andre. Noget hvor jeg kunne se at jeg var blevet bedre.