Creating a feeling of closeness between isolated patient and loved ones

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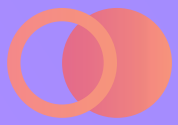

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Executive summary

The close app is a concept of a mobile application designed to help COVID-19 patients feel less isolated and lonely, therefore, closer to their loved ones with whom they cannot meet. The main principle of the application lies in fulfilling the fundamental needs of the patients and its family identified throughout the research. An isolated patient feels detached from his environment and unfamiliar with the new one, which can be defined as a lack of relatedness. Other essential needs are stimulation - to be distracted and security - to be informed. On the other side, the family members want to feel close with their hospitalized loved ones. The identified needs are relatedness, competence - to know patient's feelings and state of health and foremost to have a purpose defined as a meaningful connection and knowledge on how to help.

The goal of the project is to reduce the feeling of isolation to Covid19 patients by creating an unobtrusive connection with their family and a warm home environment.

The project intended to be a rapid answer to the current pandemic and resulted in the isolation of vulnerable patients. The process started from the market research phase, where the main categories of projects, concepts, services, and consumer products were evaluated. The outcome showed that the majority of identified solutions that tackle the problem of closeness are mobile applications. The main principles of interaction derived from the market research are: sharing the same activity, sharing an experience, evoke memories, share memories, develop a relationship.

The exploration and ideation had been made based on those outcomes resulted in the creation of three concepts: Evoke memories, Ambient participation (share experience), Active participation (share an activity). Concepts were evaluated throughout the interviews. Additionally, participants were asked about the meaning of closeness.

After every iteration, the list of requirements had been updated and led to developing two concepts the mobile application -Digital Closeness and the physical concept - Modular Closeness. The decision needed to be made; two concepts were evaluated using the Harris profile method. Results have shown the possible higher improvement of perceived closeness with faster development and implementation process than the other concept.

The Close app focuses on the discreet way of sharing memories which are the source of positive emotions and moments to send short updates to the patient, that both can serve as a distraction for the patient. App provides the patient's family with the purpose by showing them the importance of creating meaningful content. The patient is also able to send short reactions that will give the family information. Additionally, the Close app offers an ambiance connection that is based on the family location. The familiar picture will be displayed on the patient's TV during his inactivity, representing the location of the patient's loved one.

Firstly, the concept had been evaluated with the AttrakDiff to assess the hedonic and pragmatic qualities and its attractiveness. Secondly, the evaluation was conducted with hospitalized ex- COVID-19 patients, a family member of the hospitalized patient, and the healthcare professional. The concept had been received significantly positively by all of the stakeholders. Additional recommendations had been made and are included at the end of the report.

1
Introduction

COVID-19 is an infectious disease caused by a newly discovered coronavirus. The virus affects people differently, most common symptoms are high fever, dry cough, and tiredness. Around 1 in every 5 people who are infected with COVID-19 develop difficulty in breathing and require hospital care. Most people (about 80%) recover from the disease without needing special treatment, and for the majority – especially for children and young adults – an illness due to COVID-19 is generally minor. However, for some people, it can cause serious illness. People who are aged over 60 years and people who have underlying medical conditions such as diabetes, heart disease, respiratory disease, or hypertension are among those who are at greater risk. (WHO, 2020)

The virus that causes COVID-19 is mainly transmitted through droplets generated when an infected person coughs, sneezes, or exhales. These droplets are too heavy to hang in the air and quickly fall on floors or surfaces. Therefore infected patients should be isolated.
Patients admitted to the general ward spend there on average 7 to 8 days. The very first days of the treatment are the most exhausting due to high fever and breathlessness. Their oxygen level is monitored, and in some cases, it is necessary to use oxygen therapy. Patients with severe symptoms are sent immediately to ICU where they spend up to 20 days and around additional 7 days in the general ward. Those patients need to be intubated and connected to a respirator. If treatment is not effective enough, in the most severe cases patients are sedated and turned in a prone position, to improve the effectiveness of the device.

In both cases treatment involves the use of masks or tubes which block their ability to speak. Consequently, it causes impaired communication with family and nurses. This problem touches on the communication between the patient, their family, and caretakers. Contact with the patients has been banned in most of the hospitals, due to the high risk of contamination and the possibility of spreading the virus. Patients are not allowed to meet or touch with their loved ones.

Family plays a very important role during the patient's stay in the hospital ward, by creating the feeling of safety in the new unfamiliar environment, mostly by being present, providing mental and physical comfort (MacKellaig, 1987).

This may lead to patients having low mood and feelings of anger, possibly disturbing the rehabilitation process (Magnus and Turkington, 2006). Isolation is devastating for patients and in 60% of cases creates irreversible changes in patient's behavior, leading to the development of PTSD (Benzer et al., 1983).

Overall, COVID-19 patients experience isolation from family, friends, and have very limited contact with healthcare professionals. This extended period of isolation can be traumatizing for patients.

Problem Definition

The project will focus on the enhancement of the relationships with the patient's loved ones by creating a new way of interaction to enhance the feeling of closeness. Main targets are isolated COVID-19 patients, admitted to the general ward and ICU patients after the relocation to the general ward. Patients need emotional support which had been impaired due to the COVID-19 pandemic:

Loved ones can not visit in person, both have to be supported through technology to feel that they are close while being at the distance. Patients suffer from loneliness and detachment from the family and society, which have a strong negative influence on well-being. Having their family close has a tremendously positive effect on the patient and helps the recovery process.

Current technologies mostly focus only on visual and verbal communication (FaceTime/ WhatsApp) rather than on strengthening the feeling of presence or intimacy. Existing technologies are not fully supporting closeness – the feeling of being there, during their prolonged stay in the isolation.

Verbal communication for COVID-19 patients in some cases might be difficult due to high fever and tiredness, which can affect the patient's willingness to talk. Other interactions need to be created or supported, that do not rely on mutual verbal and visual communication, and therefore are unobtrusive, which will create the feeling of being close to each other.

Healthcare professionals are overloaded by the increased demands under the COVID-19 pandemic and can suffer from burnout. While trying to save patients' lives, they also have to save their own and prevent them from being infected, they wear protective suits and masks. This makes them unrecognizable and more distant for the patient. Health providers trying to be as quick as possible when they visit the patients in their isolated room, to reduce the risk of infection, which results in creating even more unfamiliar environment, and could potentially deepen the feeling of isolation.

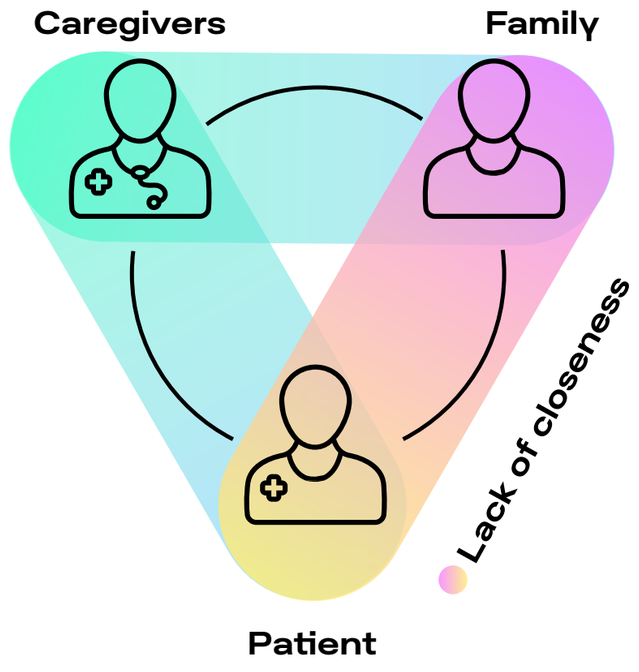


Figure 1. Visualization of the relations within the main stakeholders and identified need.

Assignment

Enhance the feeling of closeness between the isolated and hospitalized COVID patients and their loved ones by creating a new way of interaction.

The project aims to explore different ways of communication between isolated patients and their families and possible facilitating technologies. To better understand the existing interactions between the patients and their families, a map of interactions and associated emotions will be created. Moments of loneliness will be found and used as intervention points to help patients feel more connected to their families.

The design solution envisioned should consider the context of adult corona patients, their families, and healthcare professionals, to create the feeling of closeness, provide a way for the patient and their loved ones to connect to each other emotionally in a non-verbal way, and investigate the phenomenon of feeling close to someone. The design should facilitate a bidirectional way of communication and be uno
As this project is a part of medisign specialization, the concept design will fit into the healthcare setting.

Research Questions

What interaction can evoke closeness between the isolated patient and their loved ones at the distance?
What is the existing technology to support closeness at a distance?
What are the needs of COVID-19 patients during isolation?

Project Approach

Project consists of three main stages initial research, iterative design cycles and evaluation, and the final design.

Research

To get a better understanding of presence, first literature research combined with initial interviews will be done on this topic, due to the fact that still a little is known about the procedures. Existing technologies will be investigated to better understand the market and what is possible to create a realistic design concept. The exploration of main interactions that evoke closeness and the use of supportive technology will be done. To understand main stakeholders needs and emotions, research will be done by interviewing patients, family and healthcare providers, to find the valuable insights. As the final outcome of the first stage Initial list of requirements and the evaluation form for the first concepts and design directions will be made.

Design process

Project will pursue a research through design methodology (Stappers et al., 2017) by creating a design directions at the first cycle, and solutions which will be tested with stakeholders during the interactive sessions and interviews. Second cycle is a diverging phase where the decision towards the final technology shouldn't been made. During the third cycle the concepts will be turned into low fidelity mock-ups, which will be made on sufficient level to conduct the user experience and interaction testing. By the end of each cycle first the evaluation of tested solutions and new insights will be made, and second the new insights gathered within the previous cycle will be interpreted and implemented in to the design. It is planned as the outcome to have relevant design insights gathered during the final evaluation of the third cycle and together with defined list of requirements lead to the final design cycle.

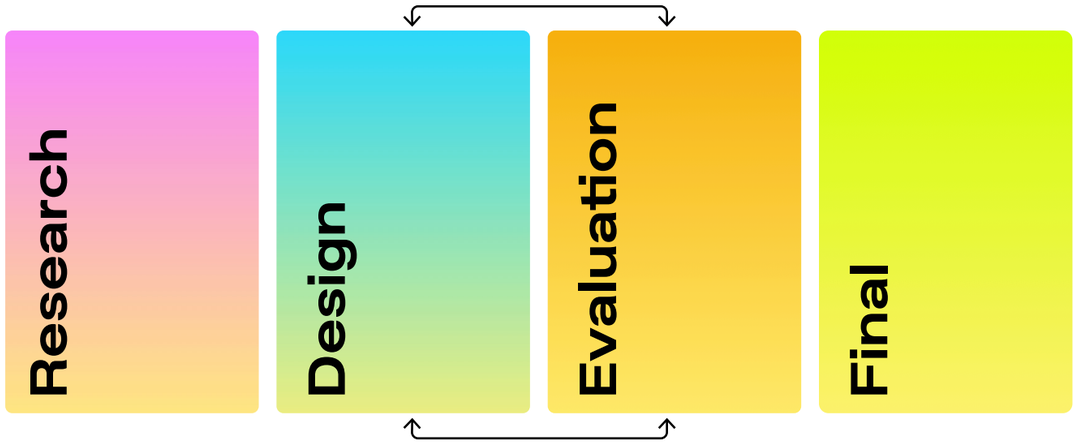


Figure 2. Visualization of the project approach

Final design

Final design cycle will be based on the insights from the three previous sessions and more concrete and detailed concepts will be created. Concepts will result in detailed experiential-quality prototypes which will be adjusted for detailed user and usability testing that will be conducted with the end users - post COVID-19 patients.
The final goal of this phase is to conduct final evaluation and pick the most valuable prototype, which will be developed further in the final stage.

Finalizing the project

During the fourth phase of the project the main focus will be on finalizing the chosen design prototype, completing the thesis report and presentation.

2
Initial Research

Two interviews have been conducted to understand better the current pandemic situation as the first stage of exploration. The first interview was conducted with an ICU nurse and researcher working at Erasmus Medical Center in Rotterdam. The second interview was with a patient who was hospitalized due to the pandemic. Both questionnaires can be found in appendix B.

Objective

The interview had been conducted to find out patients' needs and emotions during COVID-19 related hospitalization and better define the users and their state of health during the treatment. Additionally, the interviews are intended to bring a broader picture of patients' activities, their space, and the hospital's procedures or protocols.

Limitations

The gathered results are different due to the differences caused by location and time. The patient had been hospitalized at the early beginning of the pandemic outside of The Netherlands. In contrast, the ICU nurse provided the information and regulations at the time of the interview, which took place during the begging of September.

Results

Interviews resulted in obtaining multiple insights related to the procedures, patient emotions, and activities during isolation, which have been described below. The results are combined with initial literature research.

Procedures

There are multiple cases deciding upon the admission of the patient and multiple paths during the hospitalization.

Intake

There are two paths for the patients regarding their symptoms that can be mild (1) or severe (2).

1 A patient with mild symptoms is being admitted to the hospital. Firstly, all the necessary checkups are made: COVID-19 test by swabs and blood test, CT or X-ray of the lungs. Additional risk factors might be the age of the patient and/or underlying health condition. The patient is being admitted into the isolated general ward.

2 The patient's symptoms are severe, after the admission, all the necessary checkups are being done. The patient goes straight to the ICU.

Treatment

Patients with mild symptoms are being observed, and in some cases, nasal oxygen therapy is being applied. If their health status is stable, patients will recover in about 1-2 weeks from the admission. If their ability to breathe decreases, patients will be transferred to the ICU and will follow the same treatment path as patients diagnosed with severe symptoms.

Patients with the severe symptoms, as low oxygen level are being intubated and connected to the respirator. If their status remains unchanged patients are sedated and switched to the prone position, which helps to increase the amount of oxygen that is getting to the patient's lungs. Sedation, on average takes around 10 days as an average and stay at the ICU unit takes from 7 to 10 days. The patient remains in this stage until the recovery.
After a successful recovery, the patient starts to breathe slowly on their own. The patient is later moved to the general ward if their health status is stable (i.e., the oxygen levels stabilize). The recovery time takes up to 2 weeks.

Statistically, in the Netherlands, according to Leidraad Nazorg COVID-19, 27% of COVID-19 patients are being admitted to the ICU, 60% of the patients admitted to ICU are patients younger than 70 years old, 65% of all the patients have one underlying condition which makes the patient more vulnerable.

The occupancy of general ward beds fluctuates between 1102 and 2000 in the whole Netherlands. However, the occupancy of ICU beds remains stable and fluctuates around 200 beds. The shown data Fig. 3 depicts the non ICU beds from November 2020 till May 2021 (Rijksoverheid, 2021). This data also shows the importance of providing the solution to a more extensive group of patients, which are the patients admitted

to the general ward. The type of treatment can also validate this decision. Patients admitted to the ICU are most severely impaired with the COVID-19 fallouts. Moreover, the ICU patients primarily require mechanical ventilation, and in some cases, patients are being switched to the prone position to maximize the ventilator effect. (Oliveira et al., 2021)

Moreover, after a positive treatment, patients are transferred to the general ward to monitor their recovery. This means that even the recovered ICU patients could still use the envisioned later solution.

Isolation

During the hospitalization related to COVID-19, patients are being isolated, without the possibility of having visitors. However, regulations are constantly changing. Currently, Erasmus MC allows having one visitor per day.

The interviewed ex-patient stayed on the general ward for ten days with observed mild symptoms. The subject did not have the opportunity to have visitors during his stay. At the beginning of the stay at the hospital, the patient was anxious and felt lonely. On the third day of the stay, the subject's health status was confirmed to be improving, which had positively impacted the patient's mood and reduced his anxiety levels. During the first days at the hospital, the patient contacted only his closest family, and as his health condition started to improve, the subject had more energy to stay in touch with other people. The subject was not allowed to bring any objects besides the most necessary, like smartphones and tablets.

In contrast, in the non-pandemic scenarios, patients or their families bring mostly close objects to the patient. Often it is a picture of the family, or a picture of the patient itself from before the illness, and religious objects or small mascots to comfort the patient. The family also tries to evoke memories by bringing small objects - mostly souvenirs from holidays or listening to the music associated with specific events. Those objects are intended to bring the patient closer to his environment, evoking the feeling of familiarity and a closeness between the patient and patient's home environments. (Polikandrioti et al., 2011)

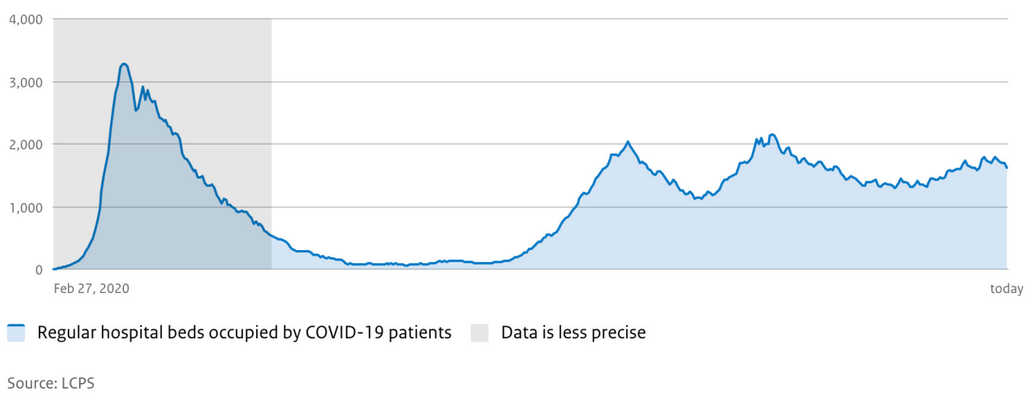


Figure 3. Occupancy of regular hospital beds during the COVID-19 pandemic

Figure 4. Patient's isolation room prepared for the COVID-19 wave

Emotions

The primary emotion during the prolonged stay at the hospital in isolation is loneliness. The patient could not leave the room and could not be part of the family's daily routines. Additionally, due to the rigorous health protocols, patients can be visited only by caregivers who are very busy and usually do not have enough time for each patient. Furthermore, patients are unable to recognize healthcare professionals due to prevention from spreading the virus. The caregivers need to wear hazmat suits and masks, which completely cover their body, leading to disorientation and frustration for the patient.

The feeling of safety has been found significant; the interviewed patient stated the regular visits of nurses, especially during the first days, were helpful. A tremendous impact on the feeling of safety could contact with patient's loved ones any time - the iPad that the patient had brought with him.

Activities

Patients' activities during the isolation are very limited. After switching the patient to the general ward, patients can use their phone to communicate with the family, but in most cases, patients are still too weak to be able to use their phone.

The interviewed subject indicated distraction as an approach to stay positive. Activities such as reading a book or watching TV can help distract. The patient communicated with his family through Facebook, Instagram, and the Houseparty app.

Patient's flow

In order to summarize and visualize all the data involving the patient's treatment, medical procedures, and protocols, a timeline was created. The timeline also led to the conclusion to pick the most suitable implementation space. At this stage, the decision was made to switch from the ICU patients and focus on the general ward. The ICU patients will also discover the solution's benefits; however, it will happen after their recovery from life-threatening conditions, when they will be transferred into the general ward.

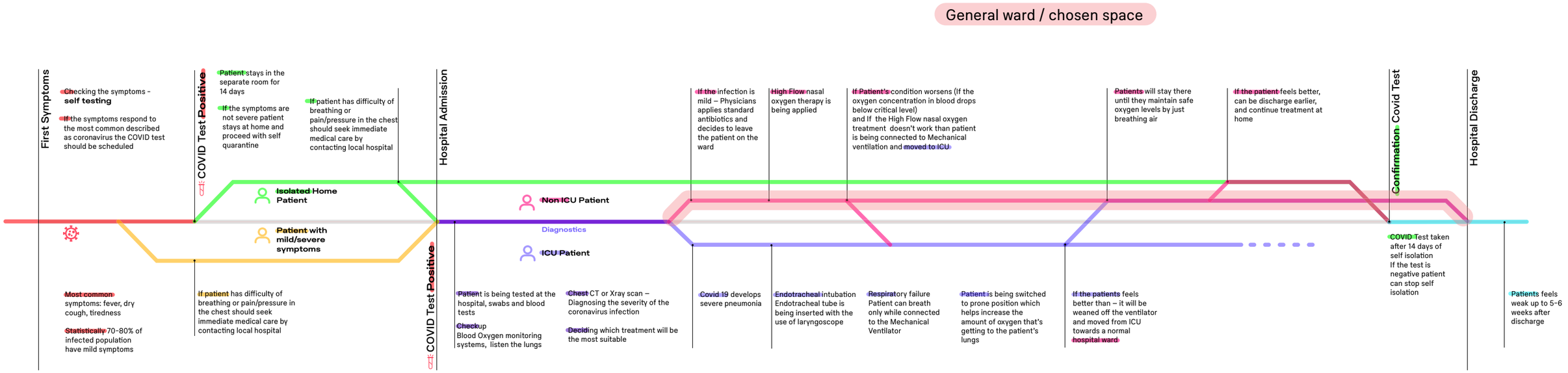


Figure 5. Timeline presenting the possible COVID-19 petient's flow during the hospitalization, and possible implementation space

3
Market Research

Market research was conducted to understand better the current solutions that answer the problem of loneliness and closeness. After the desk research, solutions had been clustered, resulting in three main categories: Mobile Applications, Robots, and Objects.

Market research has been created based on design concepts and existing solutions, including concepts, services, mobile applications, robots, and objects that evoke closeness. Firstly, online desk research was conducted to gather the most promising solutions to create a benchmark of concepts. Solutions had been clustered into the three main categories mentioned before. The findings were analyzed based on its slightly different functions and features presented in the next section.

Mobile Applications

The first group, “Mobile Applications,” is the most popular. Many apps have been developed with the main principle of connecting people. Applications are also the most popular due to the easiness of creating them compared to products, where development takes much time before being implemented. Another aspect that influences the popularity of mobile app is the growing market of mobile phones. It has been estimated that in The Netherlands, there are around 14.3 million devices registered (O’dea, 2021).

Within the leading group, specific subcategories were created in order to define the main principle clearly.

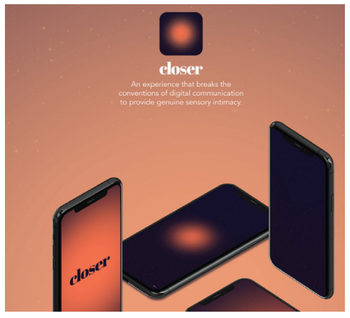


Figure 6. Concept of mobile application – Closer

Figure 7. Robot Elliq - Smart assistant

Figure 8. Homeware - Concept designed by Penny Webb

Mobile Applications

Communicators

Mainly focussing on communication services, those are apps like FaceTime, WhatsApp, etc. They are providing video calls, voice calls, and messaging.

Social Media

Social media apps create a virtual space on the internet where everyone has a public profile. The user can post pictures, videos or create posts publicly accessible by their followers or friends. Additionally, users can access different groups depending on the personal preference associated with their hobbies, the place that the user lives, or their interests. Social media gives a possibility to talk about past events, creating a wall where the user can scroll through the past “uploads.” It is also more common nowadays for social media to create memories from past uploads to share them with the people they mentioned or tagged. Social media give people the power to build community and bring the world closer together.

Community

These are applications that mainly focus on giving and receiving support. Applications like TalkSpace or HearMe create a valuable space where users can write about their problems and get instant answers from other people, mostly anonymously. Before every use of the app, the user can choose to be the listener, volunteer, or the person who will talk about their personal experiences or problems. Moreover, HearMe

focuses on creating training sessions for the volunteers to expand empathy and improve listening skills.

Another exciting approach within the community category is apps like Panion, Peanut, and TalkLife. Panion focuses on finding and matching people in users' close areas with the same interests or hobbies. It also allows looking for the people interested in doing the same activity like sports, or sightseeing. Users can also be a part of the more significant community within the app, which is based on their preferences (Movie Lovers, Makers, Creatives). Peanut is another example, however here, the users are focused on one topic - motherhood. This app associates health professionals, mothers with a diversified level of experience, and also future moms. The goal here is to exchange knowledge and to give support.

Supportive

These apps are mainly created to support users during difficult times. Between and Happy Couple focus on maintaining relationships over a distance and supporting relationships. Besides communication, the main feature is a shared calendar - to give more details about what the other person is doing. Users can also share memories inside the app and create countdowns to the following milestones in their relationship or the next possible meeting.

COVID Coach is another type of supportive app made by professionals in the US Department of Veteran Affairs. COVID Coach provides education about coping with the global pandemic, tools for self-care, tools to improve the user's emotional well-being, trackers for tracking mental health over time, and trackers for working on personal goals that had been set previously by the user.

Sharing Experience

This is a new type of application and also the fastest-growing interaction within the existing services. Created to support the feeling of being there by sharing the same activity. One of the most popular applications is Spotify and Netflix who have introduced group sessions. Spotify gives a possibility to merge two and more accounts and listen to music on separate devices simultaneously. Furthermore, it is Netflix's group session that, besides offering to watch the movie simultaneously, adds chat to feel closer and comment on the movie instantly.

Following the phenomenon of sharing activity, the HouseParty app was developed to elevate the interactions from a typical communicator app to an interactive space where users can meet other people. The app tries to mimic spontaneous meetings. Users can create an open room where other people can join impulsively. Additionally, HouseParty developed mini-games to increase the level of involvement but also to give the user more activities to share. Those activities significantly increase the feeling of closeness.

Another valuable approach is Borrel. A virtual reality game-based communicator made for informal meetings, remote drinks, or networking events. The app was made to preserve the working culture within the companies and facilitate micro-interactions that workers would have during work and or after. Borrel is settled on an island where users can freely walk around and talk to their friends.

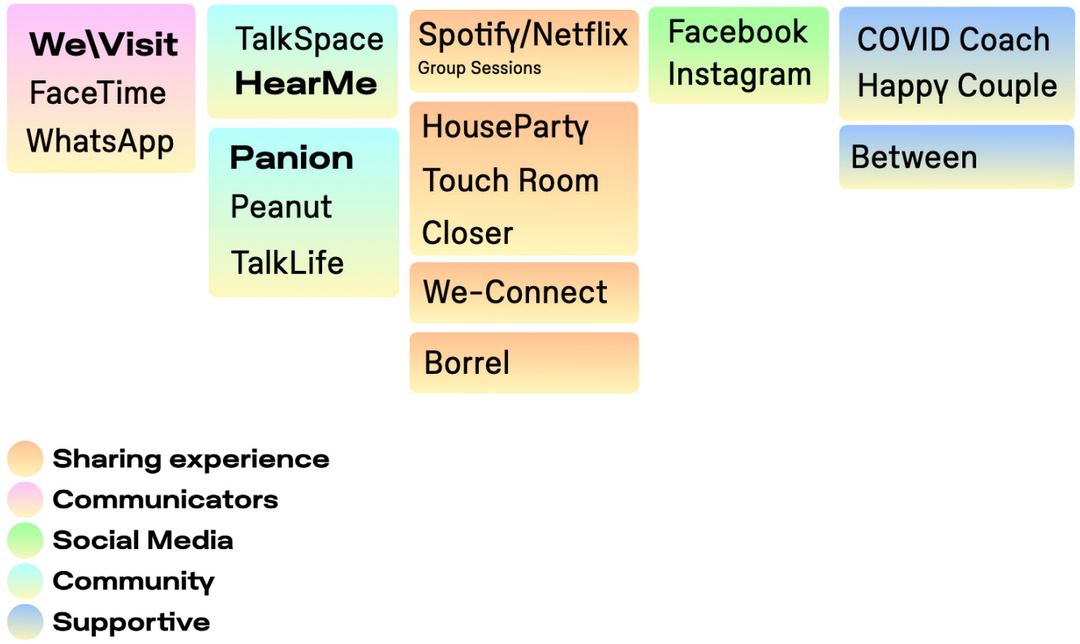


Figure 9. Overview of the compared mobile applications and services, assigned to its categories

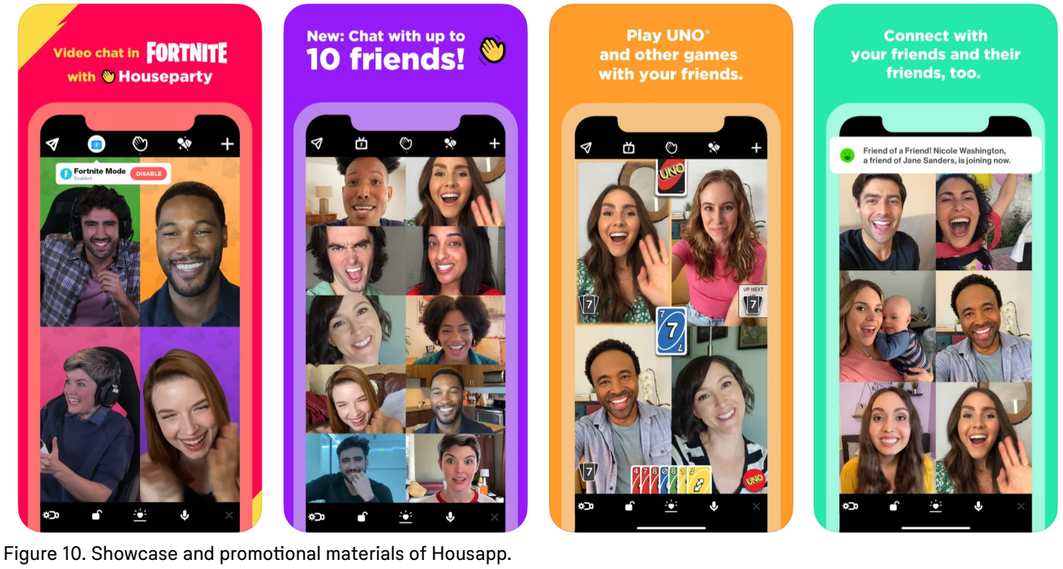


Figure 10. Showcase and promotional materials of Housapp.

Robots

Robots are being developed to recreate the feeling of closeness, same as applications, however differently. There are three main groups that we can distinguish that follow different approaches:

Communicators

The primary function of those robots is to facilitate communication between people by mainly offering a video chat. However, their added value is the given ability to move around the space they are placed in. In the case of the InTouch Healthcare robot, the user can control these movements and feel a bit closer by being able to look around and follow the person on the other side.

Another example is the AV1 robot called by the manufacturer Avatar, which was created to facilitate distance learning for children and young adults with long-term illness to take part at school via an app on their phone or tablet. Avatar has been given basic functionalities like slight movement where the student can rotate the device to look around the classroom or raise a hand. Avatar does not have a screen on another side. However, it can express the basic emotions on the back LED panel.

Companions

Companions are robots designed mainly as an extension to Siri, Google Assistant, or Amazon's Alexa, and they are envisioned to become personal assistants. One of the most exciting solutions is EliQ, a small robot and a tablet with a dedicated app designed to assist and support older adults. The main features of the robot are a conversation with the user, health reminders, music streaming, motivation, cognitive games. The robot can also serve as a communication tool.

Another approach was taken by Sony, creator of Aibo, a robotic dog, where the robot can learn the user's habits and develop a relationship. Aibo can also create and share a memory with the user by taking pictures and videos.

Therapeutic

Therapeutic robots are slightly different from the previous categories. They are mainly administered as a supplement of animal therapy to patients in environments such as hospitals and extended care facilities where live animals present treatment or logistical difficulties.

Paro is a leader in the field of therapeutic robots. Paro is a robotic seal that responds to touch and can express emotions. The robot is equipped with touch and motion sensors. It can also listen and understand the owner's voice. It has been found to reduce patient stress. Moreover has been shown to have a Psychological effect on patients, improving their relaxation and motivation.

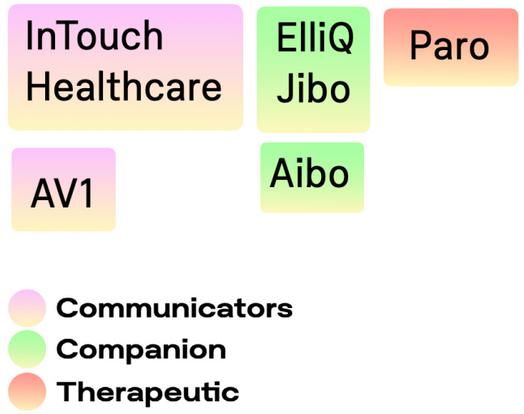


Figure 11. Overview of the compared robots, assigned to its categories.

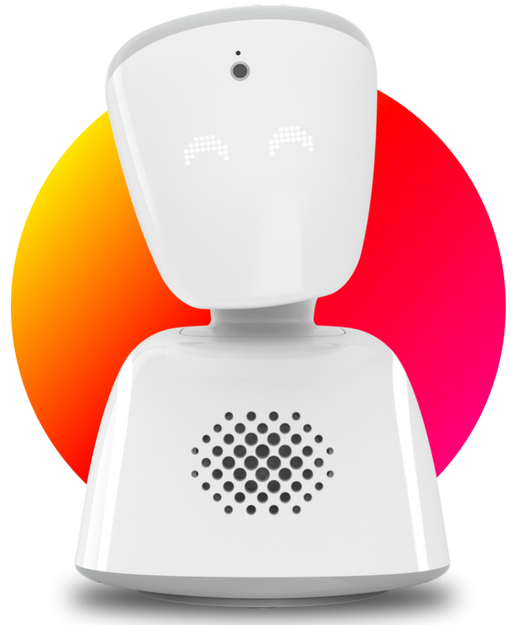


Figure 12. AV1 - Robot created by NoIsolation

Objects

Objects similar to Mobile Applications and Robots try to reproduce the feeling of closeness. To better understand their main principles, objects had been divided into two main categories: Communicators and Evoking/Socializing.

Communicators

The biggest group within the category of objects is communicators. Those are objects whose primary concept is to send and receive the message, which for every concept is different. Those concepts mainly consist of two identical pieces on both sides.

SnowGlobe is a concept created by the use of LED and proximity sensors that can sense another person's presence and notify another person on the other side by flashing lights to show that someone is nearby the object.

Similarly, the concept of Digital Presence addresses the needs of people not being able to take part in the family activity - having dinner. Homeware is a concept that triggers the LED lights on the other tableware when touched to recreate the feeling of being close while having a meal.

Fulu is a nail wearable that can bring a sense of touch to daily digital experiences and communication by use of the haptic engine. Fulu can extend the Augmented Reality by giving the sense of touching a particular surface, like fabric, grains, etc. However, its primary function is to communicate between two users by sending and receiving touch over the distance. Another similar concept of transferring touch was made by the Hey bracelets, whereby touching one bracelet user could send touch to another. The more interesting is that the bracelet uses a squeezing mechanism as a medium.

Homeware is a concept created by the student from The Design Academy Eindhoven. The concept consists of three objects where the user can be present on another side by using three principles touch, breath, and movement. Things are designed to interact with each other, helping people anywhere in the world stay in touch without necessarily communicating directly. Creator distinguished three types of interaction:

SnowGlobe
Fulu
Hey
Homeware
Licking Phone

Digital Presence
Tangiball

Unodois
CRDL

InTouch
Clap - Clap

Communicators
Socialising
Evoking

Figure 13. Overview of the compared objects, assigned to its categories.

Figure 14. Hey - A bracelet that communicates by gentle squeezing the wrist.

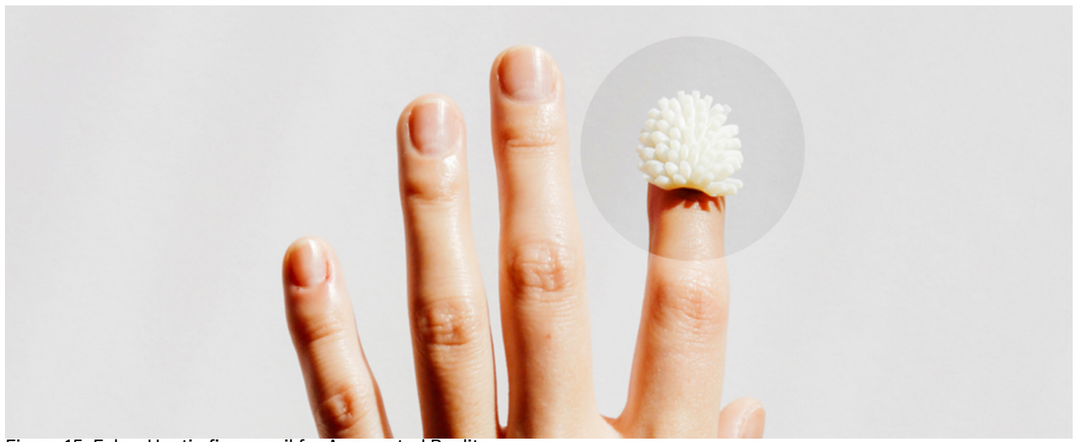


Figure 15. Fulu - Haptic finger nail for Augmented Reality

Direct Interaction - blowing to send the signal of presence, Environmental interaction - changes in light to connect spaces, Subconscious interaction - stroking as an indirect means of communication. Therefore objects consist of the lamp, which glows in response to remote changes in lighting detected by secondary things consisting of a light sensor. This textile reveals layers of colors in response to a small touchpad consisting of piezo elements, detecting pressure when stroked, a mirror that changes color in response to a distant breath.

A similar approach of translating the senses – in this case, speech into touch was made by Students from the Royal Academy of Arts. The concept consists of a pair of devices that allow people to experience conversations physically. The user's speech is translated into a series of simple haptic patterns based on their intonation and volume. One attachment can reproduce a licking motion against the user's ear.

Evoke/Socialize

Those objects had been created to bring the users together through the common activity, and therefore evoke the feeling of closeness.

CLDR is an interactive care tool that enables a new form of contact by translating touch between people into sound. CLDR had been explicitly designed for people with dementia and the people who help taking care of them. CLDR takes an interactive and playful approach to physical contact. The main principle of the object depends on placing users' one hand on the device and second touching each other, which will affect closing the circuit. The device from now on will register the differences in the way of touch due to the differences in conductivity, which will affect the variety of sound effects.

Unodois is a series of experimental, daily life objects made out of ceramics. Objects focus on solving the problem of loneliness evoked by a lack of connection and communication with other people. The concept consists of series of objects usually used by one person that has been recreated to be used baby two, creating bonds between people.

Clap-clap is a bracelet used to solve workplace loneliness by doing the action, which had been inspired by the athletes clapping their hands. Concept transfer this ritual into the office space where instead of the ball and athletes, workers pass and exchange files between them. Bracelets could have a positive impact on minimizing loneliness and enriching the feeling of working in a team.

Figure 16. Feel the Conversation (Licking phone) - Concept designed by the RCA, translates speech into sensation.

Figure 17. CRDL - Care instrument, translates touch into sound - main user group, people with dementia, autism or learning disabilities

Figure 18. Clap Clap - The concept answers the problem of loneliness in the office. Users now, in order to share a file, need to fist bump.

Conclusions

Many approaches are trying to solve the lack of closeness between people. As a result of market research, the core interactions from founded solutions had been extracted: Video Call, Voice Call, Sharing same activity, Spontaneous interaction, Evoke memories, Share memories, Develop a relationship. The most popular is the field of mobile applications, where the most popular group are communicators. Apps are being popular due to the easiness of use - every smartphone owner might become a user of a specific app or service without buying an expensive device. Applications also offer low-cost development and fast implementation compared to developing a product (objects) or a robot that also results in a significantly lower price. This could also be later a decisive requirement during decisive phases of the project. The primary intention of this project is to answer the patients' lack of closeness and prolonged isolation that leads to loneliness in the most accessible way.

Robots and objects, in contrast, are being costly due to the time needed to develop and test before realizing the product to the public. However, due to their physicality, objects can have a more significant impact. For example, Elliq, a companion robot targeted at the elderly, designed in a way that can be used mainly through voice commands, will have a more significant impact, especially in their age group, than the app. However, due to the complexity of COVID-19 illness, mainly patients have difficulty breathing which with intercurrent cough makes it impossible for them to speak. Therefore the solution including voice commands should not be considered.

Another significant interaction is sharing an experience. Many apps and services implemented this principle where both users can watch the same movie or listen to the same music simultaneously. A great example is also communicators who implemented mini-games that users can play during the conversation. Sharing an experience can also be noticed on social network platforms. Users can upload their pictures and videos from the past or future, evoking the users' memories and developing a relationship between users. Sharing an experience or sharing activity are indeed promising interactions that have the potential to bring people closer. However, the next challenge will be to use those principles to create an unobtrusive way of sharing those interactions.

SnowGlobe
Creates an awareness between two people of their presence and activity in the living room.

Fulu
bring a sense of touch to daily digital experiences and communication Touch textures - as extended AR Send and receive touch

Digital Presence
Project creates an ambient connection

Hey
Send and receive touch by use of squeezing bracelet

Homeware
to interact with each other, helping people anywhere in the world stay in touch without necessarily having to communicate directly.

CRDL
Creates music when two people keep touching the device with one hand and touch their bodies with another

Licking phone
two handheld machines that connect to a phone and translate the user's speech into a series of simple haptic patterns based on their intonation and volume.

Modular
the collection evoked emotion from people and they found it interesting, even if they don't know much about design. If my furniture brings people comfort and a bit of fun, that is what I am most proud of – making a difference."

Clap-Clap
solve workplace loneliness by doing action. find a special clapping way and repeat this action to create more emotional connections.

Unodois
Normally used by one person, these objects were revived to be used by two, creating bonds between individuals.

Figure 19. Overview of the unique Objects and their interactions.

Panion
meeting people with the same interests

COVID Coach
Manage stress
Increase well-being

We\Visit
video call

HearMe
connecting to experts

HouseParty
interactive games between
A way of naturally/ spontaneously seeing friends

Facebook
build community and bring the world closer together.
Evoke memories help to stay updated

Group sessions for Netflix/Spotify
sharing the same activity

Borrel
"In bar experience", "go for a walk"

Figure 20. Overview of the unique Mobila Applicaitons and their interactions.

Aibo
As aibo learns its environment and develops relationships with people, its identity takes on more and more layers.
Sharing memories

AV1
Robot can express some emotions

Paro
stimulates interaction between patients and caregivers
improves the socialization of patients with each other and with caregiver

Intouch healthcare
equipped in mobile base camera and screen, used mostly for telemedicine

Elliq
Conversation
Health reminders
Wellness
Morning Motivation
Cognitive games

Figure 21. Overview of the unique Robots and their interactions.

4
Initial Ideation

Initial ideation began based on the principles found during the market research, which was conducted simultaneously. Using the most promising categories: sharing experience, sharing memories, developing a relationship, sharing rituals, spontaneous interactions, evoke memories, unobtrusive connection, sharing same activity, self-reporting. The process of the ideation can be seen in Fig.23. Ideation resulted in the creation of a list of the interactions to bring the family closer. The main identified interactions during the market research had been listed. The brainstorming session was conducted in order to assign the activity resulting in the main principle. For this activity, the How To's method triggered the further exploration of activities that bring the family together.

How to share a ritual?
How to create spontaneous interactions?
How to evoke memories?
How do we share memories?
How to share the same activity?
How to develop a relationship?
How to create the assessment of a patient's well-being?
How to unobtrusively connect the patient with his family?

The outcome of market research was combined with the initial ideation and created an initial list of requirements.

Figure 22. Result of the brainstorming facilitated by How To's questions.

Interactions/ Activities that bring the family closer

Sharing rituals
Brushing teeth
Making breakfast
Cooking
Going for walks
Shopping

Spontaneous Interaction
Sending message or photo
Poking someone
Bumping into one another

Evoke memories
Photo/Video of the past year
Object
Conversation
Activity

Share memories
Send Photo/Video of the past year
Tell a story (with prompting)
Conversation

Unobtrusive connection
Sharing sound
Imagery
Knowing what someone else is doing AR/VR
Showing someone the activity in your house
Sharing heartbeat
Seeing known environment

Sharing same activity
Interactive games
"Watching moon outside"
Find something red , (ISpy)
Watching same movie
Going for a walk
Discover

Develops relationship
Share past
Share dreams
Eating - same principle -
Sharing activity
Sharing vulnerability
Translating the connection into the visualization of the tree (where have you started and how far have you come)

Self reporting
Taking a quizzes to get to know yourself
meditate
Having a scale of your emotional state that you can share with ppl

Figure 23. The list of the interactions that possibly could bring the family closer was created during the brainstorming session.

Initial List of Requirements

An initial list of Requirements had been created to narrow down possible directions of the project, by defining already known needs of users and interactions.

List of Requirements – First Cycle

Target group

1. Patients who were admitted to the general ward and are being isolated.
2. Patients who were transferred into the general ward
3. Patients who spend an excessive amount of time in isolation
4. Families whose loved ones had been admitted to the general ward.
5. Patient at the beginning of recovery can be extremely tired but within a couple of days as the recovery progress, the patient has more energy to interact with loved ones.
6. Patients during the last stage of hospitalization with full motor skills.

Concept requirements

The design needs...

7. To be easily accessible
8. To enable social presence
9. To create a meaningful entertainment
10. To be unobtrusive
11. To be inviting to use
12. To evoke positive memories
13. To create a new way of communication
14. To be accessible for the patient in every stage of the treatment
15. To facilitate the bidirectional way of communication, when patients are able to communicate
16. To be suitable for one-way communication, when the patient is unable to communicate
17. To support closeness – the feeling of being there, during the patients prolonged stay in the isolation
18. To be fully operational by the patient and should not involve any help from the healthcare professionals

Design goal

Reduce the feeling of isolation in COVID-19 patients by creating an unobtrusive connection with their family and a warm home environment.

A design goal was created to narrow down the problem definition, together with the insights gathered from the initial research, such as the patient's prolonged isolation, unfamiliarity with the new environment, and detachment from the home and loved ones. Creates the vital need of bringing familiarity and everyday activities to the patient.

Overall, hospitalized patients have partial cognitive impairment demanding special attention while creating or designing the solutions for them. Patients hospitalized due to COVID-19 illness suffer from mild to severe symptoms. Virus results in high fever, overall exhaustion, intercurrent cough, and shortness of breath, blocking patients' ability to speak. Therefore, communication should be unobtrusive or designed so that the patient can communicate easily through the illness.

5
First Cycle

The first cycle of research through design aims to establish and validate concepts of interaction and research further, the meaning of closeness.

After gathering the insights from the previous research, ideas had been clustered into three concept directions: Evoke memories, Ambient participation, and Active participation.

Evaluation of the three concepts was made in order to find the interaction that could evoke the feeling of closeness. Additionally, during the evaluation, participants were asked about the meaning of closeness. The evaluation results can be seen at the end of this chapter. In addition, FIgure.24 in the section “Evaluation” represents the essential findings and the most promising concepts.

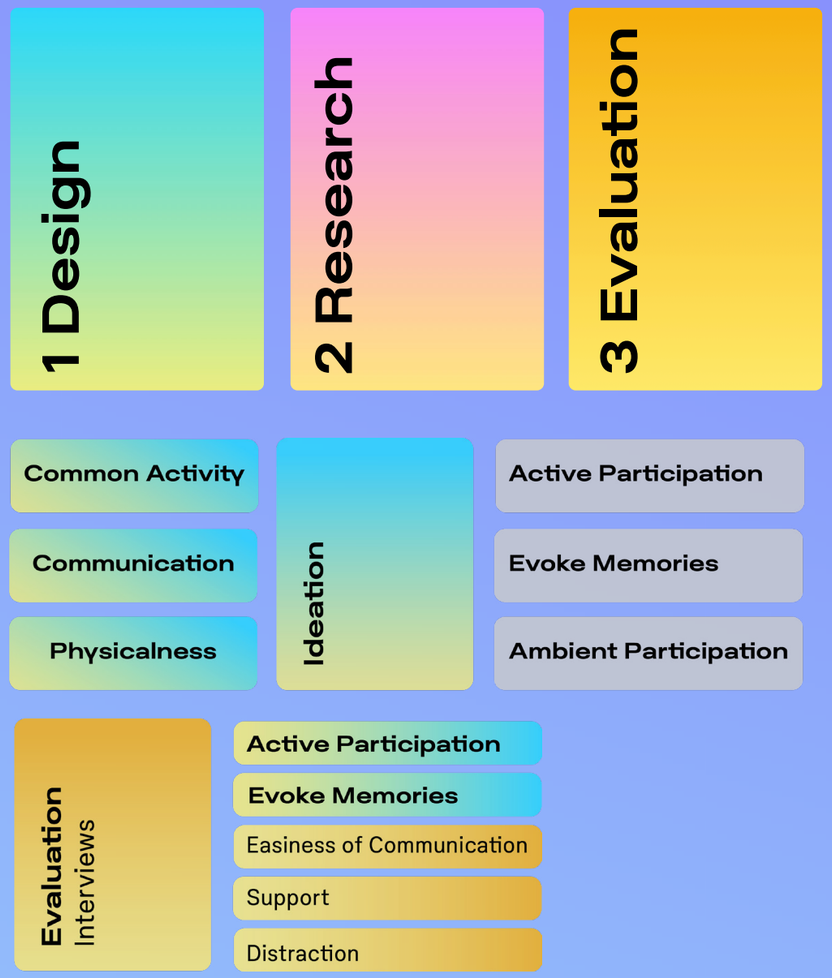


Figure 24. The overview of the design process of the first cycle.

Concept Directions

1 Evoke memories

Memories have been found to be an instant source of positive emotions like joy, inspiration, and gratitude. Evoked memories can serve also as a positive distraction from illness. Positive emotions undoes negative emotions, by additionally broadening the positive thinking. (Rusting et al., 2000)

Furthermore, memories can be used as a conversation starter at the time when the patient is able to talk or if the patient can't start the conversation family could send voice or video messages. Memories can be evoked by creating a routine of exchanging photos, music, and videos. Additionally, patients' memories could be stimulated by filing in an audiovisual questionnaire or proposing a small object that can generate random textures, sound, music, colors pictures, or videos related to the patient in order to evoke the memories. Having a shared virtual space could help to organize existing memories.

Scenario

1. **The patient lies on the bed and opens the app.** During the first time use, the patient is being asked to indicate some travel preferences or visited places.
2. **The app is evoking memory by asking the questions using Emojis.** Or showing the randomized colors, sound, music, pictures that the user will combine to the story.
3. **Users create the story out of separate pieces.**
4. **Users can share the memories through casting the stories on the TV or inside the App.**
5. **Almost in every patient's room, there is a monitor that can cast the evoked memory by the patient or by the family member.**

Ideation

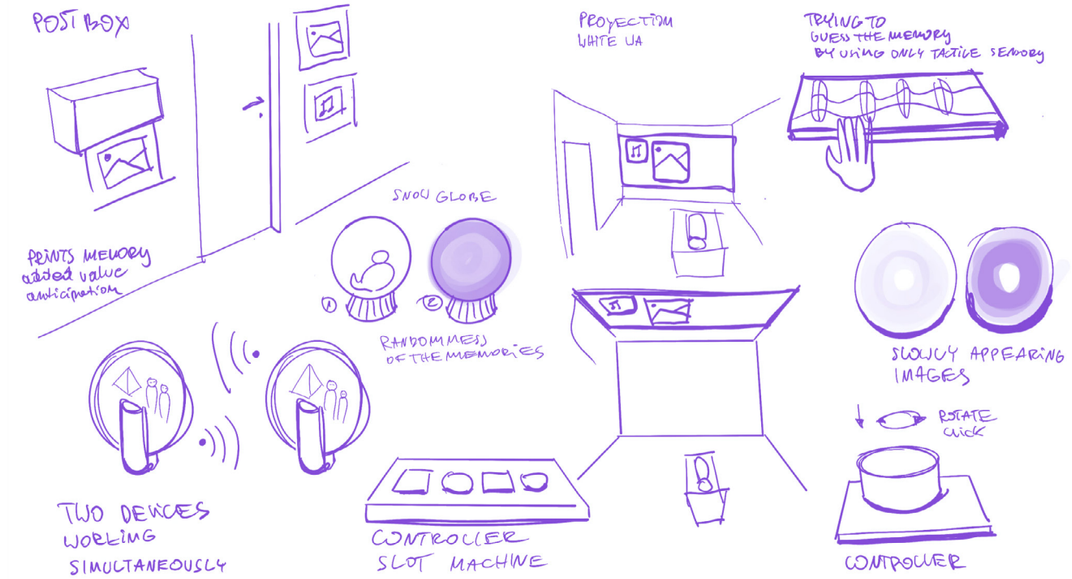


Figure 25. Result of ideation – Evoking memories

Scenario

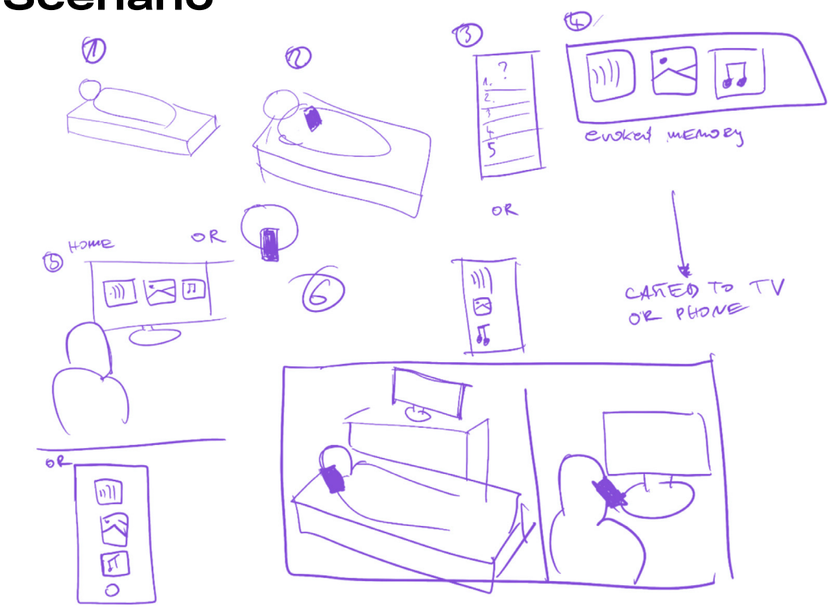


Figure 26. Possible scenario of evoking the memories.

2 Ambient Participation

Ambient and active participation concepts aim to improve the relatedness experience between the isolated patient and the family throughout daily activities. Concepts refer to how those activities or experiences might be perceived in a meaningful and satisfying way.

Ambient participation (in the activity) - refers to the activities where you don't communicate with other people and or you are not dependent upon another person during the activity (like watching a movie, being in the same space).

The second concept addresses feeling the surrounding of the family house, where you don't always have a conversation but you feel the presence by itself by being a part of the space.

The interaction will consist of two identical products, one located at home and the second will be placed in the isolated room where the patient is recovering. Once one object will be touched, the second object on the other side will change its state to indicate that it is used by one of the users.

Scenario

1. **The patient lies on the bed with a connected pillow.**
2. **When one of the users interact with the pillow the other pillow will generate warmth**
3. **The patient knows he is at home**
4. **The patient can send voice messages or talk directly**

Ideation

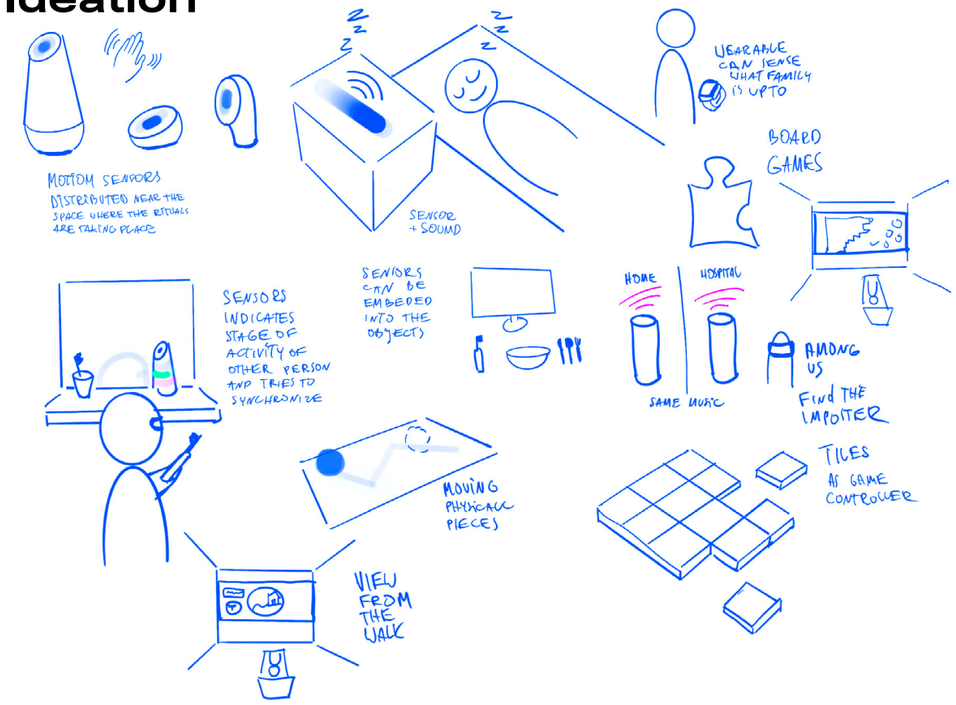


Figure 27. Result of ideation – Ambient participation

Scenario

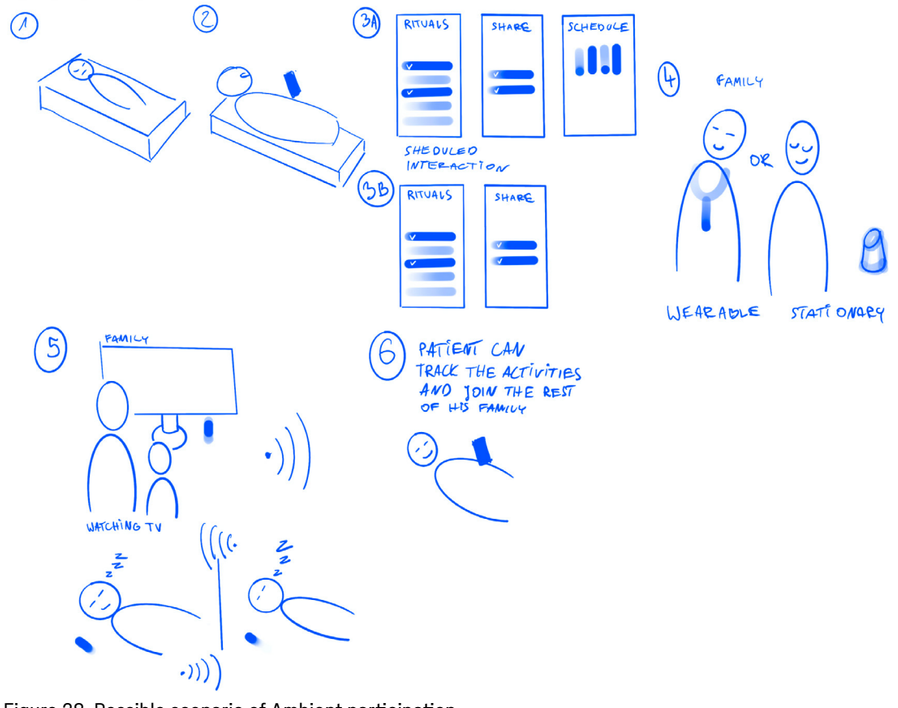


Figure 28. Possible scenario of Ambient participation.

3 Rituals/Active participation

The third concept addresses the same phenomena as the second concept, however, the main difference is the active way of spending time. Sharing the same activity influence the feeling of togetherness, both users can actively participate to create a feeling of closeness.

Active participation might be used in many activities and re-create meaningful interactions and family rituals like going for a walk.

Scenario

1. The patient lies on the bed and opens the app. During the first time use, the patient is being asked to indicate some rituals or activities.

2. The patient picks predefined activities or create new ones and share them with loved-ones.

3. The patient can schedule the ritual or track the activity of the family and join them.

4. Family thank to motion sensors (or smart Home) can let to know unobtrusively that they started the activity.

5. The patient enjoys time spent together.

Ideation

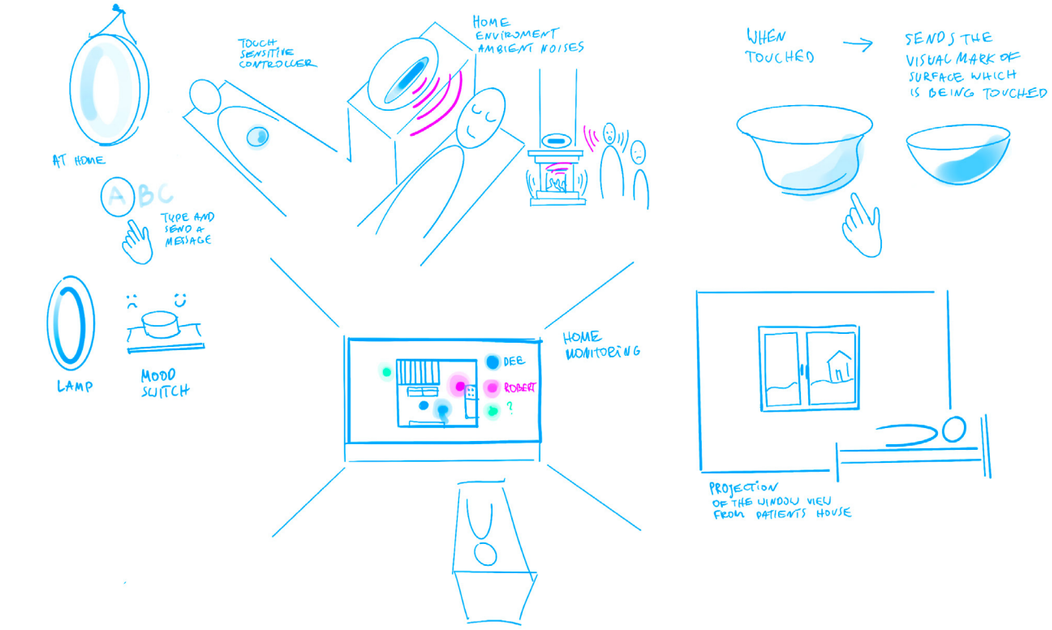


Figure 29. Result of ideation – Active participation

Scenario

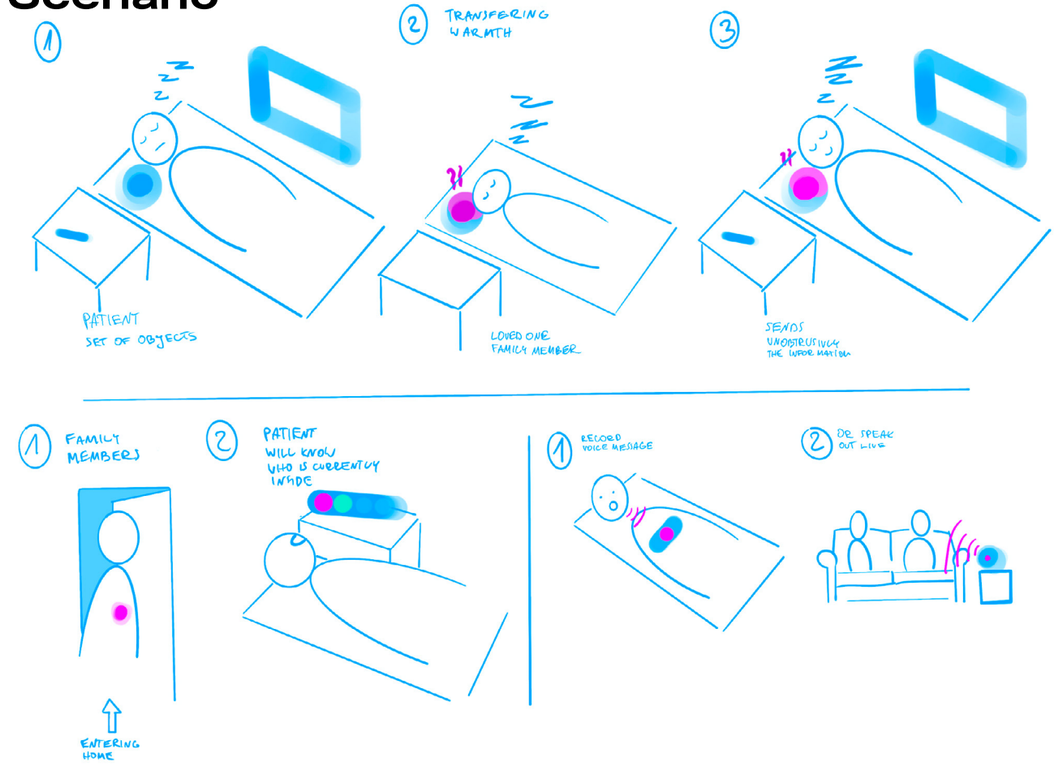


Figure 30. Possible scenario of Active participation.

Impact vs Feasibility

To compare the ideas, impact vs feasibility chart was created, to validate which idea is most realistic and can have the highest impact. At this stage, it hasn't been decided on which idea the project will be focused and therefore all three ideas had been clustered and evaluated separately.

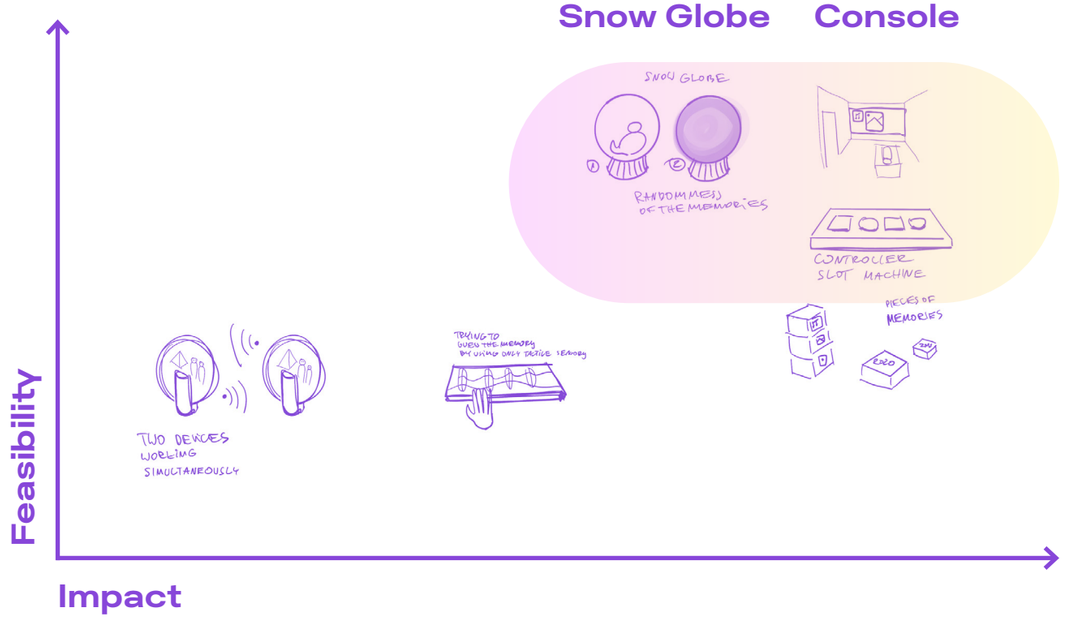


Figure 31. Impact vs. Feasibility - Evoke memories.

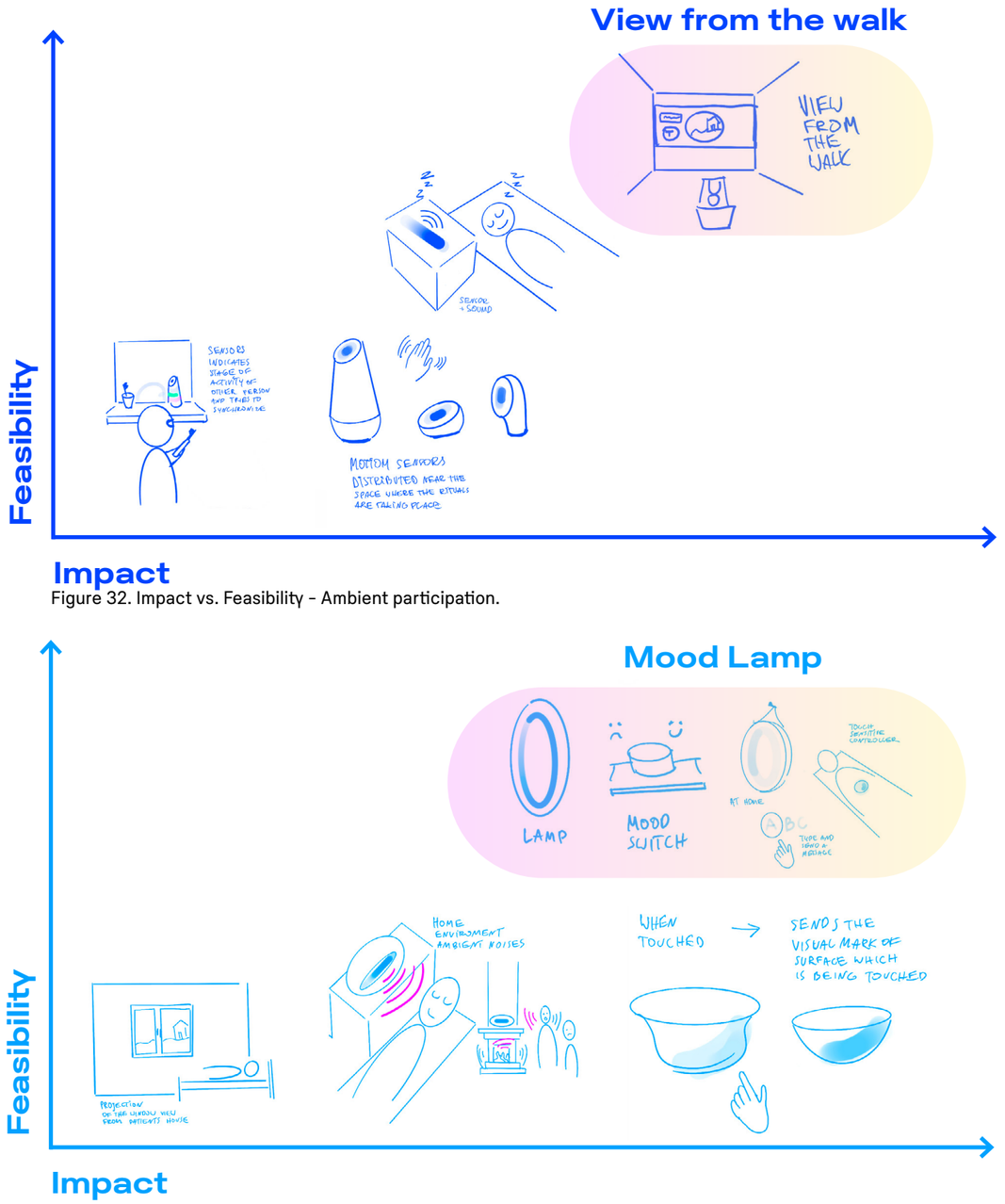


Figure 32. Impact vs. Feasibility - Ambient participation.

Figure 33. Impact vs. Feasibility - Active participation.

Evaluation

Evaluation was done through the interviews in order to validate the users' needs and emotions, understand why they are important for creating the feeling of closeness. Additionally to find out and understand which design direction is the most impactful for the user. The Interviews had been created from open-ended questions and consisted of two parts, the structure is presented on Figure 34.

In the first part, the user had been asked about closeness and what does closeness means to the interviewee. The second part was focused on the evaluation of the previously created design directions and consisted of five questions per concept seen in appendix C.

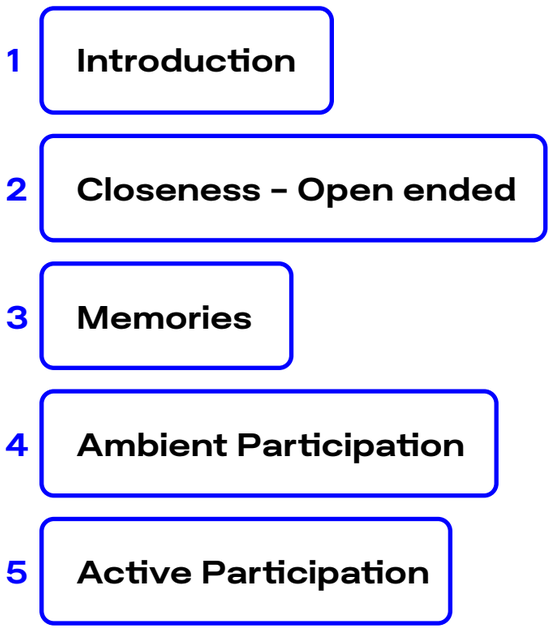


Figure 34. Structure of the interview.

Interviewees

Participants were in the age group between 26 up to 70 years old. The group was transgenerational and consisted of 2 baby boomers and 3 millennials. Two interviewees had experienced prolonged isolation during the lockdown. One of the subjects had multiple prolonged stays at the hospitals also during the pandemic. In respect of COVID-19 regulations all of the interviews took place online.

2
Baby boomers

3
Millennials

The meaning of Closeness

Baby boomers

Participants quotes related to closeness:

“Closeness is the feeling of having support”
“Taking care of me and possibility to give the support - that they are there”
“Touching someone, hugging”
“Having someone who remembers about you”
“When other person thinks about you”

The meaning of closeness for the participants from baby boom generation is to have the support and to be remembered. They feel closeness with the people who care about them, who visit and call often.

Millennials

Participants quotes related to closeness:

“Closeness is having the opportunity to get and receive help instantly. “
“Being close to my loved ones gives me self confidence happiness and small interactions”
“Sometimes I feel like my question might be not big enough to make a call”
“Being close to the person is important you can always ask someone if it is positive or negative. There is way more effort when you can’t be at home with your family. There are more steps to communicate something to them.”

Millennials tend to also think about the support while asked about the meaning of closeness. However, they value more the easiness of communication. Subjects reported that being able to be physically close to their families gives the possibility to get an instant response and small interactions that cannot be reproduced over the distance. Besides communication through phone or other medium-cost them more effort which resonates in the less frequent attempts of communicating with their loved ones.

Feedback on the concepts

1 Evoke Memories

Happiness

“Nice memories make me happy”
“Memories stimulates positive thinking”

Interviewees asked about the value of the memories unanimously indicated that memories are the source of happiness, which also help them to influence positive thinking.

Sharing Happiness

“During moving I found the picture that was taken together with my aunt and I immediately shared it”

Subjects indicated that they tend to share memories, that were created together with another person, such as pictures taken together o pictures of souvenirs brought from holidays.

Togetherness

“Memories evoked by myself are not as valuable as those evoked together with the person that was a part of the memory.”
“Talking with the person who was the part of the experience is more meaningful and makes me happy”

Memories can create a moment of togetherness especially when they are evoked during the meeting or conversation with the person who is part of the memory, which can result in more meaningful conversation.

Reminder

“It is nice to remember things especially when now we can’t meet with my family”
“Memories can remind you about the people that support you”
“Positive memories can be also used as an icebreaker to connect with the friend that we hadn’t been in touch with for a while - It gives you the pretext to do it.”

During the time of pandemic or isolation, memories can serve as a reminder of the times before the pandemic and can serve as stimuli of positive thinking. Memories associated with people close to them make subjects feel supported, and sometimes lead to the stronger bond or renewal of the friendship.

Hope

“During the pandemic, everyone just tries to cheer up and comfort that it will be as it used to be.”

Looking back at the memories subbjects indicated that this activity can be a source of hope.

Uncertainty

“During these uncertain times, it’s almost impossible to make some plans [to recreate those memories].”

During the interview, only one subject out of five reported that memories could have a negative impact, due to the uncertainty associated with making new plans affected by constantly changing pandemic measures.

What evokes memories?

“During moving I found the picture that was taken together with my aunt and I immediately shared it”

Subjects have reported that their memories are mostly evoked by Pictures, Objects, Meeting with other person or conversations. However the most meaningful are the spontaneous activities, such as the unplanned discovery of a picture or object associated with a positive memory.

Distraction

“It is better to go through isolation when you don’t have to think about it”
Crossword - “It works to relax me”
“During the stay at the hospital you don’t want to feel sick you want to forget your sickness.”

The distraction had been found to have a positive impact on the patients during the unpleasant times. Distraction can take many forms, one of the participants mentioned crosswords - which is the activity that keeps the mind busy and help to drag the focus, in this case, from the stay at the hospital.

By Memories

“Positive memories can serve as a distraction especially if it’s positive and it makes me laugh”

During the interviews subjects related memories as a way to serve as a distraction from illness, which could have a positive impact especially during the stay in the hospital.

By Advice And support

“When sharing the memories or having a chat in general we as seniors tend to more and more share some tips on how to treat some common illnesses or exchange some tips on - What is healthy? (etc.) “

Giving advice is another form of distraction, that gives also a feeling of compassion and support.

2 Ambient Participation

Togetherness

“I feel stronger when someone follows the same activity even if we weren’t participating in the same activity”

Participants who live together with their loved ones indicated that they feel more productive and are more motivated when they follow the same activity. An example could be working remotely from home. This type of activity is not intended to be teamwork, everyone is focused on their tasks and work.

Safety

“Ambient participation gives me the feeling of safety, I know that someone is at home.”

Knowing somebody is there makes the participant feel safe.

Common Ambient Activities

“Listening to some music, having the same dinner even when not eating together, creates the feeling of being at home.”

Common ambient activities, such as listening to the same ambient music increases the feeling of togetherness.

Unobtrusive

“Last day I was just hanging my clothes and I was talking to my cousin I’m doing my housework and she is doing hers “

Unobtrusiveness is preferred by millennials it helps them to focus on their daily tasks and at the same time, they can have a meaningful chat

Care

“Nice to be taken care of - when at home - My parents would sometimes bring me a snack”

Participants feel taken care of when others do small tasks or things for them.

3 Active Participation

Easiness of communication

“You can watch something together and you can comment on it”
“Watching series simultaneously chatting in between, sending the voice memos and having a FaceTime during breaks. In my opinion, it was the best what we could do about this activity. It felt like a usual/ normal situation”

Participants especially millennials tend to recreate some of the activities that they would participate in during the stay at home. A great example is the use of Netflix’s group session, users can watch content simultaneously without losing small interactions.

Meaningful chat

“Walk with my father – It’s more about the conversation.”
“The most meaningful is a conversation that takes place during those activities. It deepens the friendship.”

Activities done together are special however the main value is the conversation.

Togetherness as Activity

“Having a dinner together – I could imagine having it even digitally with another person”
“Activity or interaction is not that important as a fact that someone remembers about you and want to talk with you and wants to share more like what is he/she doing at the moment.”
“We also play with kids sometimes over the phone It gives us joy and happiness to be a part of their life even for a bit.”
“Same activity like playing a game together you don’t usually talk but you are in the game you share the activity.”

Participants want to be a part of the life of their loved ones. sharing the thoughts but also showing the space where the other person is at can give the feeling of being there. Common activités are transgenerational. Baby boomers want to be a part of their kids’ and grandkids’ life, same as the Millenials are willing to be close to their parents - baby boomers. One of the participants indicated that sometimes the activity is just about the activity - having the same objective, like for example in multiplayer games.

Conclusions

The primary outcome of the study pointed out generational differences related to the perception of closeness. Participants representing Generation Y said that closeness means the easiness of connection, and for the contrast for the Baby boomers, closeness means to support. Participants had also been asked to talk about the proposed interactions and how they could influence closeness. Most of the positive feedback focused on “Common Activities” and the activities involving Memories and activities that evoke memories. Participants referred to “Common Activities” such as a walk, holiday, or a family meeting as an activity that supports togetherness and enable meaningful conversations. During the interviews, distraction was found to be one of the critical elements for the patients. Interviewees indicated that memories might also be associated with the distraction that might help the patient stay in prolonged isolation. Additional findings pointed out the relation between activities and memories where activities create the memories by themselves.

Findings from this cycle had been used to establish a future direction of the project and will be used later to develop further the concept.

Based on the findings, the List of Requirements was updated.

Defined List of Requirements

Target group

1. Patients who were admitted to the general ward and are being isolated.
2. Patients who were transferred into the general ward
3. Patients who spend an excessive amount of time in isolation
4. Families whose loved ones had been admitted to the general ward.
5. Patient at the beginning of recovery can be extremely tired but within a couple of days as the recovery progress, the patient has more energy to interact with loved ones.
6. Patients during the last stage of hospitalization with full motor skills.

Concept requirements

The design needs...

7. To be easily accessible
8. To enable social presence
9. To create a meaningful entertainment
10. To facilitate mindful conversations
11. To be unobtrusive
12. To be inviting to use
13. To evoke positive memories
14. To create a new way of communication
15. To be accessible for the patient in every stage of the treatment
16. To facilitate the bidirectional way of communication, when patients are able to communicate
17. To be suitable for one-way communication, when the patient is unable to communicate
18. To support closeness – the feeling of being there, during the patients prolonged stay in the isolation.
19. To be fully operational by the patient and should not involve any help from the healthcare professionals
20. To enable a positive distraction from the place and situation, that could serve also as a reminder of a better times.
21. To show the support given by the loved ones
22. To enable an easiness of communication
23. To support the transgenerational way of communication
24. To recreate a feeling of togetherness – while sharing the same activity

Initial Concepts

More defined concepts had been created in order to distinguish the directions and possible solutions.

Concept 1

Concept consist of:

On the patient side:
A multifunctional dashboard and a camera. Projector or a TV to display the memories or activities at the patient's room

Family will have only an app.

Creates the possibility of sending voice messages, sharing pictures and videos by the Family. Easy to use by the elderly and people with limited mobility. Supports the transgenerational way of communication. It gives the possibility to communicate with the patient's Family easily. [Press to record message]

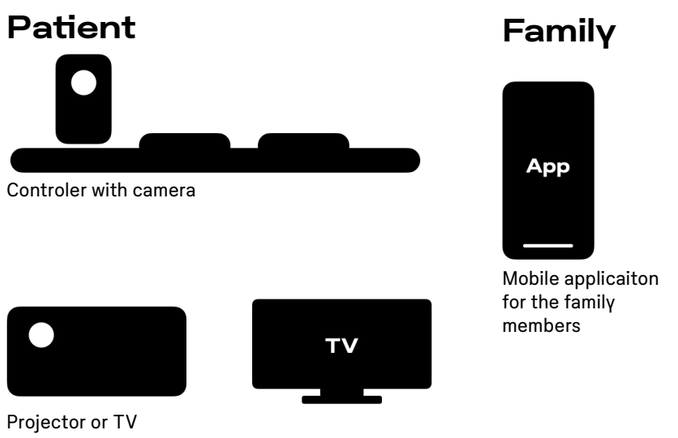


Figure 35. Concept 1 - Possible solution schematic.

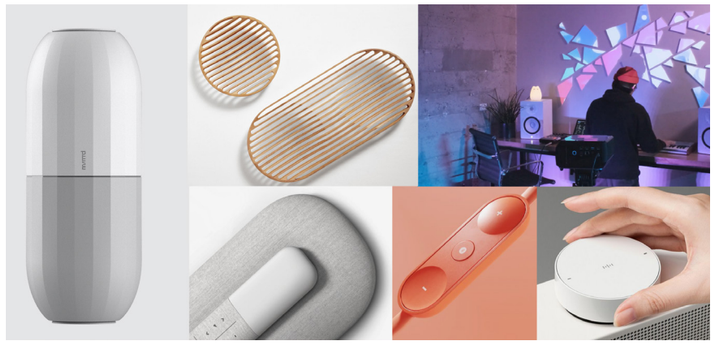


Figure 36. Concept 1 - Mood board.

Concept 2

Concept consist of :

On the patient side:
A smart device with screen, which can be used as a communicator. An app as a remote control for the device.

Family will have a wearable with microphone and a speaker, wearable with camera and the mobile application

It gives the feeling of closeness by giving a wearable to the family members. Wearable A could work as a Walkie-Talkie and send some visual signals by tapping on it. Wearable B will have a built-in camera to make the connection easier. The display would act as an intelligent device controlled by gestures and voice. Where, by voice commands, a user could start the conversation or send the voice memos. Users, by the use of the app, will be able to share memories with each other.

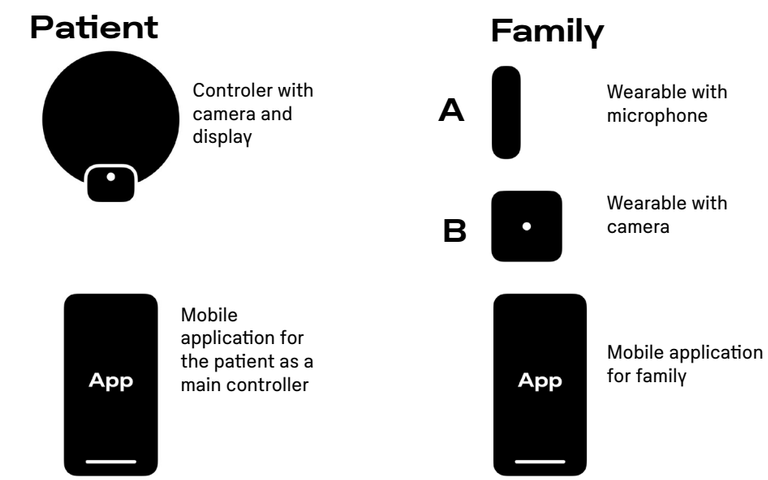


Figure 37. Concept 2 - Possible solution schematic.

Figure 38. Concept 2 - Mood board.

6
Second Cycle

The second cycle brought the creation of the personas and user scenarios. To find the meaning of closeness, desk research had been conducted focusing on the needs of the patient and family. The cycle was focused on finding the three main stakeholders' needs, which led to the more elaborated ideation. The cycle is intended to propose more defined concepts that will shape the final concept.

Figure 39. The overview of the design process of the first cycle.

Personas

For a better understanding of the target group, it was decided to create the personas. Personas were created basing on the previous interviews from the beginning of the project, including the interviews with the ICU nurse, the ex COVID-19 patient, and partly the interviews conducted during the first cycle interviews. Three personas had been created Ted – patient, Irene – patient's wife, Kate – patient's daughter. Personas later had been used to create the scenarios describing the use of the concepts created later in the process.

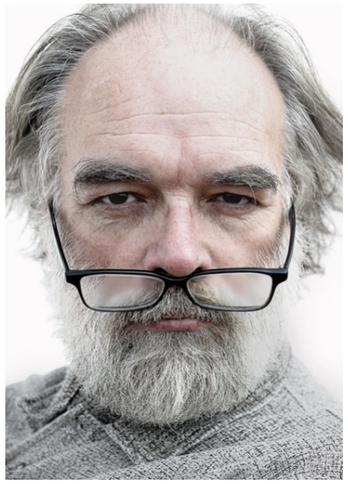
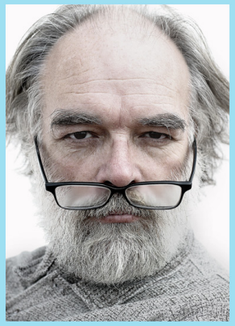


Figure 40. Persona Ted – Patient

Figure 41. Persona Irene – Patient's wife

Figure 42. Persona Kate – Patient's daughter



Ted

65 years old

Me Generation

Education
The University of California, Berkeley

Occupation
Retiring Senior Engineer

Hobbies

Hiking
Loves spending actively time with his family during his free time.

Tennis
Especially playing with his daughter

Tech entusiast
Ted is always looking for the newest available tech solutions

Current status

Ted is currently hospitalized, with a confirmed COVID-19 virus. Due to the pandemic, and the high possibility of spreading the disease, Ted needs to stay in the isolation for around one and a half week.

The first three days of hospitalization were tough for him. In the beginning, he had problems with breathing and a high fever. He was very weak, it was hard to communicate but he wanted to update his family about his current situation same as he wished to have more energy to talk with his family.

Ted had an access to TV and his iPad. Initially, he used a TV as the main distraction but due to the overwhelming information about coronavirus, he decided to keep it off. After the fourth day, Ted felt better and he started to use his iPad to communicate with family, update friends, browse the internet.

Ted felt lonely, without the closest family. He missed the smallest interactions such as having meals with his family and playing tennis with his daughter.

"During the stay at the hospital you don't want to feel sick **you want to forget yours sickness."**

"It is better to go through isolation when you **don't have to think about it"**

Figure 43. Detailed persona Ted – Patient

Irene

65 years old

Me Generation

Education
The University of California, Berkeley

Occupation
Senior financial analyst

Hobbies

Hiking
Loves spending actively time with his family during his free time.

Traveling
Exploring the world with her family

Current status

Irene is Ted's wife and a mother of Kate. She loves her work and she decided to still work as a financial analyst at the Bank of America. However, due to the pandemic, Irene works now remotely from her home.
Irene's working hours remained unchanged, she still works from 8 till 17.

She misses Ted and her longing is increased by not being able to visit her husband at the hospital. Her biggest struggle at the moment is to be closer to her husband.

The only possibility to communicate they have now is FaceTime, however, Ted feels really tired and every even short conversation costs him a lot of effort.

"I want to be a part of my family even if I can't see them"

Figure 44. Detailed persona Irene – Patient's wife

Kate

29 years old

Generation Y

Education

Pasadena School of Art

Occupation

Graphic Designer

Hobbies

Hiking
Loves spending actively time with his family during his free time.

Art
Kate loves to explore art museums to get inspired. She sometimes takes her parents with her.

Current status

Kate finished university and got a job at Marketing Agency in San Francisco where she found her boyfriend. Kate misses her family, before the pandemic they used to spend at least one week of a month together.
Due to the pandemic, her work has been switched to the remote. Knowing that her father stays at the hospital she feels anxious, she would like to feel a connection between them to show her support. Kate is trying to call her father at least once during the day to check on him. Depending on Ted's health status they have sometimes longer or shorter conversations.

"It is nice to **remember** things especially when now we can't meet with my family"

"Walk with my father – It's **more about the conversation."**

"Memories can remind you about the people that support you"

Figure 45. Detailed persona Kate – Patient's daughter.

Scenarios

Scenarios had been created to envision better the everyday interactions between the family and the hospitalized patient.

The median length of hospital stays ranging from 4 to 21 days (Eleanor et al., 2020). However, it has been decided to refer mainly to the data collected through the interviews and reduce the scope to only a general ward patient suffering from mild to minimal symptoms of COVID–19.

The main finding was that the patient's needs are changing throughout the hospitalization. The first days after admission to the general ward, vulnerable patients mainly suffer from high fever and shortness of breath. Patients who are moved to the general ward are not always newly admitted. Some of them are being moved from the ICU, where they had been plugged into the ventilator. This also shows that the treatment is not always linear. The illness can relapse, leading to worsening patients' physical and mental state - resulting from prolonged hospitalization.

The distinction concerning the patient's health state was made, and it has resulted in the creation of a timeline, divided into two sections treatment and recovery. The first stage takes, on average, around five days. Patients during that stage cannot easily communicate. Most of the patients complain of coughing that disturbs communication, high fever, and lack of energy. Patients are trying to rest mainly.

However, during the recovery phase, patients are feeling better, their speech is still disturbed by cough, but they start to bore and want to interact more due to the compulsory isolation.

Detailed scenarios can be found in appendix D.

Their needs

Firstly, the scenarios' key moments had been highlighted and moved to the matrix, where they were assed with emotions and needs. Overview of needs was created in a visual form representing a "heat map" for each persona Fig 46,47,48, based on The Typology of Thirteen Fundamental Needs for Human-Centered Design created by Pieter Desmet and Steven Fokkinga (Desmet et al., 2020). Basing on the scenarios, all the relevant needs had been listed and evaluated. (Appendix D)
The matrix helped to converge the critical moments of hospitalization and family scenarios.

The results show that patient needs are shifting from the moment he enters the isolated room the need of feeling closeness–relatedness with his loved ones increases (Verhaeghe et al., 2005). Throughout the hospitalization patient also need is to be positively distracted – stimuli, which could potentially affect his well-being and evoke positive memories and thoughts. The last highlighted need relates to security and being informed by the family about them to minimize the feeling of detachment but also by healthcare professionals about the current treatment.

The family's needs are similar to the patient's. The strongest one has been indicated as relatedness - the feeling of closeness. The family also wants to be informed about their loved one's health status, but they also want to know his emotional well-being – to fulfill the need for competence. Lastly, the family always wants to help. However, they do not always know how to show their involvement and help. Here there has been indicated the vital need for purpose, that can serve as (solution) a straightforward way of providing help, that can result as a meaningful connection.

Figure 46. Overview of the patient's thirteen fundamental needs. The most deprived needs are highlighted.

Figure 47. Overview of the patient's wife's thirteen fundamental needs. The most deprived needs are highlighted.

Family – Kate

Figure 48. Overview of the patient's daughter's thirteen fundamental needs. The most deprived needs are highlighted.

Patient

Relatedness	To feel closeness
Stimulation	To be distracted
Security	To be informed

Figure 49. Summary of the most deprived needs for the patient

Family

Relatedness	To feel closeness unobtrusively
Competence	To know patient's feeling and state of health
Purpose	To have a meaningful connection and know how to provide help

Figure 50. Summary of the most deprived needs for the family

Ideation

The IDEO methods had been used to summarize and structurize findings and to facilitate the ideation process.

Insights statement

The method had been chosen to identify and validate the most crucial moments - pain points crucial for closeness. Method helped to create clear insights such as:

Feeling of Closeness

Insight had been found at the early beginning of the project and confirmed to be one of the fundamental human needs - Relatedness. The insight had been gathered throughout the interviews with the ex-COVID-19 patient. The desk research where the study focused on the patients' isolation showed the devastating results of isolation effected in loneliness (MacKellaig, 1987). Moreover, social isolation and loneliness increase the risk of depression and possibly anxiety (Loades et al., 2020). The feeling of closeness is disturbed by the pandemic measures - visitors are not allowed in most hospitals, and the current communication method can be achieved only by voice or video call. Moreover, those activities are insufficient throughout the hospitalization patient feels mostly exhausted and rarely initiates the calls by himself.

Distraction

The importance of the distraction had been found at the end of the first cycle, and the ex-patients primarily indicated it. Distraction is seen as a powerful method that can cope with a prolonged stay at the hospital. If the distraction is positive, it can take a short shift in the focus from the current situation. (Huisman et al., 2012)

Information

It has been found that information is one of the primary needs of the family of the hospitalized patient. Information can give the assurance, feeling of control, and can increase the feeling

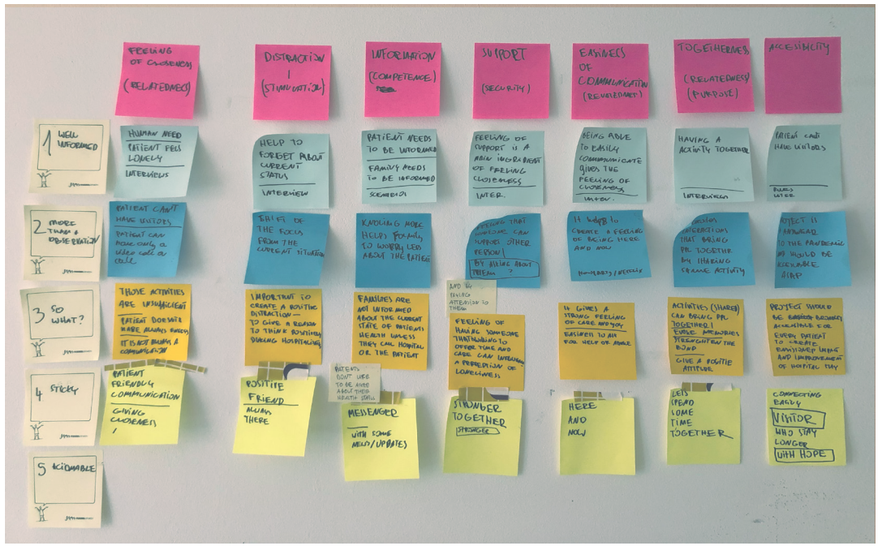


Figure 51. Insights Statement - Effect of ideation

of closeness. Considering the scope of this project (prolonged hospitalization inside the general ward), information should be directed to the patient to serve as an update and prevent the patient from further detachment from his loved ones. (Verhaeghe, S. et al 2005)

Support

Most of the hospitalized ex-patients indicated that the feeling of support is essential. During the previous interviews, participants representing the generation of baby boomers asked about the meaning of closeness indicated as first support. Support can be divided into the functional – emotional, financial, provision of information, and structural – that refers to the size, type, frequency, and quality of contact of the supportive network of people surrounding the patient. (Polikandrioti et al., 2011)(Broadhead et al., 1989)

Easiness of communication

This principle can significantly reflect the frequency of contact, and it has been derived from the interview with participants representing Generation Y.

Togetherness

The insight suggest recreating and strengthening the family bond, envisioned as a common activity.

Accessibility/ Feasibility

This insight is more a requirement that needs to be taken into account. The project had been envisioned as a response to the current pandemic situation. Concerning feasibility – cleanability, development costs, and possible development in a short period, the project should also be easily accessible to every patient.

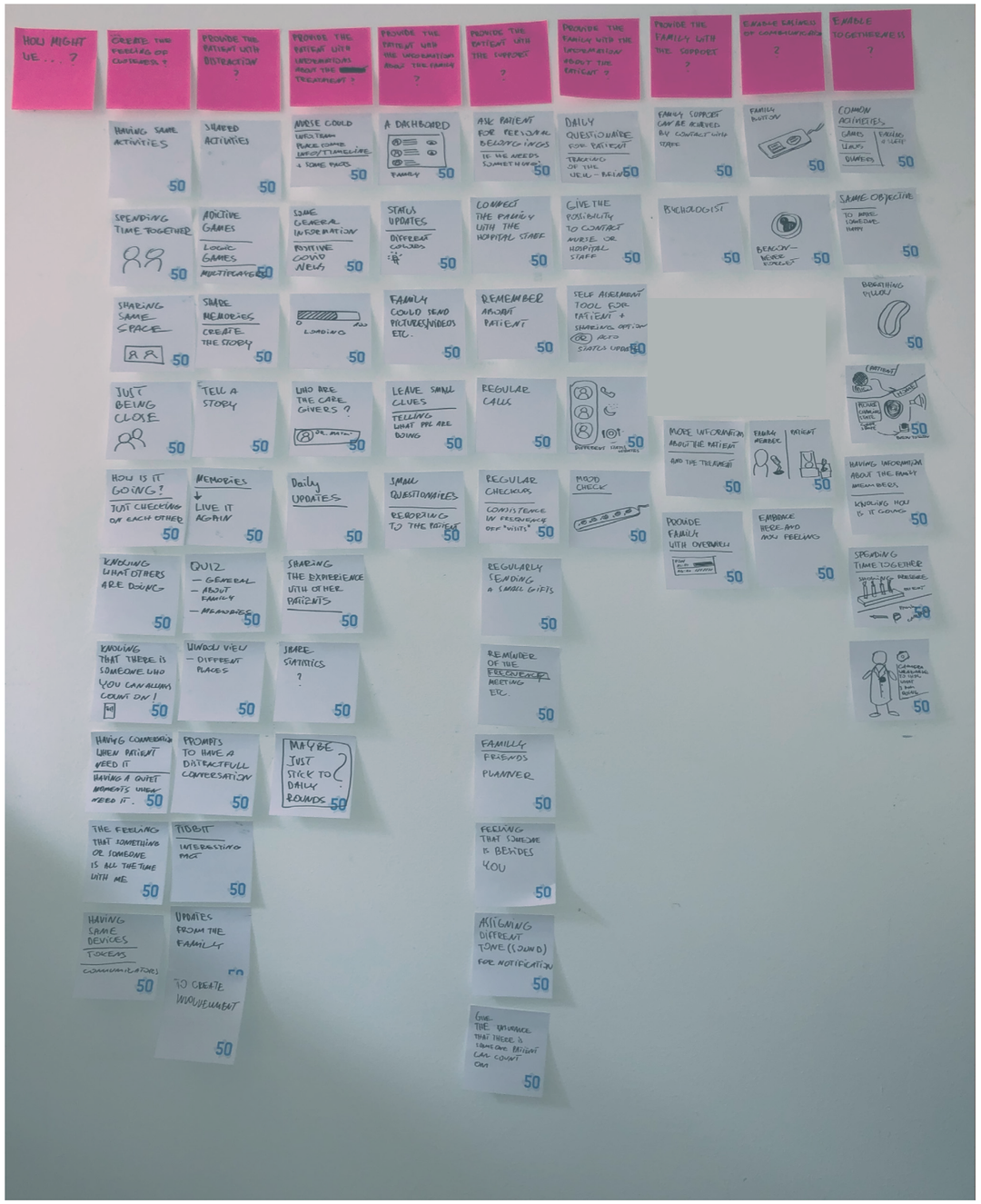


Figure 52. How might we? - Result of ideation

How might we?

HMW1 questions were formulated regarding the insight statements to generate several possible answers and broaden the possible outcome.

The questions had been used to evoke creativity, which resulted in the brainstorming session. The ideas generated during the brainstorming session were divided and bundled into two concepts.

Formulated questions:

How might we create the feeling of closeness?
How might we provide the patient with distraction?
How might we provide the patient with information about the treatment?
How might we support the patient?
How might we provide the family with information about the patient?
How might we provide the family with the support?
How might we enable easiness of communication?
How might we enable togetherness?
How might we propose a concept fulfilling the feasibility requirements?

1. IDEO.org. (n.d.). How Might We. Design Kit. Retrieved from https://www.designkit.org/methods/3

Concepts

This cycle resulted in the creation of two concepts that were differentiated by their interactions and physical.
The first concept, “Modular Closeness,” was created in contrast to the “Digital Closeness” to assess the values and answer the question
Does it have to be physical to evoke the feeling of closeness?

Modular Closeness

The concept was created during the ideation session as a direct response to communication/ connection and an active/ passive way of connecting.
The core of the concept relies on deconstructing the senses and sensors usually used to communicate and create the single modules.

The modular Closeness concept consists of 6 modules and the docking plate. Four of them (microphone, speaker, screen, camera) are designed to recreate a more active communication way. However, here the interaction can also be passive and unobtrusive. Users could take only one of the modules to send the voice message or the camera module to share the moments, while the speaker module and screen module would serve as a receiver. Here the envisioned interaction is intended to increase the easiness of communication. For example, the user could actuate the microphone to send the voice message by simply picking the module. On the other side, the user would receive the visual notification on the speaker module – telling that someone left the voice message.

The unobtrusive communication method is represented by two modules: the module of “breath/ air” and warmth. The context looks the same as inactive communication (users have the same modules on each end). However, users are provided with different modalities. The breath module can register someone’s breath on one side, and it can represent it as a blown air on the other side. The warmth module also provides direct interaction and registers the warmth on one side to represent it.

This concept’s modularity also creates the possibilities of stacking up(connecting) the modules: to have a call - user would pick up microphone and speaker, for an unobtrusive connection - user can stack breath module with warmth module. More of the exemplary interaction can be found in the user scenarios appendix E.

Digital Closeness

The “Digital Closeness” is basing on the Modular Closeness concept; however, the concept does not provide the user with any physical pieces. The app can be connected with the TV or other display placed in the patient’s room. The application focuses on sharing the memories and creating content – moments for the patient. App provides the functionality as a social media where the patient is the only receiver of the content. The app is measured as being less unique in comparison to the Modular Closeness. However, it is easier to implement, which will have a more substantial impact and create it accessible for many patients.

Scenarios of use had been created and can be found in appendix F.

Modular Closeness

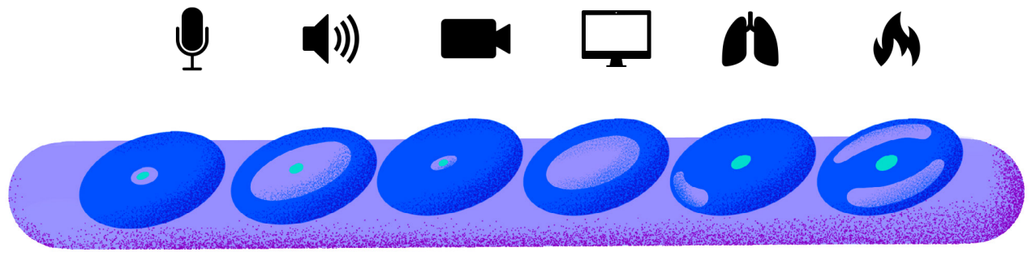


Figure 53. Modular Closeness - vision of the product

Digital Closeness

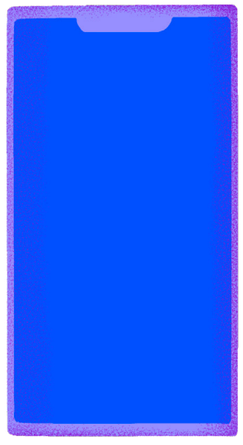


Figure 54. Digital Closeness - Symbolic representation

Concept Evaluation

Evaluation of the concepts
The evaluation and the decision-making at this stage of the project were needed to direct focus on the most impactful and feasible concept. To evaluate the concepts, the relevant criteria had been created – derived from the List of Requirements. Additionally, the principal, decisive criteria were marked with the higher weight – Feasibility and Ownership.

Created qualities were later used in the Harris Profile method to visualize the strengths and weaknesses of the concepts that create a graphic representation needed for comparison of multiple concepts.

Results

Due to its novelty and simplicity, the first concept scored the highest in the qualities as Innovation, Adaptability, and Easiness of connection. However, it has not met the essential requirements such as Feasibility and Ownership.

Ownership is complicated due to the relatively short use of the product – the median of the patient stay varies from 4 to 21 days. Additionally, hospitals have very limited budgeting, especially during the current pandemic and the chances of providing every patient with the solution are not realistic.

Feasibility is an essential quality considering the future implementation of the product or service. The consideration was taken into account that the application's digital solution would have the most pleasing qualities that could lead to the implementation. Harris profile can be found in the Appendix G.

Conclusions

The patient's needs had been mapped and assessed. The most prominent need for both sides is relatedness, the need for closeness.

The most feasible solution to implement will be the mobile application connected with a TV located inside the patient's room.

Summary

Requirements	Qualites assessed	Modular Closeness	Digital Closeness
To be easily accessible	**Feasibility** (including cost and the way of implementing)	-2	2
To create a meaningful entertainment	**Entertaining**	1	1
To facilitate mindful conversations	**Facilitating Mindful Conversations**	2	1
To be unobtrusive	**Unobtrusiveness**	2	-1
To evoke positive memories	**Evoking Positive Memories**	-1	2
To create a new way of communication	**Innovative** (in the way of creating the connection)	2	1
To be accessible for the patient in every stage of the treatment	**Adaptability**	2	-1
To support closeness – the feeling of being there, during the patients prolonged stay in the isolation	**Closeness**	2	1
To enable a positive distraction from the place and situation, that could serve also as a reminder of a better times.	**Distractive**	1	1
To show the support given by the loved ones	**Supportive**	2	1
To enable an easiness of communication	**Easiness of communication**	2	1
To recreate a feeling of togetherness – while sharing the same activity	**Togetherness**	-1	1
	Ownership	-2	2
		10	**12**

Figure 55. Summary of Harris profile for Modular Closeness and Digital Closeness.

7
Third Cycle

The third cycle consists of the three main components: research, design, and the finalizing part focused on the definition of the user flow. Chapter seven will focus on defining the main principles the app should consist of. In the generative session, its goals and results will be summarized. The final storyboard was developed that led to creating the final user flow of the mobile application.

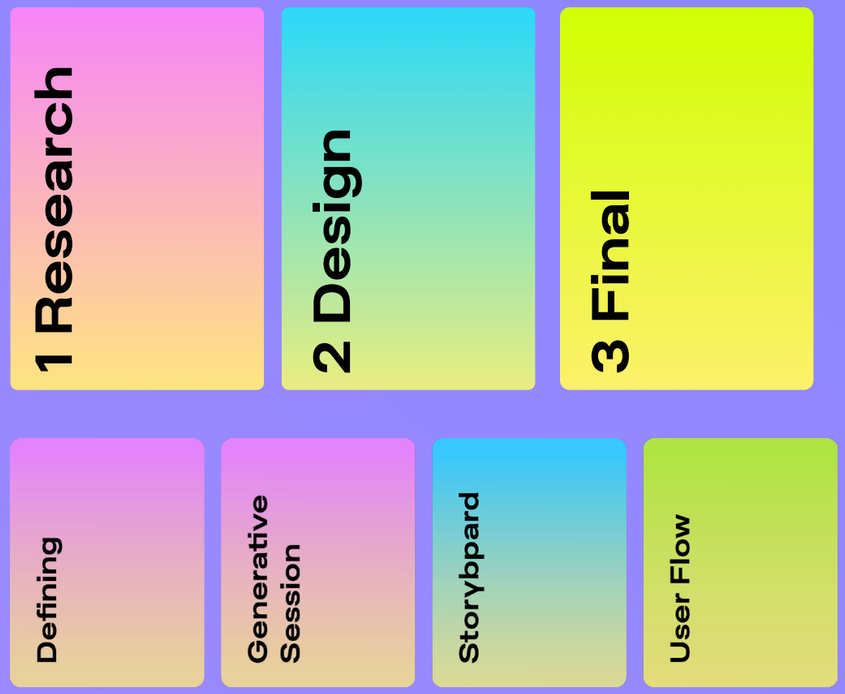


Figure 56. The overview of the design process of the first cycle.

Defining

The core values of the concepts created during the second cycle were reassessed and merged with the first cycle's outcomes. Modular Closeness brought the adaptability and uniqueness that rely upon the modularity of the concept. Digital Closeness stands for sharing memories, moments, and activities.

Functionality

The app's intended functionality would help the patient feel the support of his family by sending him memories and moments. Both will serve as a distraction and as information in the form of short videos and pictures to reduce the detachment from loved ones. The patient will be able to display received content on the TV installed in his room. Memories and moments will have multiple layers, besides the visual modalities to enrich sent content, consisting of writing a story, sharing music, recording the voice message, and sharing the location.

Family by creating content has a simple objective and given clear purpose to help the patient feel a bit closer to the home environment and especially his loved ones.

Adaptability

Adaptability refers to creating the two modes that will best suit the current needs of the patient. Further ideation brought the concept of having two modes Unobtrusive and Active.

Unobtrusive mode relates to the first days of the treatment where the patient is mainly exhausted, and his motor skills can be limited. It is hard for the patient to communicate with his family during the first few days. The functionality of the app in the unobtrusive mode will be limited for the patient. The application will be possible to use as a dropbox for the received content from family, such as memories and moments, which will be delivered unobtrusively to the patient. The patient will have only a possibility to send simple, pre-made reactions.

Active mode is envisioned to be switched on after the couple of first days of hospitalization, where the patient would start his recovery. It has been found during the research that patients during that time are experiencing the feeling of boredom. In contrast, this mode will give the patient the possibility to have more complex reactions, but the incoming content will not display on the patient's TV till the patient decides to reveal the memory. Revealing the memory could consist of a short quiz where the patient would have to discover the hidden meaning of the moment or memory that would create a more involving experience and possibly positively distract the patient.

Uniqueness

These interactions' uniqueness would mainly depend on creating the content only for the patient, by his loved ones. This activity could increase the feeling of support and give the sense that everyone is currently thinking about the patient and

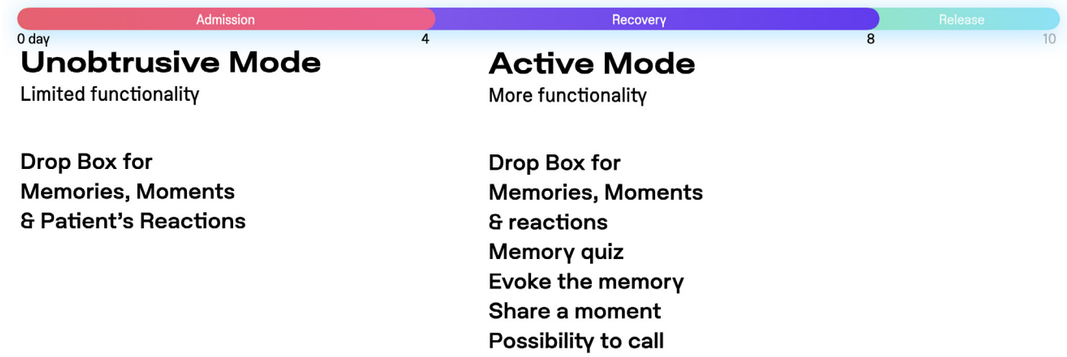


Figure 57. Timeline of patient's hospitalization with the proposed mode division.

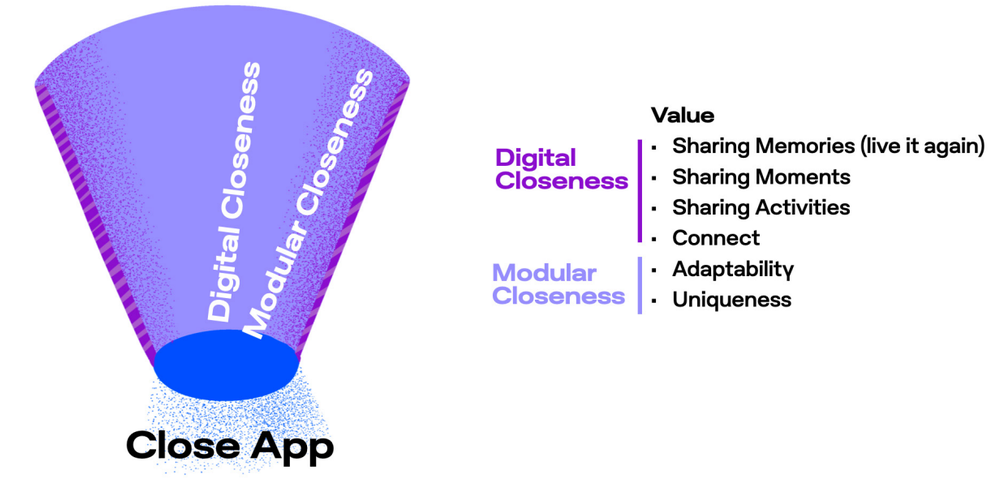


Figure 58. Visualization of the key elements, from the two previous concept that will be merged and used to create the new concept - Close App

is willing to share the memories that could evoke positive emotions and create a joyous moment. Sending moments will help keep the patient updated with all his social networks, which could trigger positive reactions that will create a positive memory.

Share a memory – create a moment.
Share a moment – create a memory.

Flow

The application will offer a different experience for the member of the family and the patient. The family side will mainly focus on creating the content while the patient will be most revealing the sent content.

Creators side

The family will have the possibility to simply send the memory or the moment they would like to share. Additionally, to create a more playful approach, the users will have the possibility to use prompts or challenges in case of moments that will facilitate the process of evoking the memories. During the next step, the user will be asked to upload or create the content choosing the different modalities, appendix K.

Patient side – Unobtrusive mode

In this scenario patient will receive the silent notification, letting him know that he received the message. The app will store every message sent to the patient, which will be revealed and displayed as a timeline. The patient will be able to trigger a revealing process on his mobile application.

Patient side – Active mode

The significant difference, as mentioned before, depends on creating a more involving experience for the patient. Besides revealing and guessing different modalities that create the moment or the memory, the patient will also be able to respond by sending small “stories” using differentiated modalities. This could allow informing the patient’s loved ones by sharing updates about his current health status. Additionally patient could express his wishes and gratitude.

To illustrate the workflow of the application, the storyboard has been made and can be seen in the appendix H.

Generative Session

A generative session was organized with nine (n=9) participants ranging from recent graduates of engineering-related fields to industry professionals. The main goal was to investigate the unobtrusive way of presenting the messages and the meaning of unobtrusiveness. The sessions’ anticipated outcomes should intentionally broaden the range of possible directions or refine and evaluate ideas for interactions without affecting the overall design.

Due to the current pandemic measures, it has been decided that the generative session will take place online, and additionally, participants will generate their ideas and send results back. Participants first received a short presentation explaining the project’s background, the design goal, concept, and the exemplary flow of the application briefly. Problem statements were formulated in three questions, and participants were asked to generate the ideas – in the form of drawings or text.

1. What the unobtrusive way of communication means to you? How can it be achieved?

2. How should the patient interact with the application unobtrusively? (Taking for granted that every patient has a phone and a TV in the isolated room.)

3. How would you evoke memories?

After receiving the participants’ results, a follow-up meeting was held to get to know the participants’ stories and learn in-depth about the unobtrusive communication.

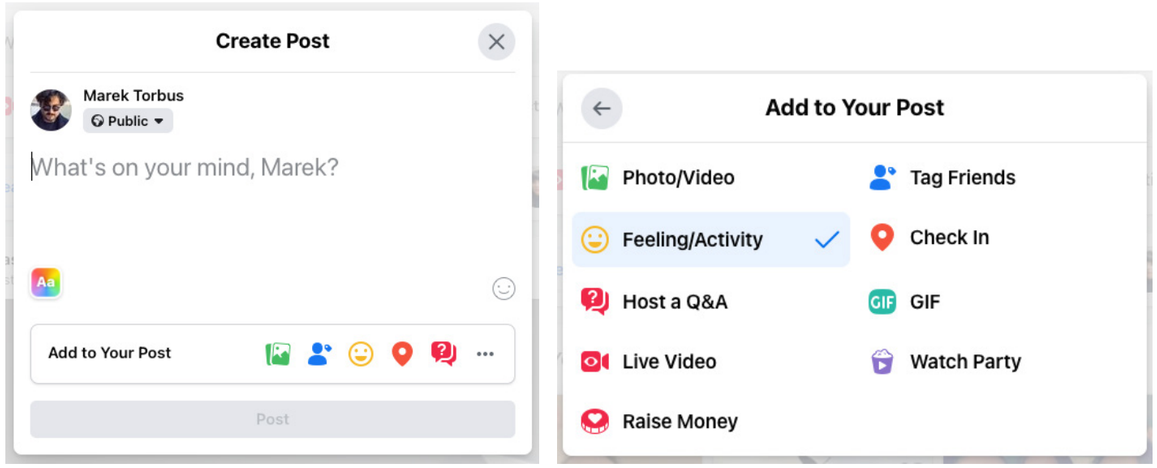


Figure 59. Facebooks “prompts” - recomendation created to guide the user through the process of creating a post, exisitng of different modalities.

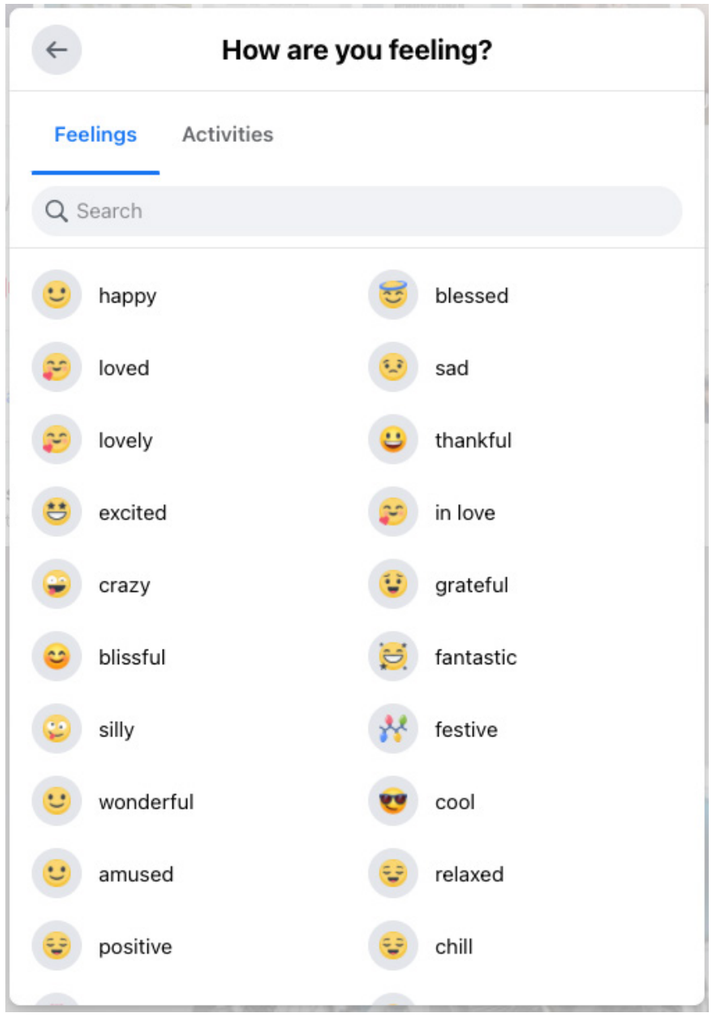


Figure 60. “How are you feeling?” – Designed by Facebook list of emotion that user can pick.

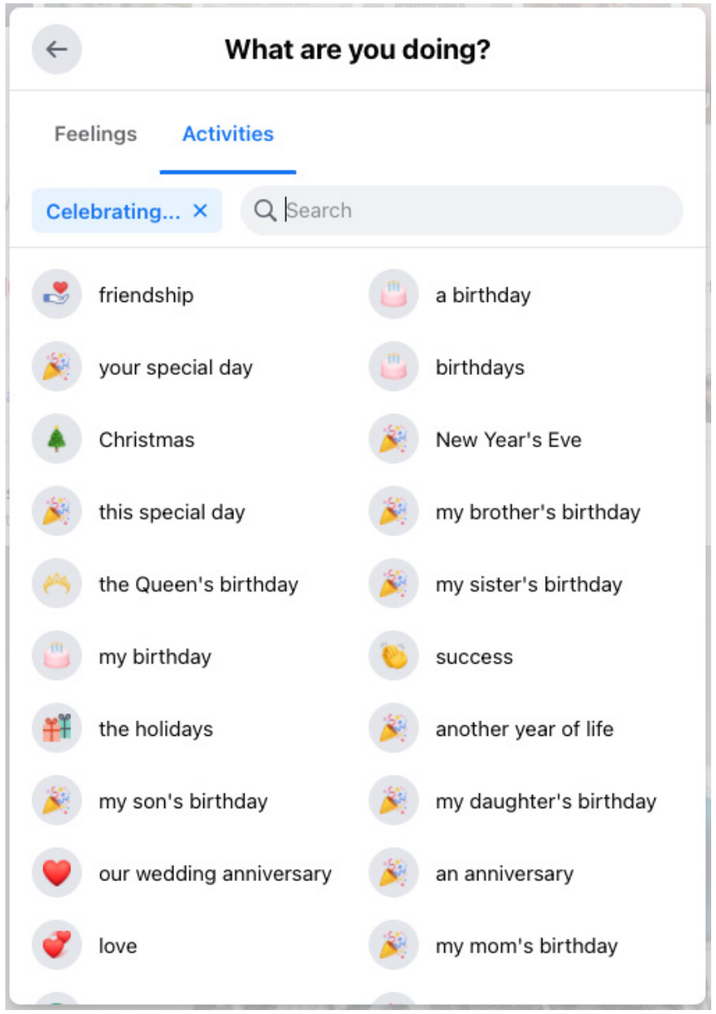


Figure 61. “What are you doing?” – Designed by Facebook list of activites that user can pick.

Figure 62. Home screen of Nintendo Mii Channel – representation of the users online (associated with memories and moemnts - waiting to reveal)

Results

Gathered ideas had been clustered into six groups and evaluated. Some results of the generative session can bee seen in Fig. 63,64 and appendix I.

Reactions

One of the participants' relatives suffered from covid 19. His insights validated the vital need for an unobtrusive way of communication, and the proposal was mainly concentrated around the reactions that the patients could send back to their loved ones.

Another suggestion refers to creating a patient's recovery reports that can serve as a form of informing the family about the patient's current health status. Recovery reports could be sent automatically, daily, after the finished round at the patient's room. This form of informing the family could be the most suitable at the beginning of hospitalization when the patient cannot communicate with the family.

Unobtrusiveness

Participants asked about the unobtrusive way of communications defined as an easy and accessible activity in the background, without affecting the behavior and no need to respond. This way of communication should be focusing on being present, not active. One of the participants compared the unobtrusiveness to the Philips Someo – line of products called "Wake up light." The light starts the pre-alarm wake-up process with low-intensity light turning on and gradually increases it until it reaches full glow and finally waking up the user.

"Unobtrusive way of communication means that it will not influence my behavior."

Some of the ascetics values were also proposed as "calm and soft visual identity" to represent the value of unobtrusiveness.

Another suggestion refers to the moment of revealing the memories and moments, which also should happen unobtrusively. The system should sense that the patient is awake, and the revealing process should not require any action. It can also be associated with mealtime, rituals – such as waking up or after the daily checkups.

Participants recommended investigating the depiction of the waiting to reveal memories. Memories and Moments were compared to Nintendo's Mii Channel(Fig.62), a virtual space made to create avatars. Every newly created user would appear in one shared space. The suggestion can relate to sent memories and moments which unobtrusively will show up in a shared space and wait till the patient reveals it.

Another suggestion associated with displaying the content refers to creating categories divided by different modalities (music, pictures, videos), time received, the date of the memory, and loved ones.

Sensor transparency

The idea of sensor transparency of the smartphone between the patient and patient's family had been highlighted. Currently, smartphones generate an enormous quantity of data that could be interpreted to evoke closeness. The exemplary solution could bring the preset sounds mirroring the current environment of the patient's closest family.

Evoking and sharing memories
Participants asked about the way of evoking the memories created an understanding of positive memories. Memories evoked with objects are significant – participants are related to the Intensive Care Units where the belongings surround the patients, objects that they are attached to emotionally, reminding them about the life outside of the ICU gives hope for a normal life. Besides objects, patients are surrounded by pictures of them and their family, mostly captured memories from the holidays.

Holidays and trips are also seen as positive life events that will be remembered. Some of the memories are also forgotten and exist only in the old photo albums and are evoked only while browsing them. The idea of creating prompts was recommended. Prompts are also broadly used by Facebook (Fig.59). Facebook uses them to summarize the shared event and encourage users to share their emotions and associated life events.

Accessibility

Participants highlighted that using the smartphone can be difficult for the patients to navigate through the app. The use of the physical piece – the knob had been suggested. Another suggestion is to use an Apple TV or similar remote controller with an intuitive touchpad and haptic feedback to add the physicality and create a more accessible way of browsing the memories and moments.

Another strategy was related to difficulties in reading or seeing text, especially taking into account elderly users. The voice-over had been proposed.

Possible drawbacks

One participant indicated that the memories could bring down the patient's mood and serve as a reminder of being trapped at the hospital. Instead, creating the moments could be more beneficial for the patients.

Limitations

As expected, the major limitation of the generative session was the online form of it. The ability to give a more in-depth explanation and the possibility of gathering participants together had a significant influence on an in-depth understanding of the project's background and the generated results. Referring to the physical piece, the cleanability issues were not included during the explanatory session, and also, participants were not informed about this decision being made.

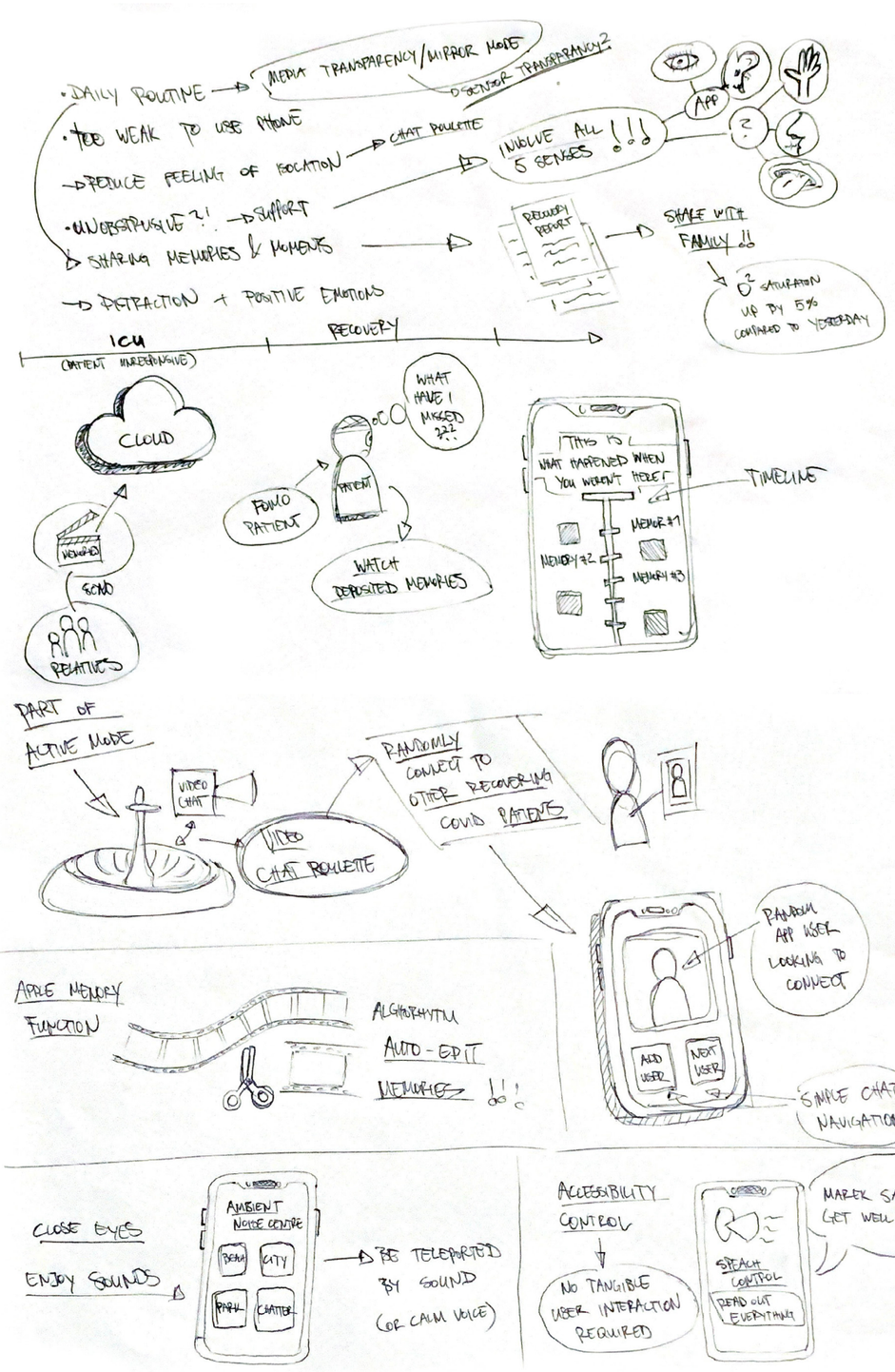


Figure 63. Results of the generative session from one of the partitipanct, showing the importance of the sensory transparency

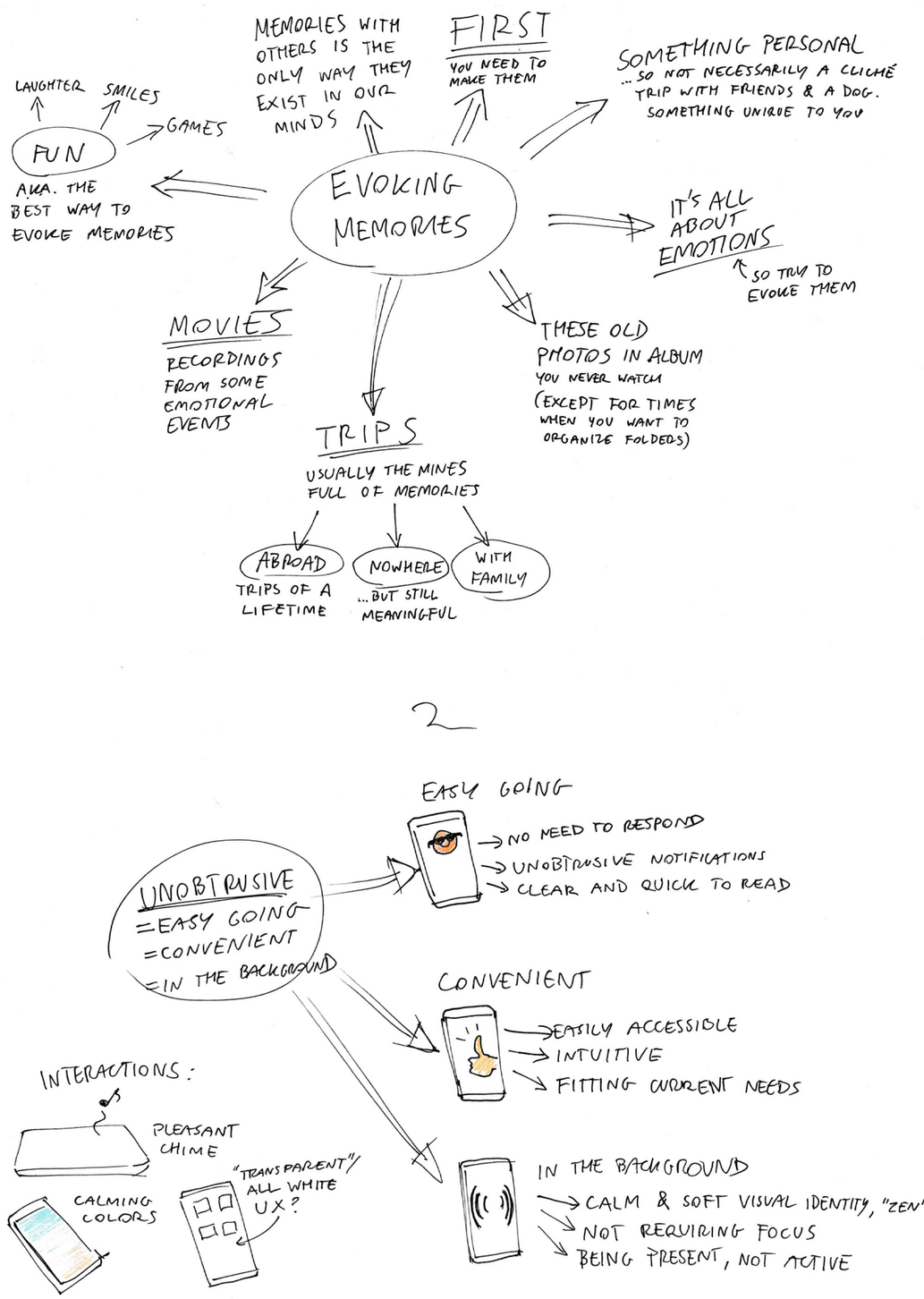


Figure 64. Result of the generative session from one of the participants, including brainwriting, touching up on the visual aspects of the app.

Experience Map

The entire experience map had been created to map the current patient's and family's experience. The key moments had been derived and further evaluated.

The current experience had been mapped basing on the data from interviews and desktop research. The map resulted in the creation of 16 interactions between the patient and the family together with the assessment of their emotions. (appendix J)

Process

The experience map turns out to be a helpful tool. However, the scope of the interactions was enormous. The decision was made to narrow down the scope of the project to seven key moments. (appendix J, second figure)

After finishing an analysis of the second iteration of the experience map, the validation had been made, resulting in narrowing down the scope and the initial functionality of the app.

The experience map had been narrowed down once more, this time focusing only on the unobtrusive side of the app. The final experience map consists out of 4 key moments - Figure 65.

Results

Current Experience

Loneliness – Frustration

The first key moment is focused on the first days of the patient's stay and the patient's shift from a cozy home to the new hospital environment. The dominant feeling during the prolonged isolation is loneliness and unfamiliarity. Patients, on average, spend ten days inside of the isolation.The patient's family does not know how to help, which leads directly to frustration.

Loneliness – Confusion

During the first days after admission, the patient is mainly exhausted and feels isolated. Furthermore, a strong cough is a common symptom during the COVID-19 illness that limits communication ability. Patients are also reluctant to use their mobile phones.

The family does not know what they can do to support the patient - they decide to call the patient less and let him rest. They are trying to send text messages.

Overwhelmed, Anxious – Worried

The patient feels tired and overwhelmed going through his phone and messages. He finds it difficult to respond to everything.

Family and friends send many messages and pictures but do not always get a response, which makes them worried even more.

Annoyance – Frustrated

The patient is improving but still recovering. The messages from the family do not always align with when he is awake. This causes the patient to be disturbed when he should be resting, which leads to frustration.

The family is not always aware of what time is the best for the patient to have a conversation or receive the message, leading to annoyance.

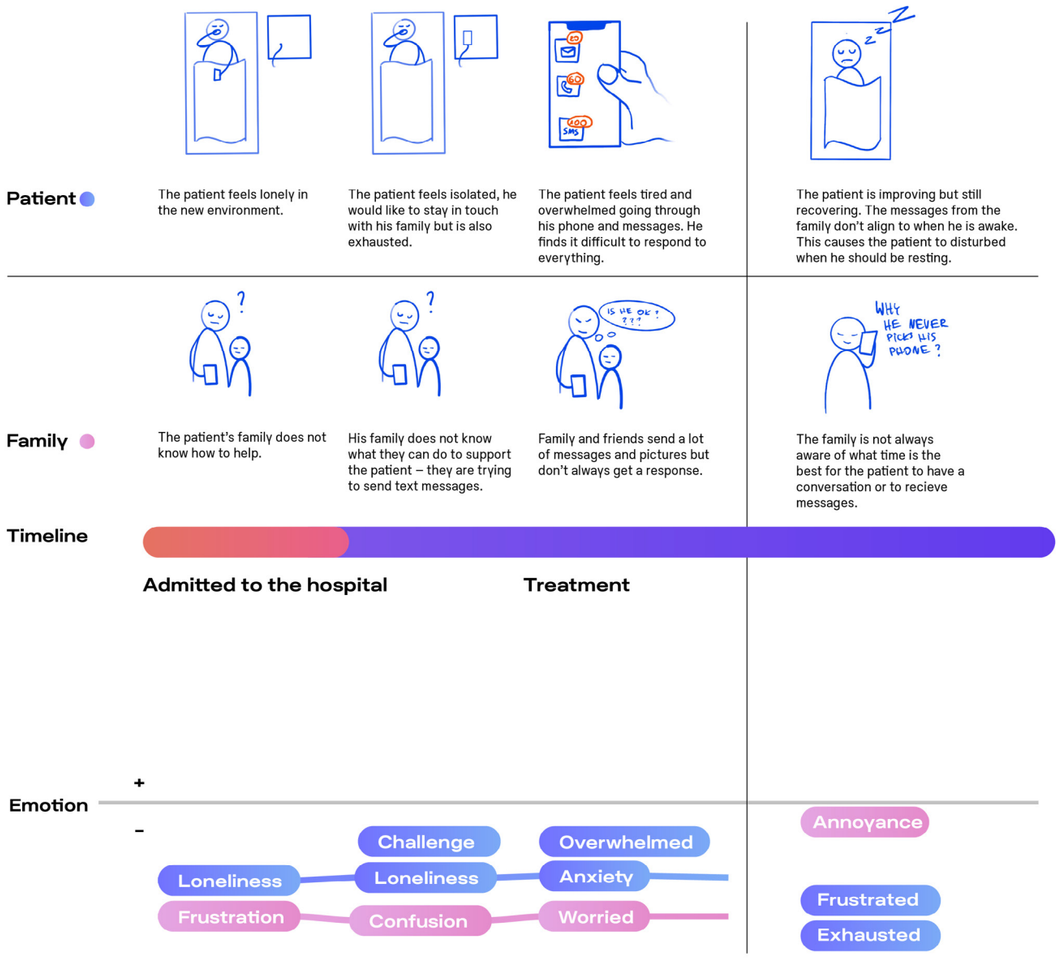


Figure 65. Current experience map - Including the interactions between the patient and family, together with the associated emotions.

The new experience

The new, improved experience was envisioned based on the research results and additionally supported by the outcomes from the generative session.

Closeness – Purpose, Satisfaction

The envisioned app shows the importance of memories and the moments to the family., They want to send pictures from the last holiday. During the process of composing the memory, they wrote a meaningful story to cheer up the patient, and additionally, they added the song that they discovered during that time. After composing the memory, they decided to send it.

The patient unobtrusively reveals the memory. The patient feels closer to his family - the memories evoke positive emotions.

Supported – Closeness

While the patient is not using the TV, the ambient environment of his loved one is being displayed. This helps to bring familiarity to the environment and serves as information about the patient's closed ones, which helps him to stay in the loop.

The family and patient are all the time unobtrusively connected -, the family can see if the patient is currently active(awake) or resting.

Relaxed, Supported – Relieved

The patient can view all of his notifications on the TV, including the memories and moments shared by the family. The patient can send back small preset reactions and voice messages to his family.

Family and friends send the content, giving them a purpose. Additionally, they are receiving small reactions and knowing that the patient is ok. Resulting in feeling relieved.

Undisturbed, Relieved – Conscious

The patient can quietly rest and recover, enjoying the ambient mode. All the notifications will be delivered quietly and will be shown on the patient's TV screen.

Sensor transparency works in two ways. The app informed the family that the patient is currently sleeping and that their message will be delivered unobtrusively.

Outcomes

The ambient environment is envisioned to be connected with only the closest family members - the location of the loved one will be used to present the familiar environment (in the form of a picture or video) - as a representation of the current location.

Focusing on the four key moments lead to narrowing the scope of the whole project to only the unobtrusive mode.

Redefining use scenario - focusing only on the unobtrusive side of the application.

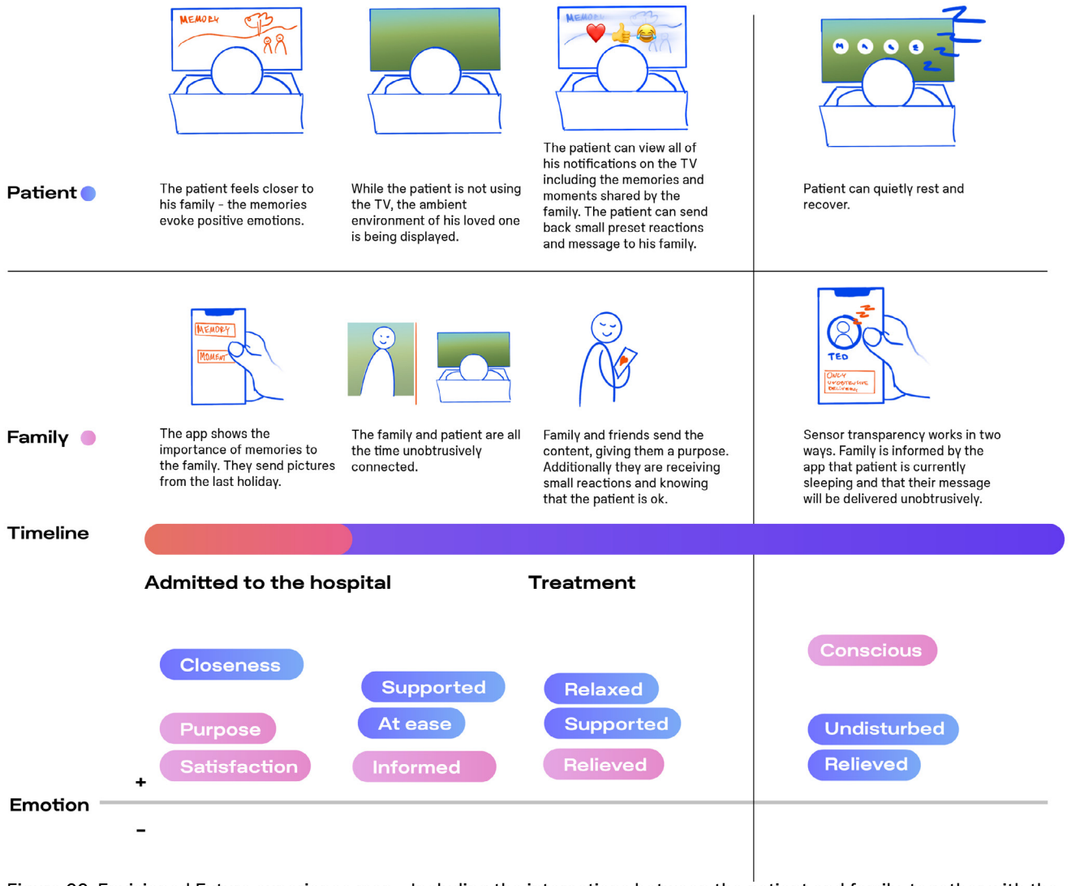


Figure 66. Envisioned Future experience map - Including the interactions between the patient and family, together with the associated emotions.

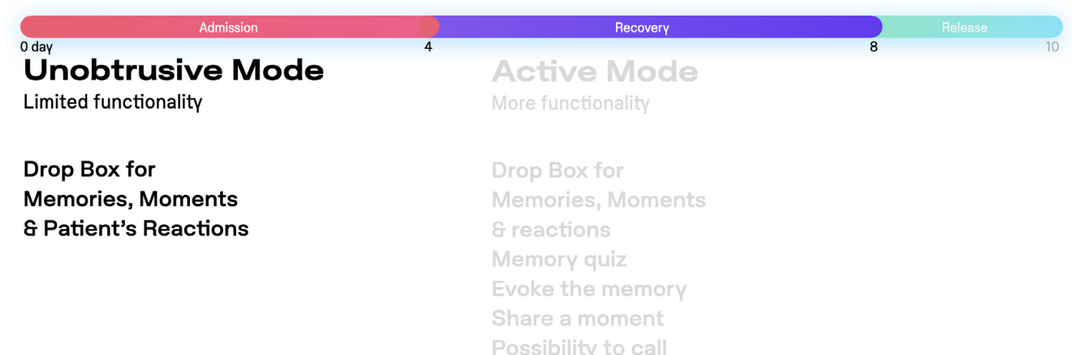
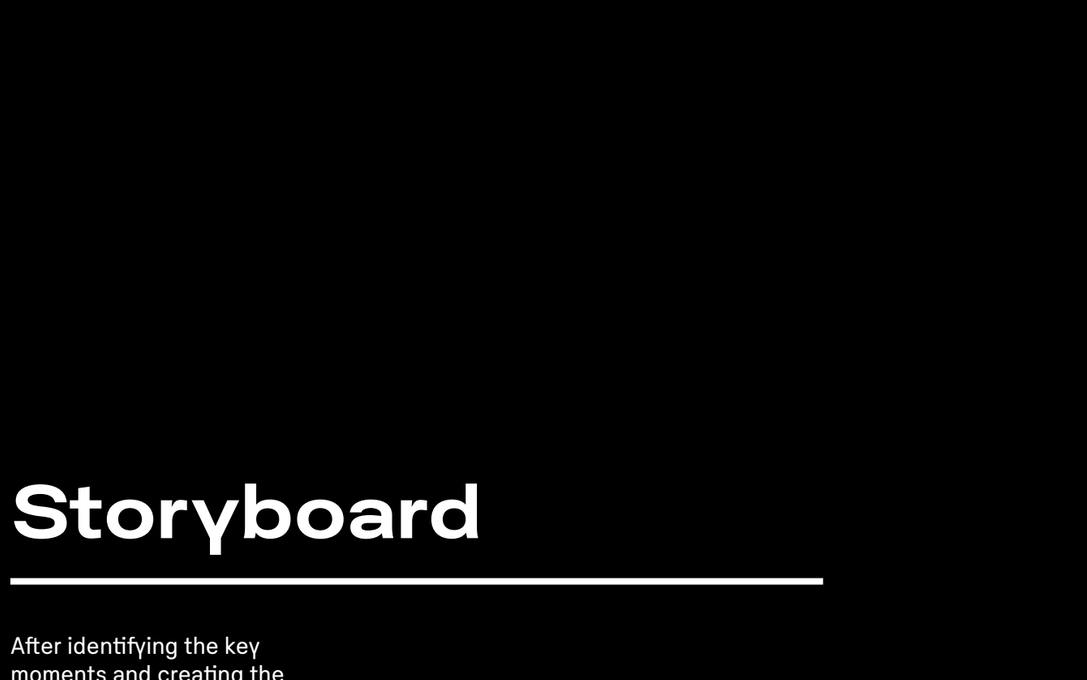


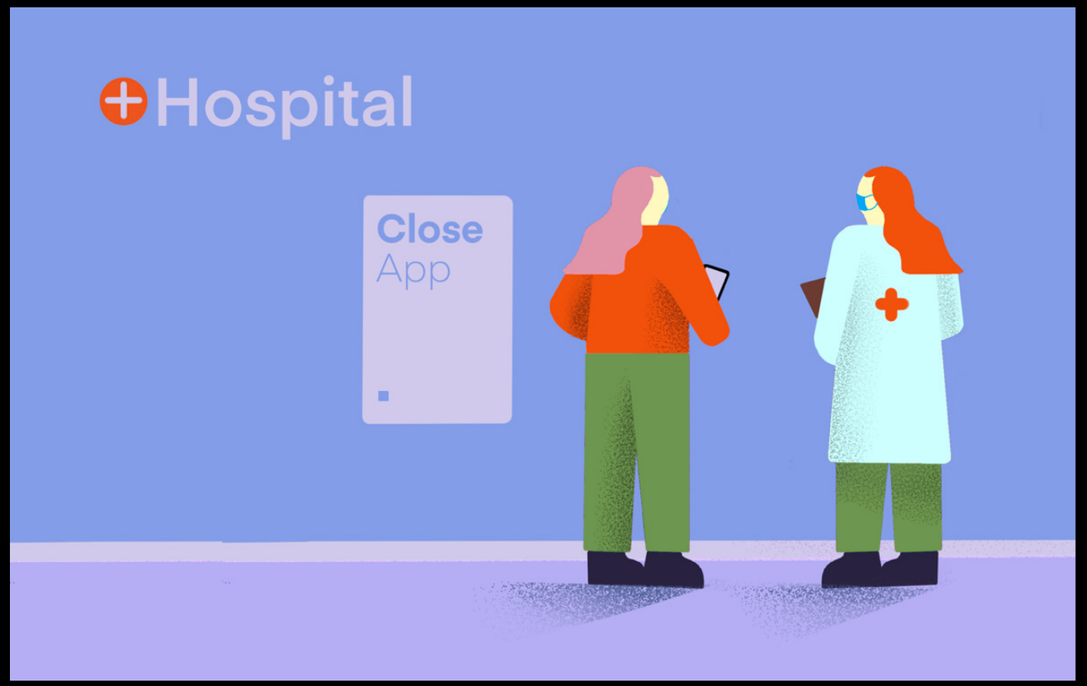
Figure 67. The timeline of the patient's hospitalization shows the result of narrowing the scope and the outcome focusing only on the Unobtrusive mode.

Storyboard

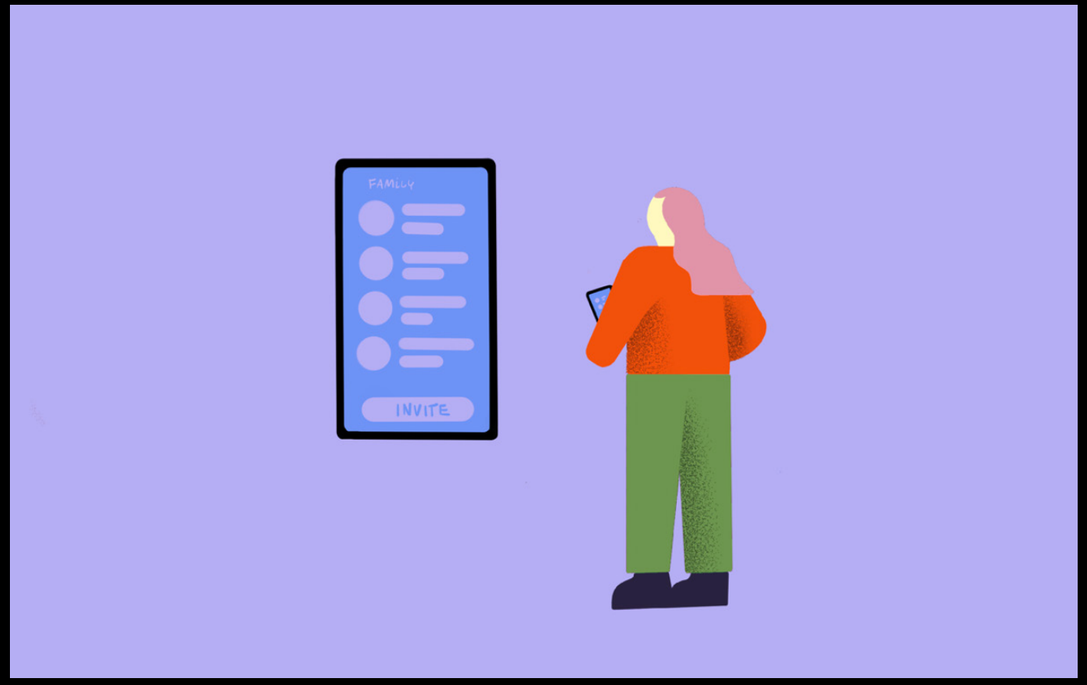
After identifying the key moments and creating the envisioned experience, the scenario had been redesign to fit current requirements.



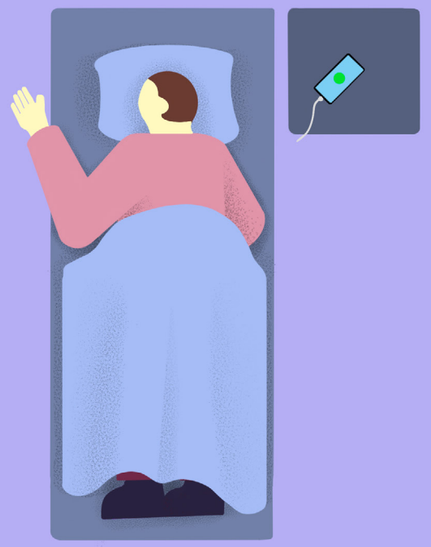
1 The journey starts from the patient’s admission. Here we can see that Ted is being admitted into the hospital due to mild COVID symptoms.



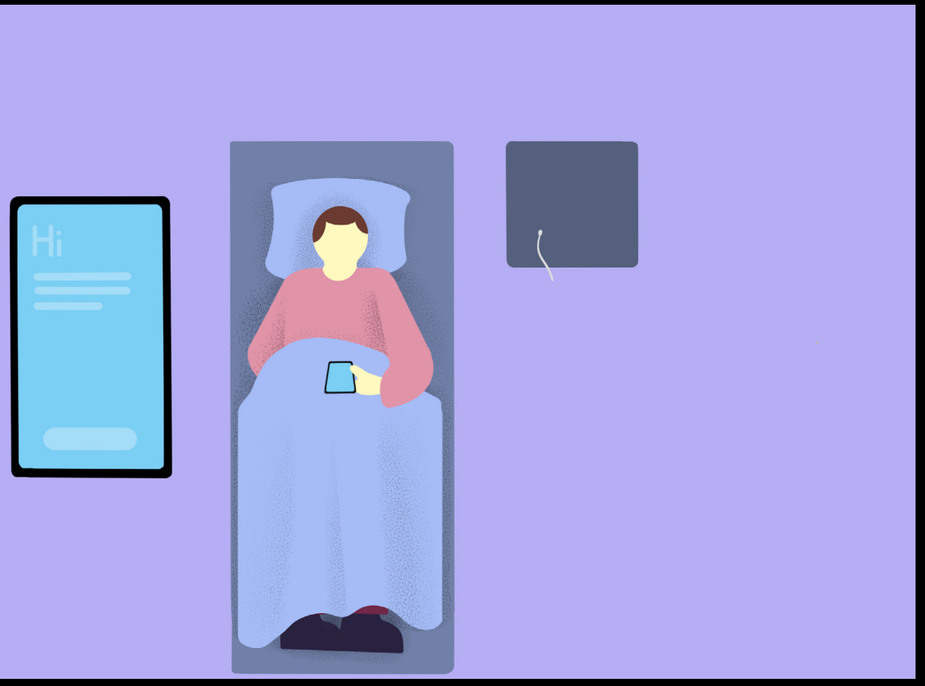
2 Irene is getting to know about the existence of the close app from the healthcare professional.



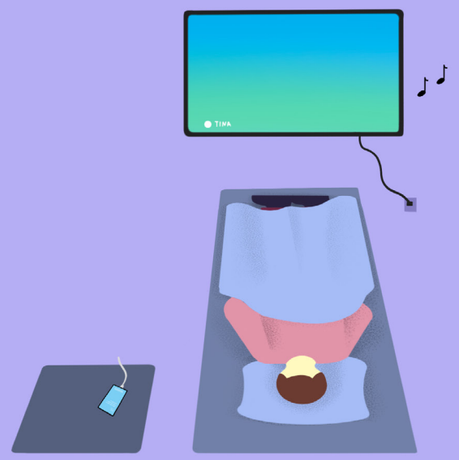
3 After installing the app, she gets acquired with its benefits related to the memories and moments.



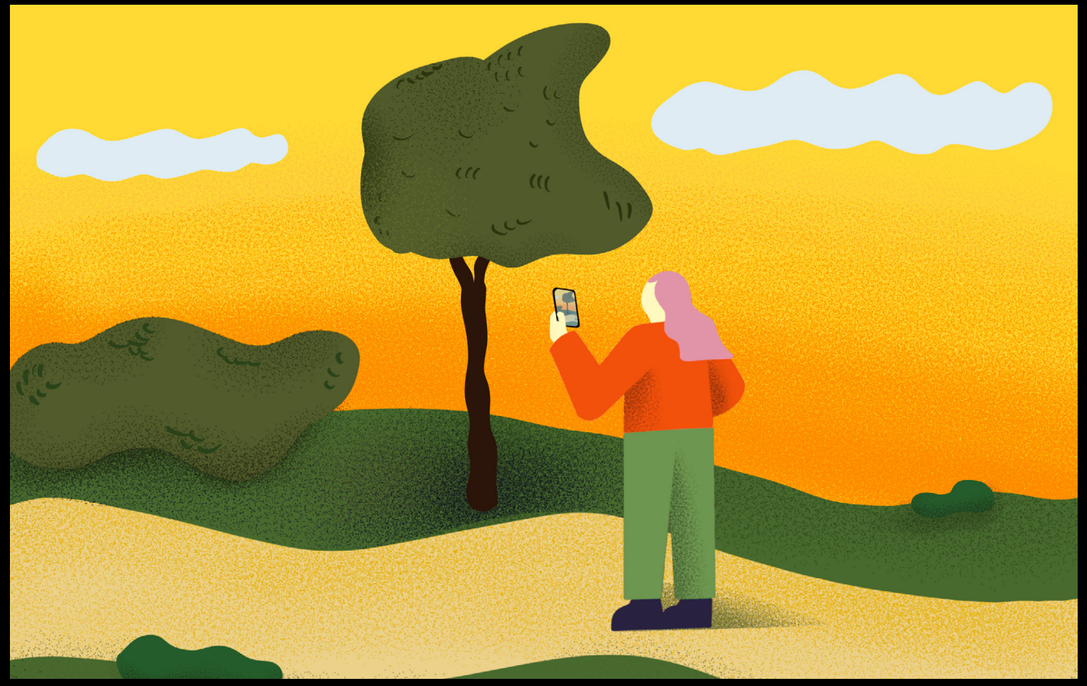
4 The first days of Ted’s hospitalization are very rough. Ted fights with high fever slight shortness of breath - he mostly naps throughout the day. Barely using the phone.



5 Ted finally checks his phone and knows that Irene sent him a text message with the link to install the app. After logging in with only one tap, Ted can start using the app. Irene set up everything before. She also invited his loved ones.

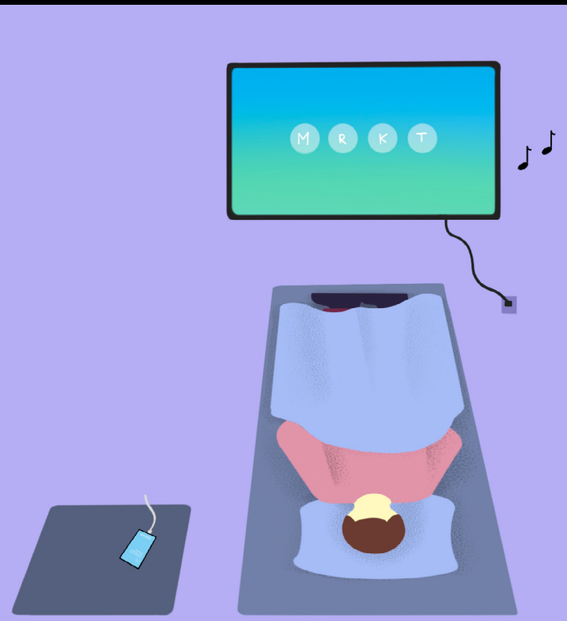


6 Here there is a moment for the ambient mode, which is always activated automatically when the patient is not using his mobile device. The patient can see the visual representation of the closest family member that can also be connected with calming music - as a further level of projection.

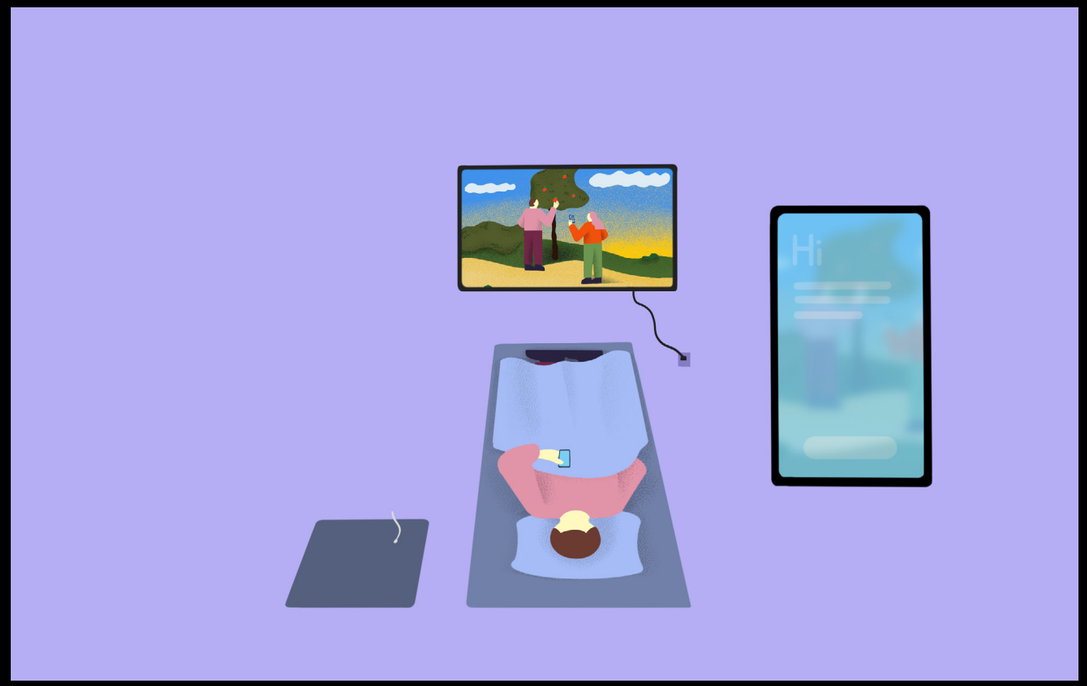


7 Memories and moments can be created using different modalities such as pictures, videos, music, sound recordings, or location. Kate takes a photo of the park where they always had a walk during Sunday afternoons

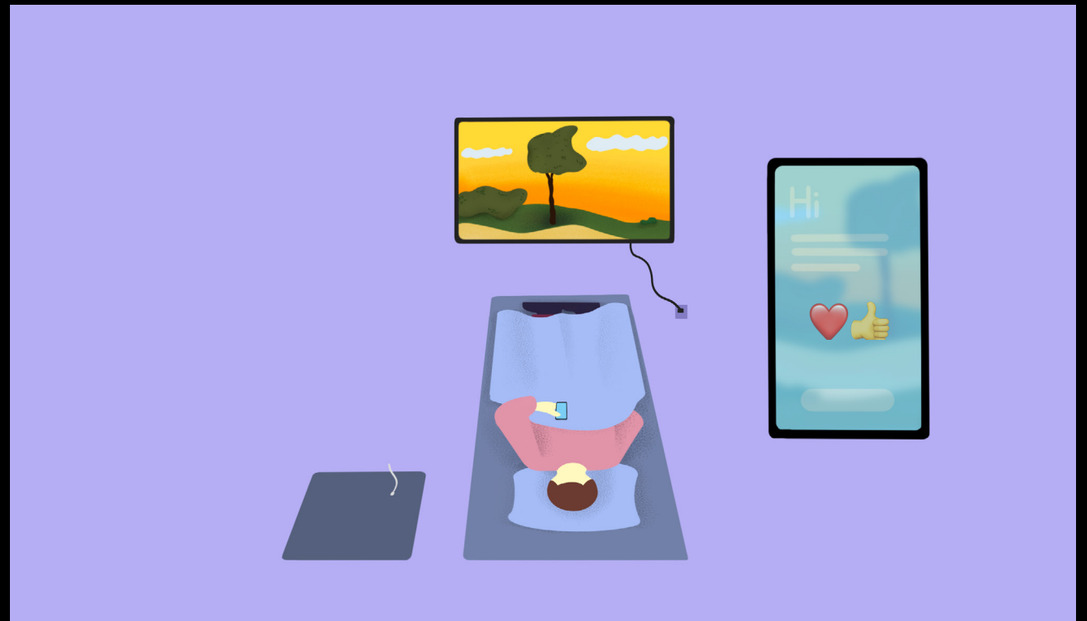
8 Irene takes a picture of the photo taken during Their last holidays



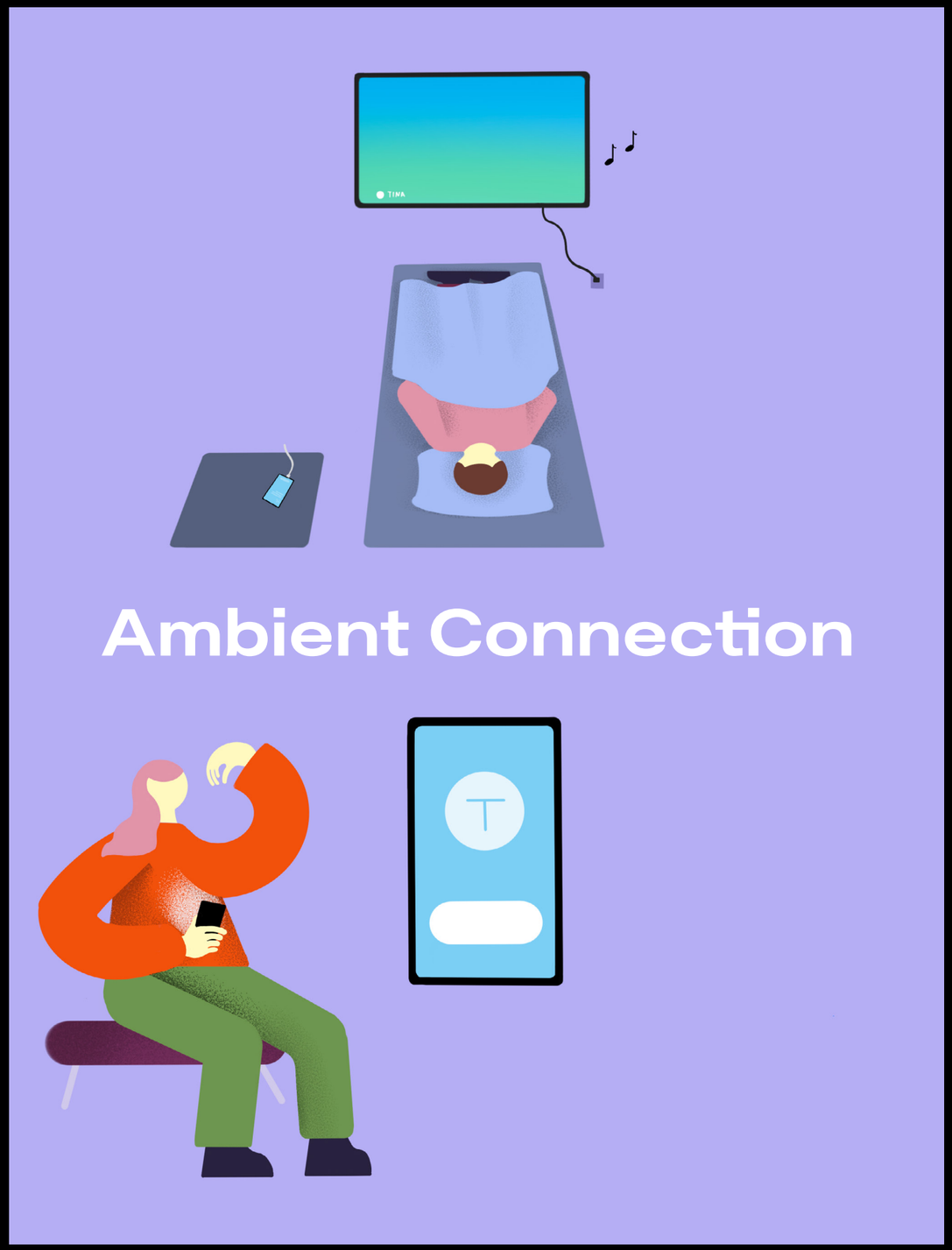
9 The patient is receiving moments and memories sent by his loved ones unobtrusively during his sleep. Shared Content displays on the screen in the form of pictures of the family and waits to be revealed by the patient.



10 Ted woke up and took his phone while the shared content started to reveal the memories and moments. After seeing all of them. He sent his reactions back to everyone.



11 Ted at any time can come back to them - to react to them, in the timeline section on his mobile app or inside the reactions section.



Ambient Connection

12 The ambient connection had been mainly envisioned to create the distraction, inform the patient, and bring the patient closer to his loved one. However, the sensory transparency can also work in both ways, informing the family about the current availability status of the patient.

User Flow

The user flow started basing on the previous iterations of the app (Appendix K). It led to the development of the detailed user flow that helped to understand better the complex system standing behind the app. During the process of creation, the flow evolved multiple times.

First steps

The base architecture consists of one app that serves two sides, family and patient. The first use of the app starts from the welcoming screen showing the benefits and impact of the app. During the following step, the user needs to define himself and choose between the patient or family.

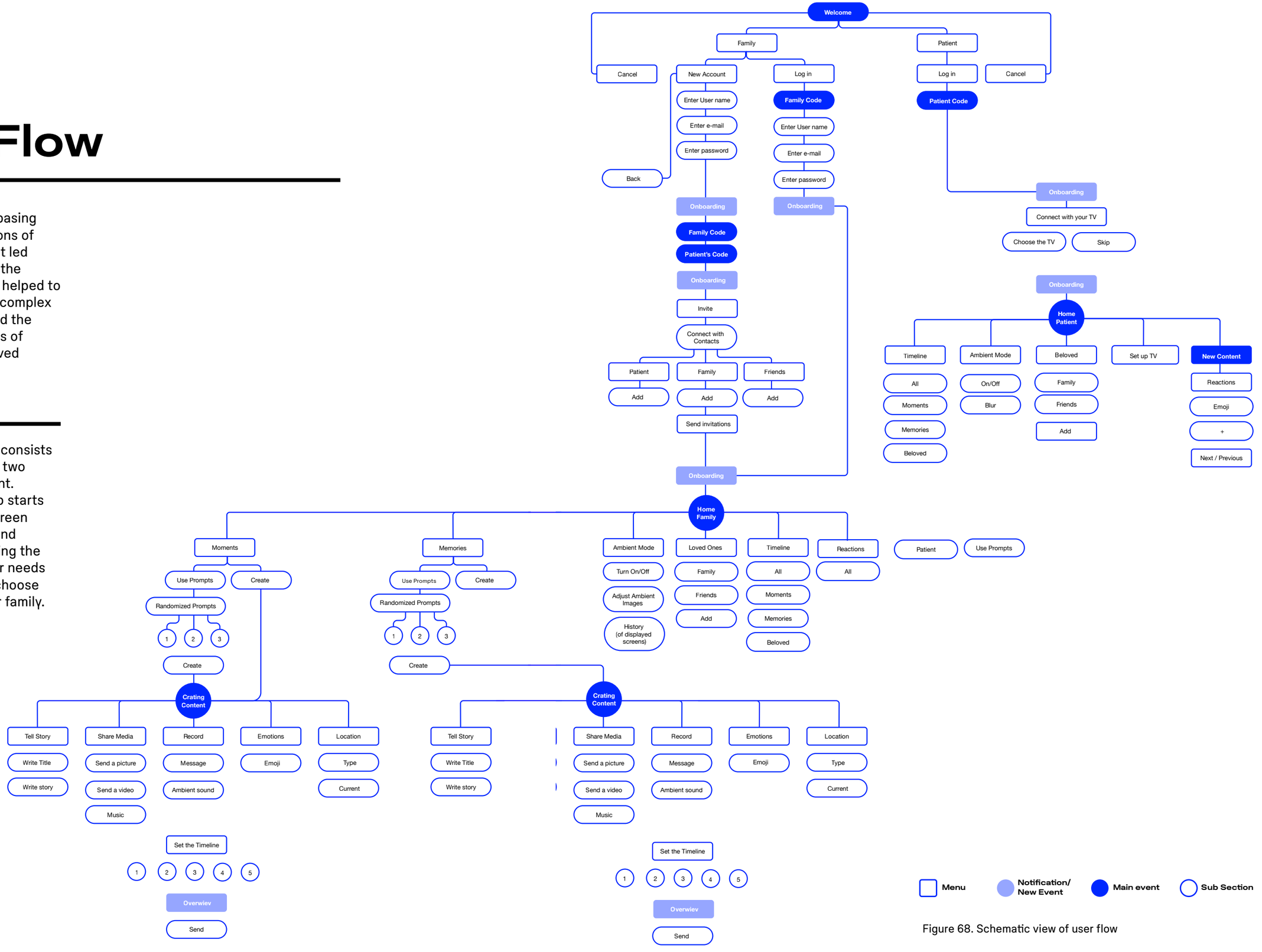


Figure 68. Schematic view of user flow

Family Member

The first use of the app will start from creating an account or connecting it with an existing account from social media. After the setup process, the family member will get two unique codes for the family and the patient. To reduce the burden of creating the account, the family sets up the account for the exhausted and ill patient. The family code will be used later for other loved ones who want to join this family. The patient code will be sent to the patient as a login that will allow him to enter the app.
The next step for the family is to invite the closest ones here. The first user will invite family, friends and also create an account for the patient.

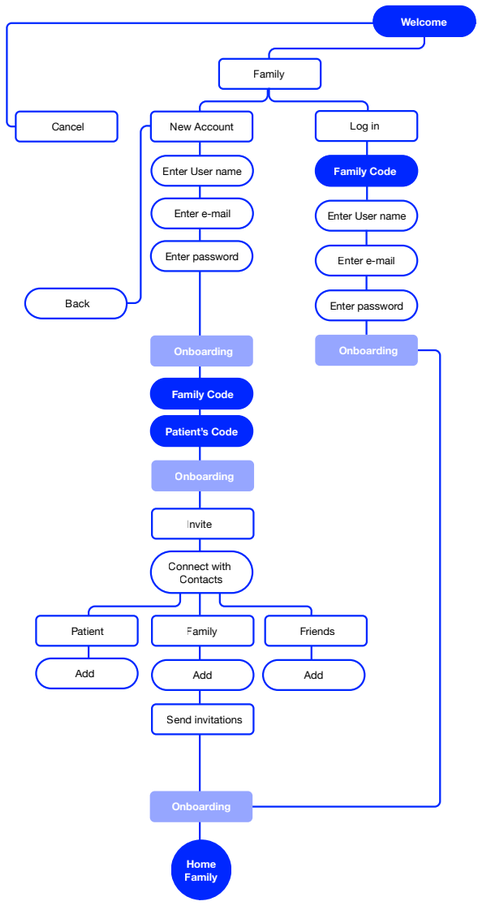


Figure 69. Schematic view of family's side onboarding of the app, and creation of the account.

Patient

The family sends the link via text message firstly to the App Store so the patient can download and install the app. The next step comes in the second link, which opens the app and logs in the patient.
At the firsts steps application asks the user to connect to a compatible casting device such as Chromecast or a smart TV. The patient can easily connect the device or skip this step.
It is also envisioned that here small help from the healthcare professionals can be needed to establish a connection or to set up the app - depending on the user's current cognitive abilities.
The onboarding screen shows up to guide the first-time user through the application showing the essential features.

Functions

Patient have access now to the timeline - ambient mode loved ones and the possibility to reveal the new content created by the family manually.

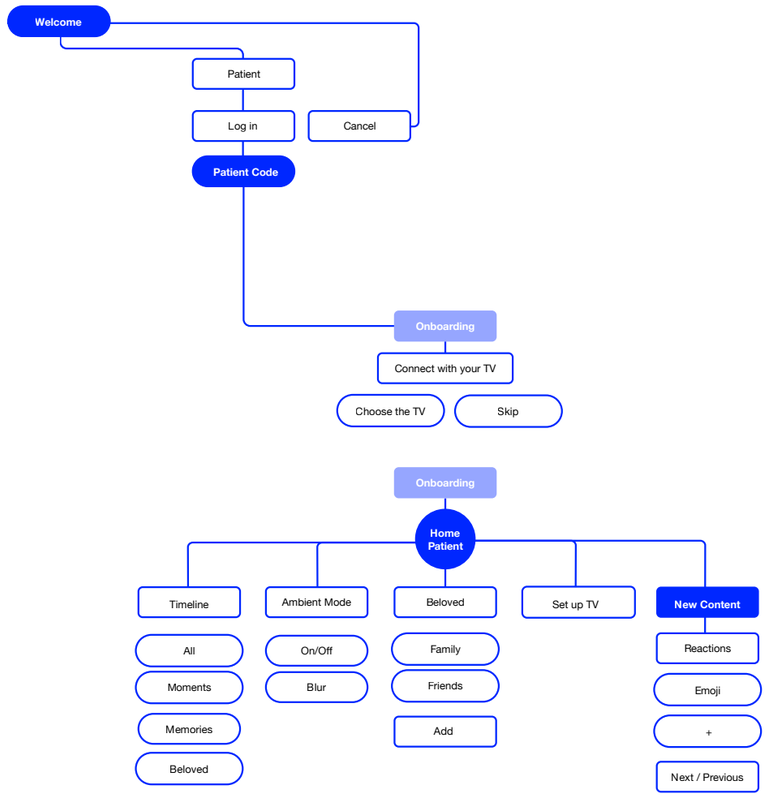


Figure 70. Schematic view of patient's onboarding and main functions side of the app.

Familiy's Functions

The family will have a similar menu with one main difference. They will be able to create the content with a clear division between the memories and moments. Memories similar to the Moments will lead to the creation of content. Content will be divided into small sections starting from the title of the moment or memory, Tell the story, share media (pictures, videos, and links), record message or ambient sound, emotions, and location.
After filing in at least one of the components, the user will have the possibility to send the story.

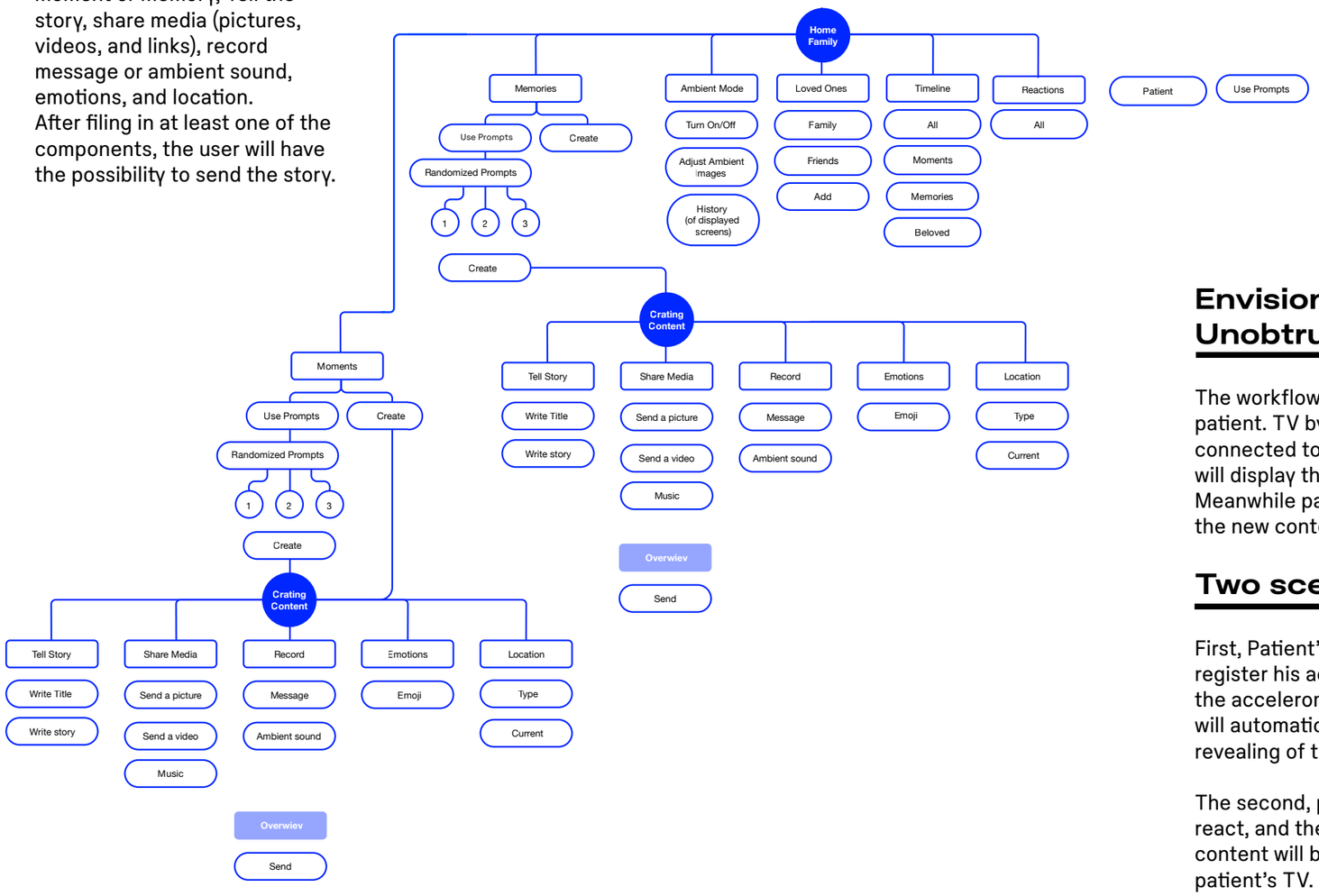


Figure 71. Schematic view of family's main functionalities.

Envisioned Active/ Unobtrusive mode

The workflow for the main user-patient. TV by default (only if connected to the Chromecast) will display the ambiance mode. Meanwhile patient will receive the new content.

Two scenarios

First, Patient's phone will register his activity by using the accelerometer, which will automatically trigger the revealing of the new content.

The second, patient will not react, and the icon of new content will be displayed on the patient's TV.

The last variant is connected with the first scenario here. If the patient is actively using his smartphone, he will additionally get the screen on his phone asking to send a simple reaction.

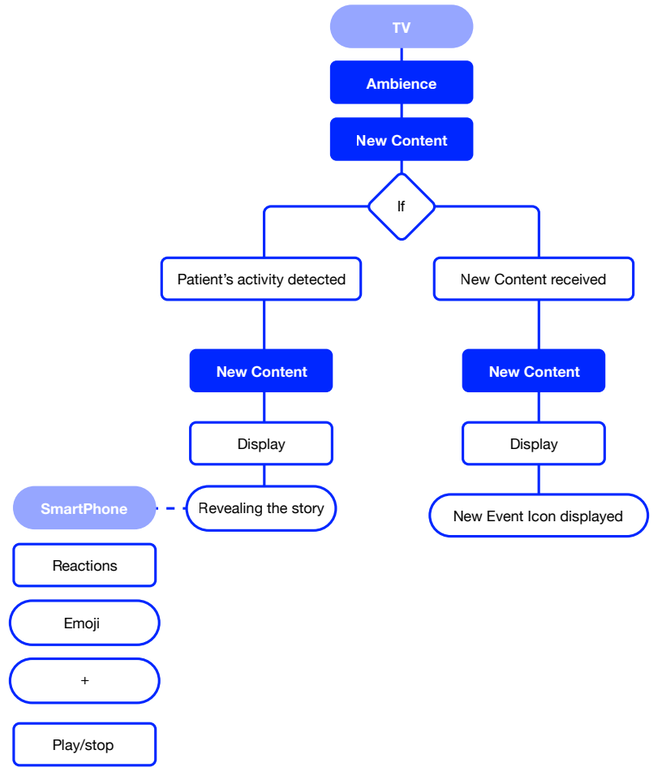


Figure 72. Work flow of Ambiance mode.

6
Finalizing

This chapter will be focused on the finalizing of the project. Firstly the final design of the application was established by creating a final version of wireframing. A Mood board was created to create the visualization of the envisioned mood of the Close app. The final design was created showcased, and the crucial workflow moments were explained. This chapter provides the evaluation of the attractiveness and the final evaluation of the evoked closeness.

Figure 73. Work flow of Ambiance mode.

Wireframing

Wireframing was created to validate the drawn user flow. After evaluation, the changes were primarily needed inside the family - user flow. Some of the actions were shortened.

Decisions were made supported by countless iteration in order to create the most optimal and useful user interface.

Final wireframing

Previous wireframing lead to the second version, where a more consistent user interface was created. One of the primary goals was to shape the app's look with the content created by the users and to bring the instant familiarity to the user.

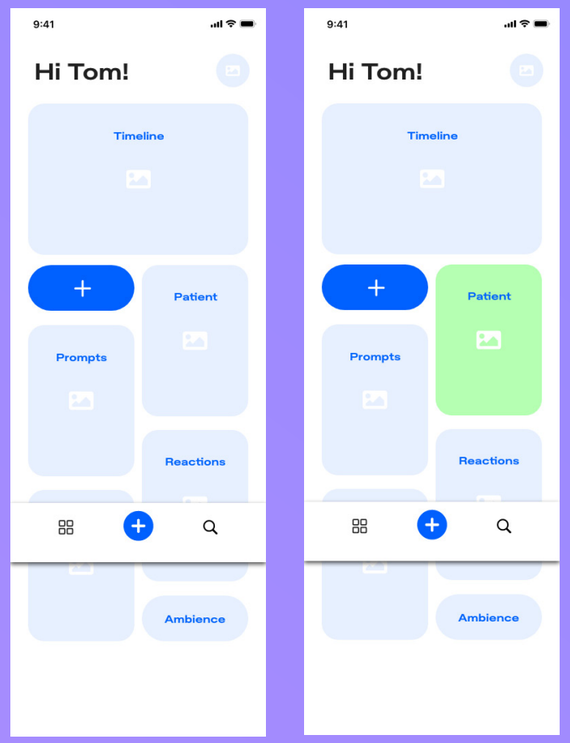


Figure 74. Final wireframing - Home view of the app

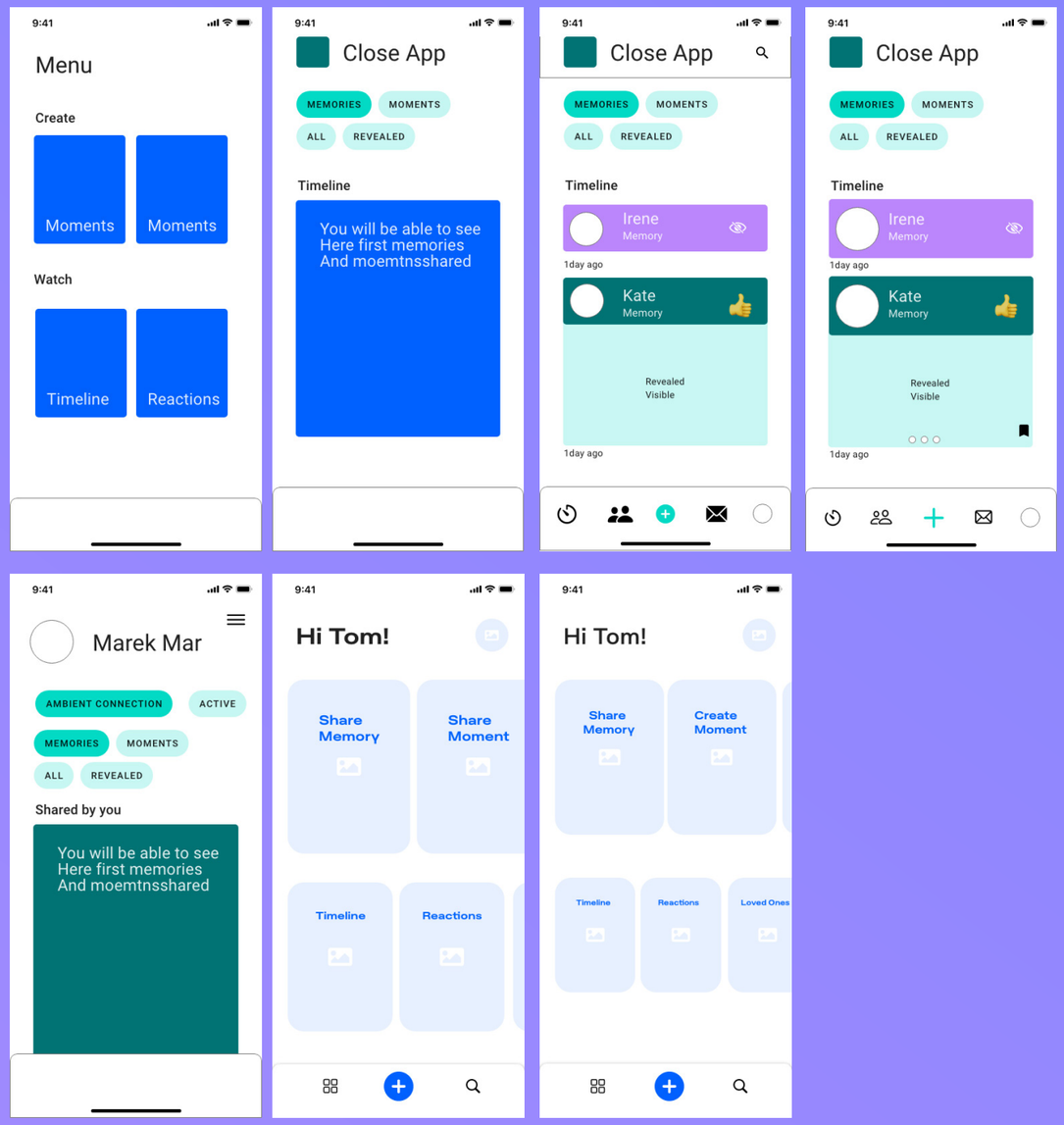


Figure 75. Initial wireframing - Different approaches during the wireframing process.

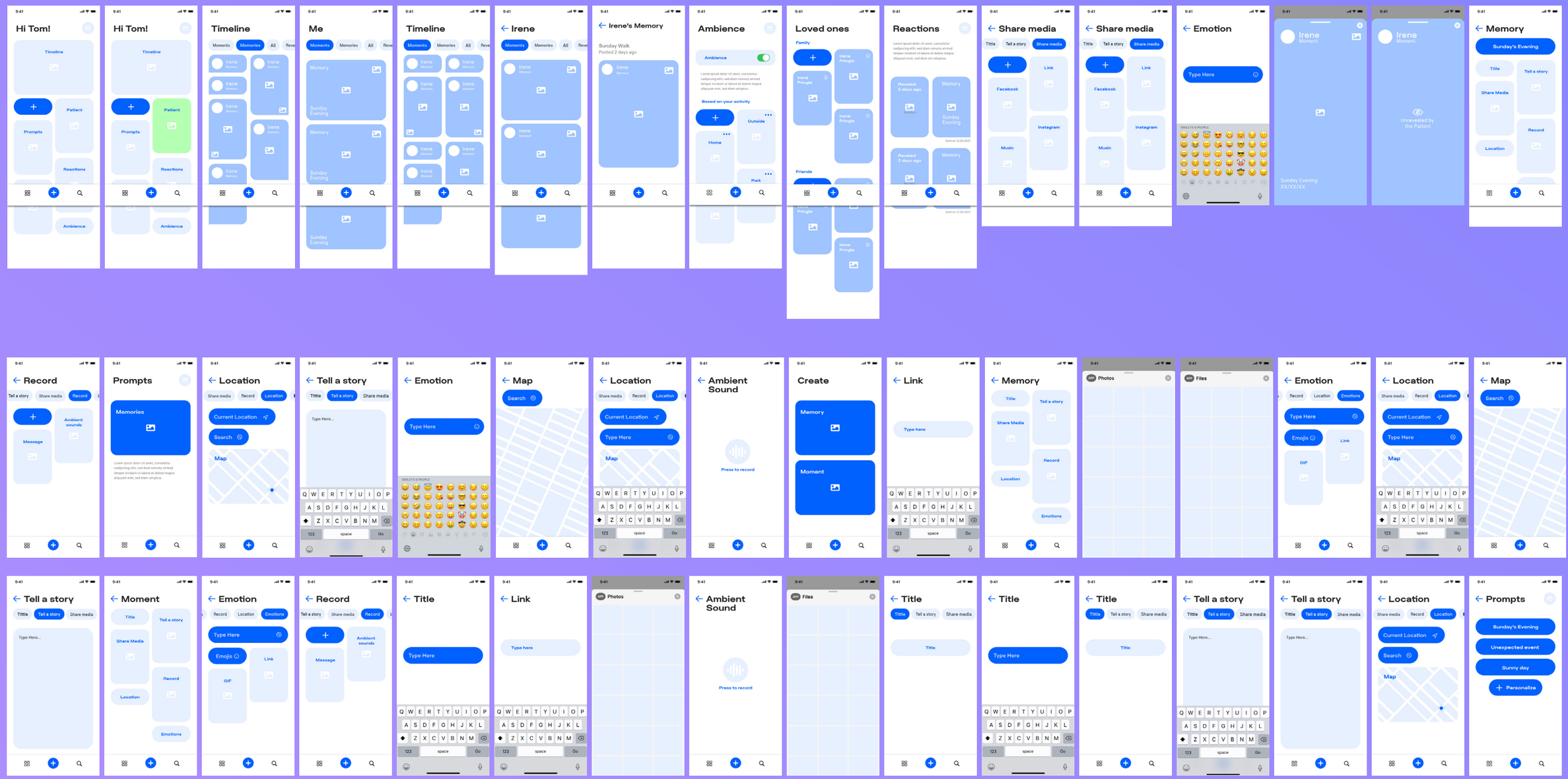
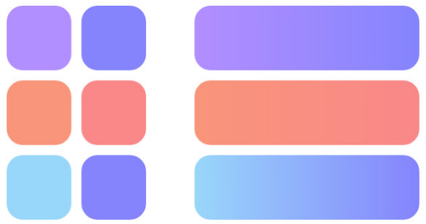


Figure 76. Final wireframing - complete app.

Mood board

Besides making structure, the design decisions need to be made and implemented. The CloseApp is a medical application used mainly in the hospital to connect families with their isolated patients. But yet it is an app that connects families and should be pleasant to use for everyone. Here also the inspirations show mostly a cosy warm and calm colors that can sparkle some joy.

Colors



Font

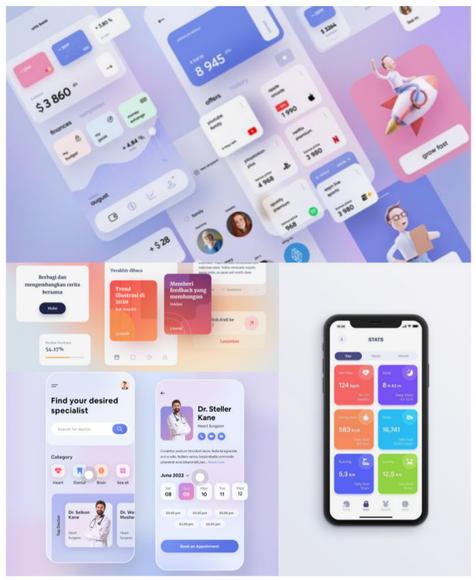
Plaid L

Plaid M

Plaid S

Figure 77. The color palette and font gallery chose to be used for the final design of the Close app.

Inspiration



App

Figure 78. Mood board - Presenting the visual esthetics of the final app with inspirations from already existing solutions.

Final Design

The app

App had been created with the main idea to help the patient feel closer to his family. The Close app consists out of two sides and one additional variant. First was created only to be used by the family member. The main feature here is the content creation sections where family and friends can upload the memories or share the moments with the patient. The patient's side of the app serves more like a "dropbox." The patient's main feature is revealing the content created and shared by the family and sending back the reactions. Furthermore, the patient's app will have a possibility to be connected with the existing TV located in the patient room. The patient's TV here is used to display the ambient mode and can unobtrusively reveal memories and moments.

Timeline

Both family and patient have access to the timeline. Users here can browse the sent content. Family in this section would be able to see the preview of the memory shared by another user if the content had been revealed previously by the patient. The patient will have the possibility of viewing the entire memory or moment, and additionally, he will be able to reveal the content.

Loved Ones

The patient and the responsible family member can edit the family and friends lists or add new members. Additionally, users can browse the content made by a specific user.

Reaction

This section serves different functions depending on the user. For the family is the place where they can check the given reactions by the patient. However, for the patient, this section will serve as a place to send the reactions if he did not share them yet.

Ambiance

In the ambiance section, the family will be able to activate or deactivate the mode and create the background that will be displayed on the patient's TV. However, the patient will be able also to pick the person he wants to be unobtrusively be connected with.

Family's side

Add

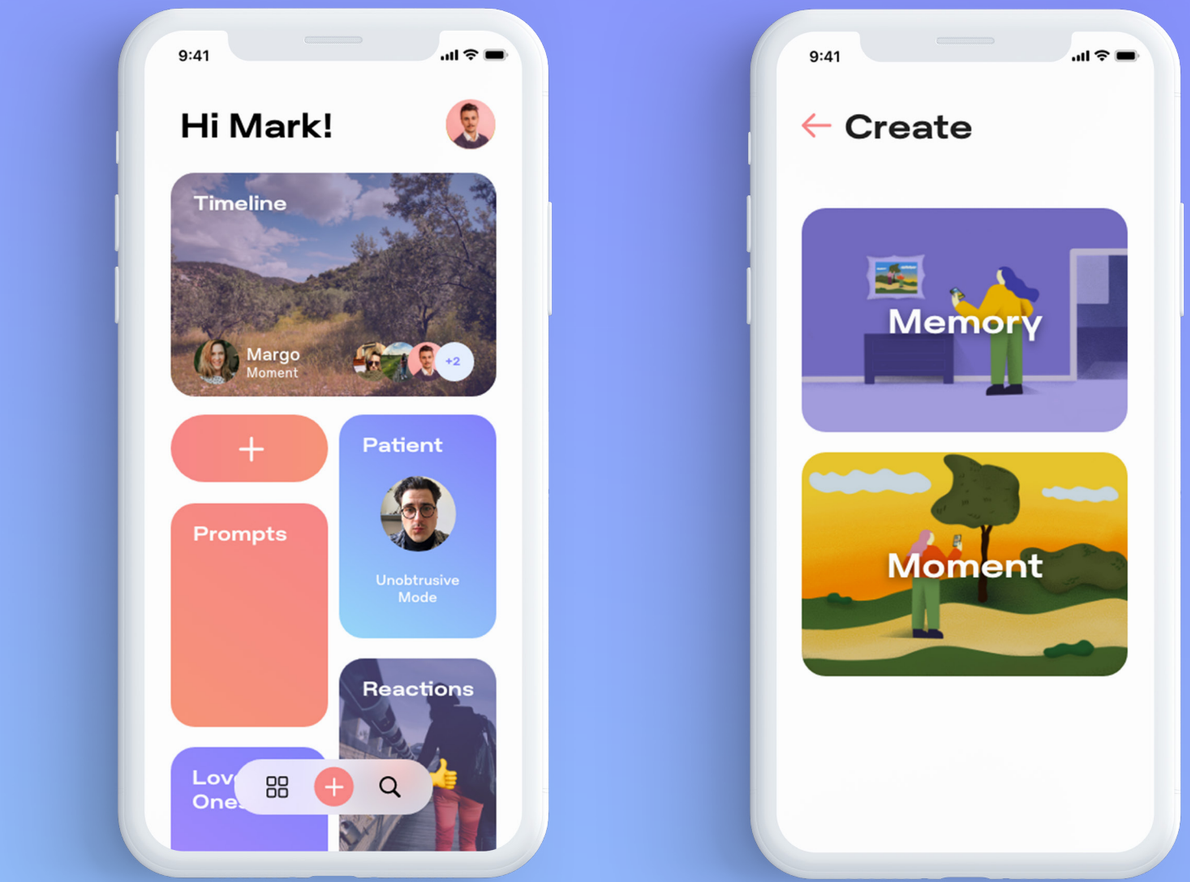
Family and friends will have the possibility of composing the content. By clicking on the add button, users will have to choose between the memory and moment on the next screen. Creating the content was divided into six categories: title, tell a story, share media, record, location, emotions.

Prompts

Prompts had been envisioned to support the creators with coming up with the memory. After entering this section, the user will have the three propositions from which the user should pick one. By choosing it, the story automatically will have assigned the name of the memory with the name as a prompt.

Patient

In this section, the family can see if the patient is active (actively using the app or revealing the content). The icon shifts from the light blue gradient - unobtrusive mode to green - active mode.



Close

Figure 79. Mockup of the final version of the Close app - Family's home screen, and the logo.

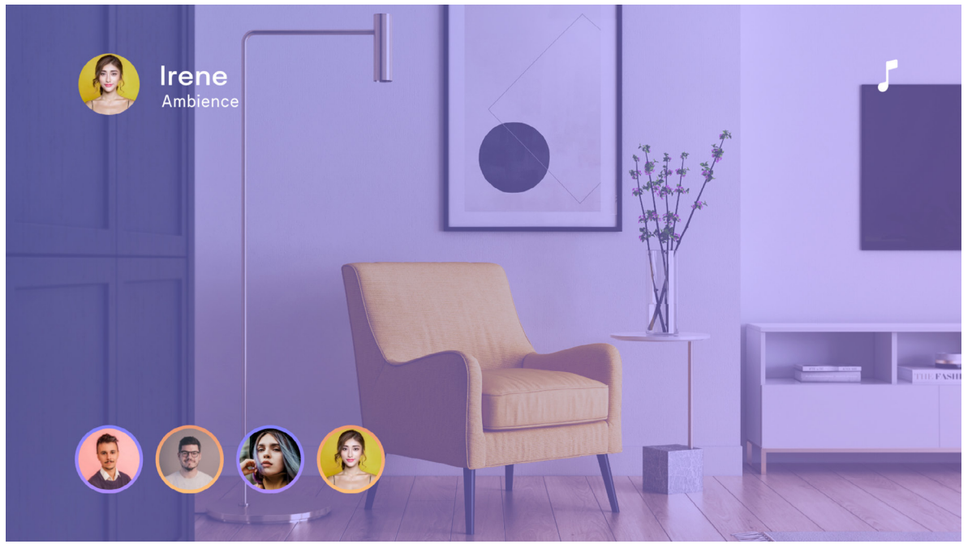


Figure 80. Mockup of the final version of the Close app - Patient's home screen. Below the TV display presenting the Ambiance mode.

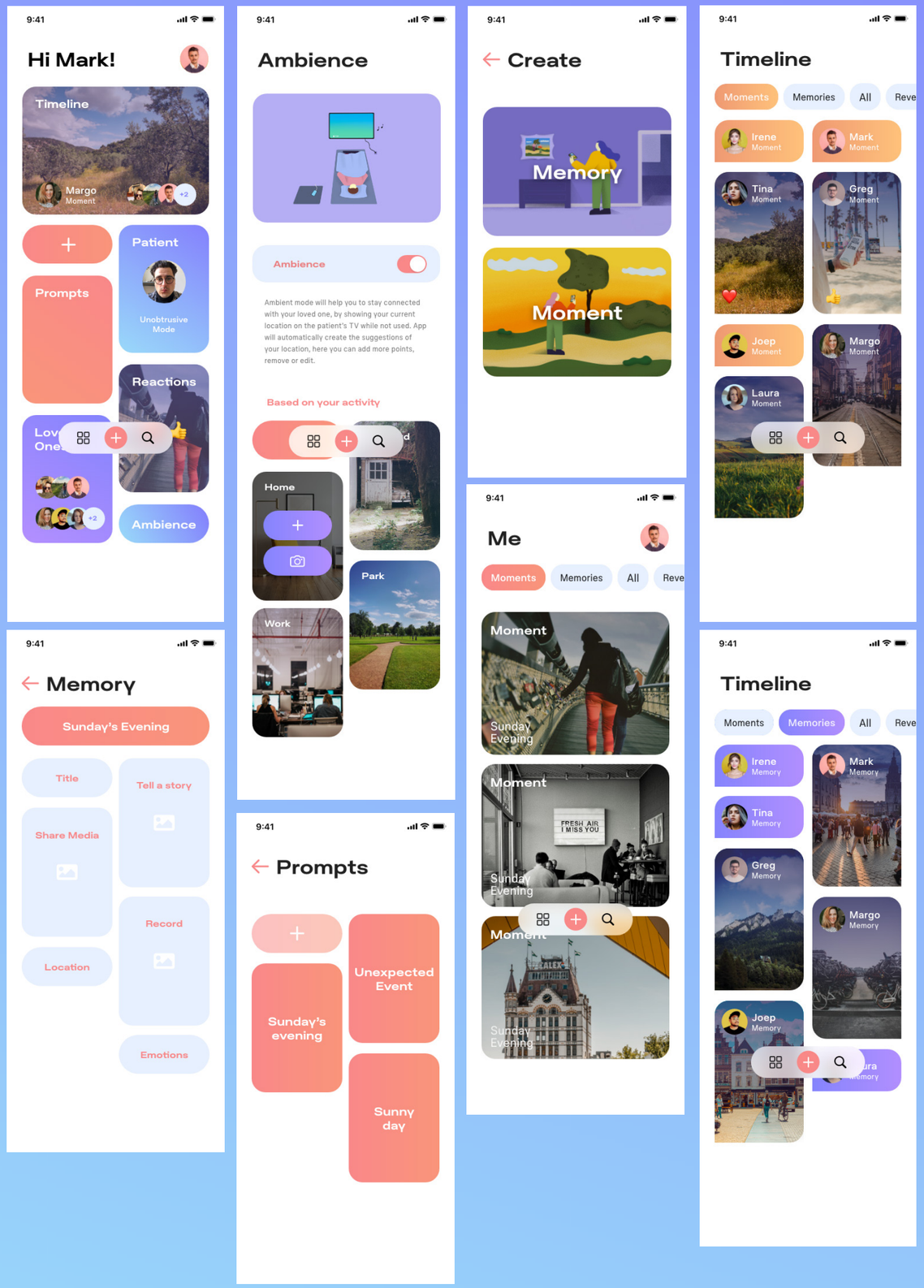
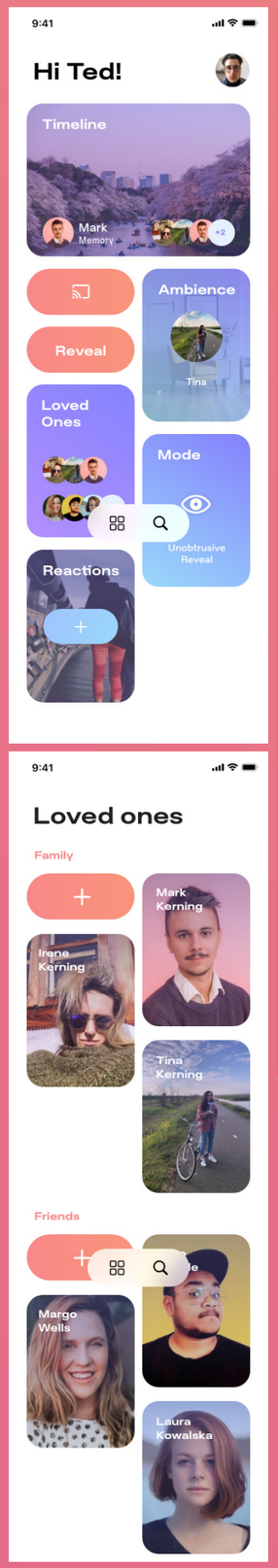
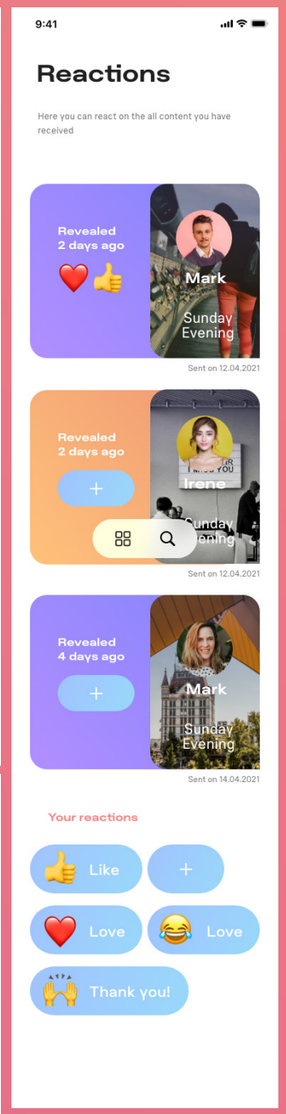
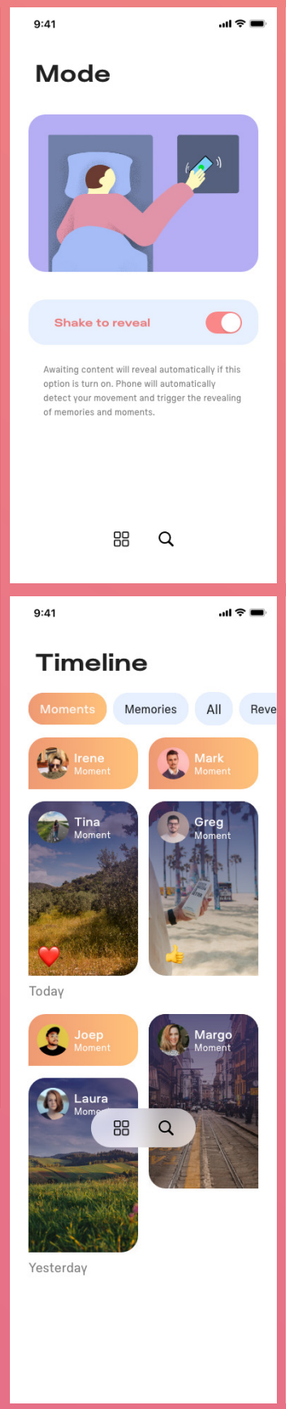
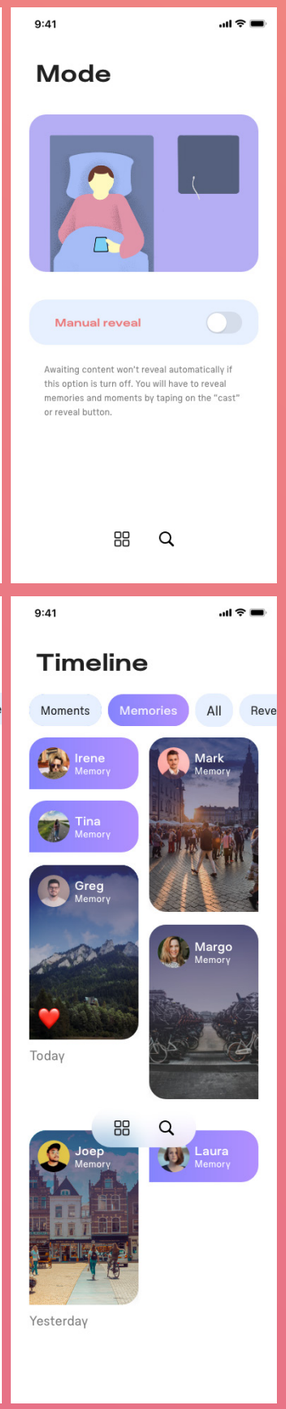


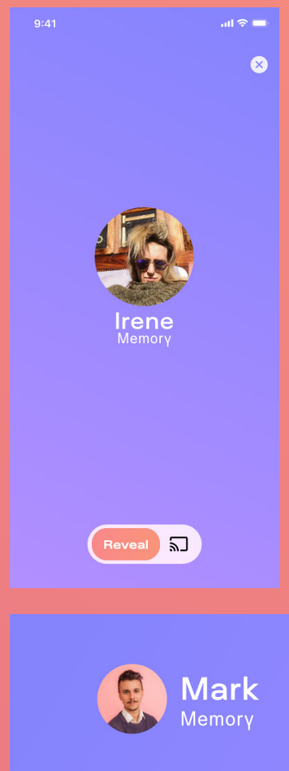
Figure 81. Family's side Ui – Main features

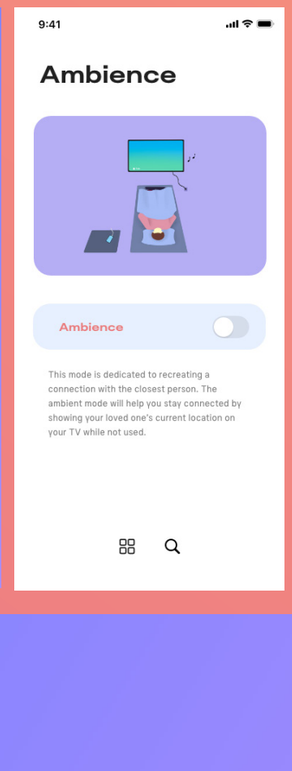


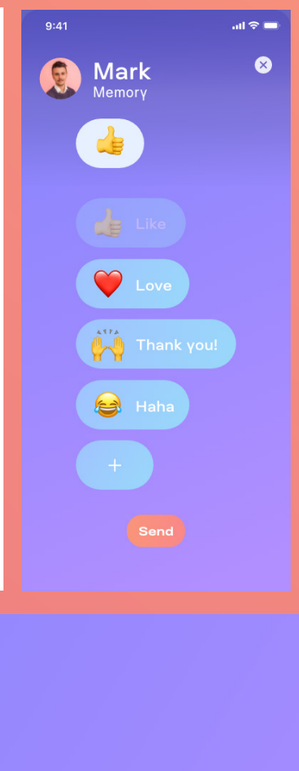


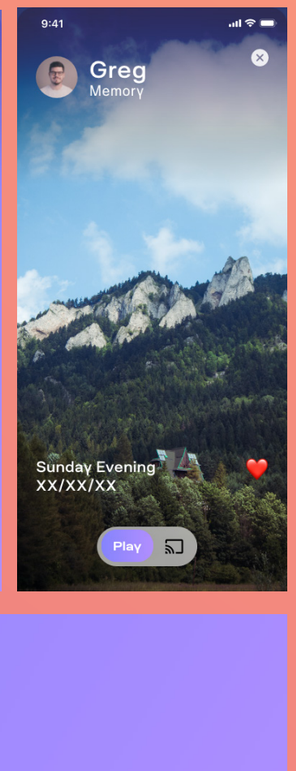












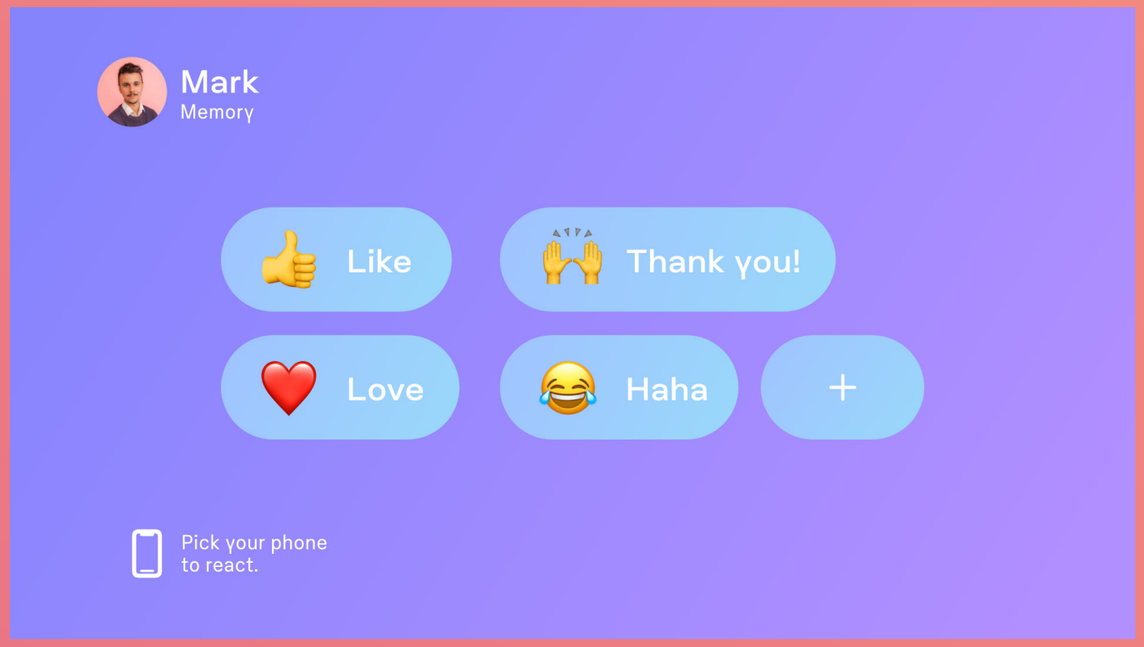


Figure 82. Patient's side Ui – Main features

Figure 83. The family member chooses the memory to sent to the patient.

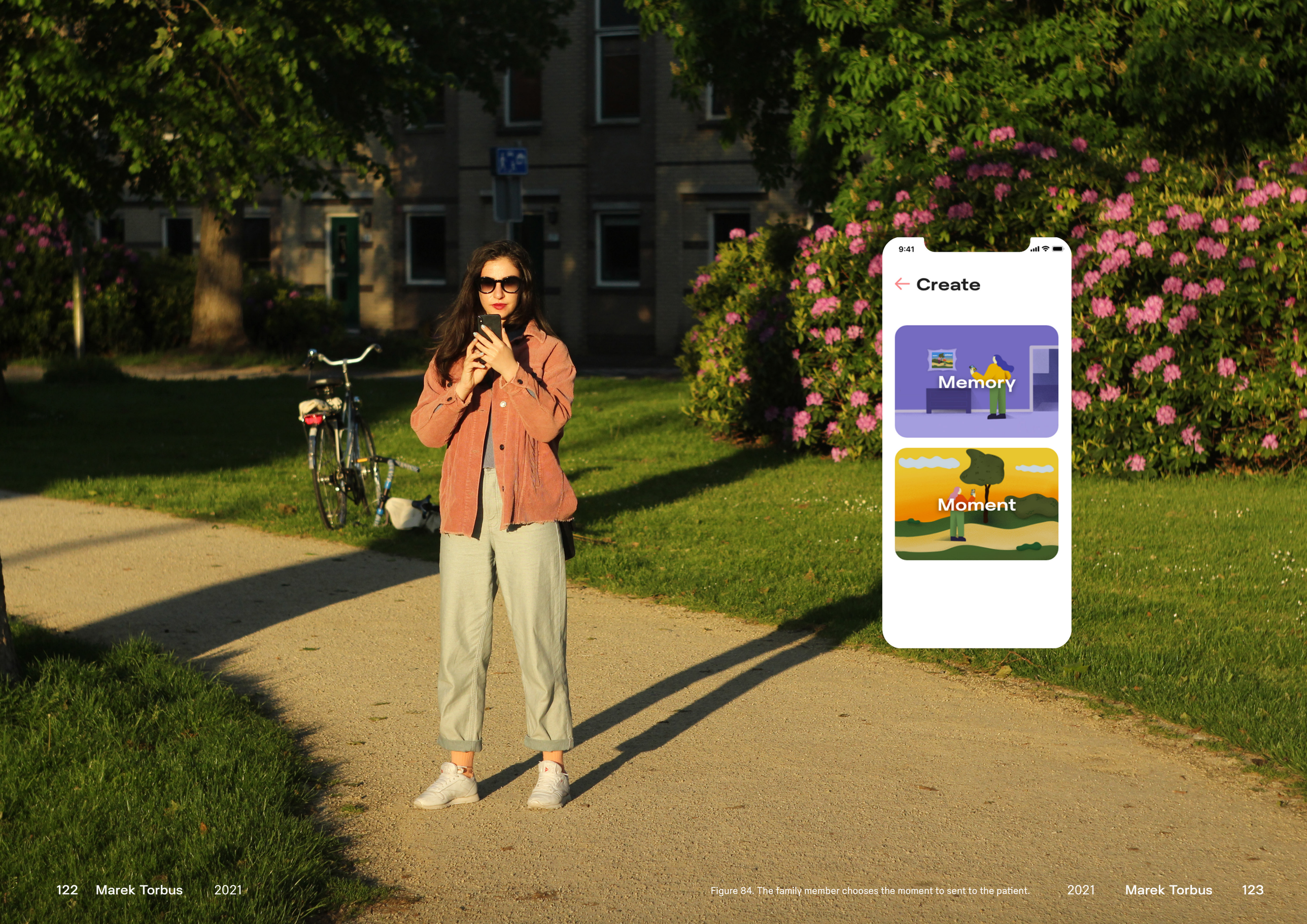


Figure 84. The family member chooses the moment to sent to the patient.

Figure 85. The patient received the sent content from his family.

Patient's side

TV

Ambiance mode + Revealing
The use of the TV located in the patient's room was envisioned to facilitate the unobtrusive connection between the family and the isolated patient. The ambiance mode discussed before will be displayed here together with the new content sent by the patient's loved ones. The patient will be able to trigger the revealing of the sent content simply by shaking/waking up the phone.

App

Application for the patient can be seen as an expansion of the basic functionalities. However, the patient is not required to use it.

Manual Reveal

The patient, instead of creating a button, was equipped with the reveal buttons. The button located on the top will reveal the content manually by casting it on the TV screen. The reveal button is envisioned for the patients who cannot have access to the TV or are isolated together with other patients.

Mode

Additionally patient will have the possibility to switch the shake to reveal if he is willing to use the phone more often.

Workflow

Ambiance

Ambiance mode helps patient to stay updated with the closest family member about their location by displaying familiar pictures on the TV screen located at the patient's room.

How it works?

There are two ways to set up the first ambiance background. Family members, by uploading the content, can additionally geotag the memory. The software will process this information and automatically display the background on the patient's screen. The second possibility is to set up the picture manually. The family needs to open the section ambiance to upload or take a picture of the surroundings and add the location.

Reveling + Modes

Revealing of the content is an essential function. The interaction was designed in a way that would allow easily to trigger the revealing. The decision was made that the most accessible trigger for the patient will be "shake/wake up to reveal." The application is intended to be working in the background, and it will constantly record the data generated by the accelerometer. Shake to reveal was used due to the fact that patients are rarely using their phones at the begging of the hospitalization. Furthermore, this action is the most suitable for the patient that might be cognitively impaired, and therefore he will not be able to use the app. In conclusion, the phone will be used as a trigger.

Patient's smartphone + TV

Patient's smartphone was intended to work together with TV located in the patient's room. In order to display the content the most feasible solution is to use the Google Chromecast. Besides the ready to use solution, Chromecast provides privacy protocols so the users data won't be transferred through the hospital's infrastructure.

Another possibility could be Smart TV which will work as an advantage due to the built-in casting feature.

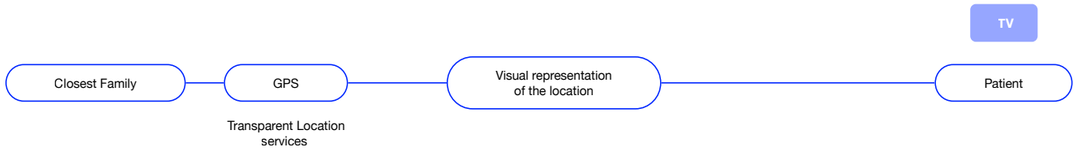


Figure 71. Workflow of Ambiance mode, displayed on the Patient's TV.

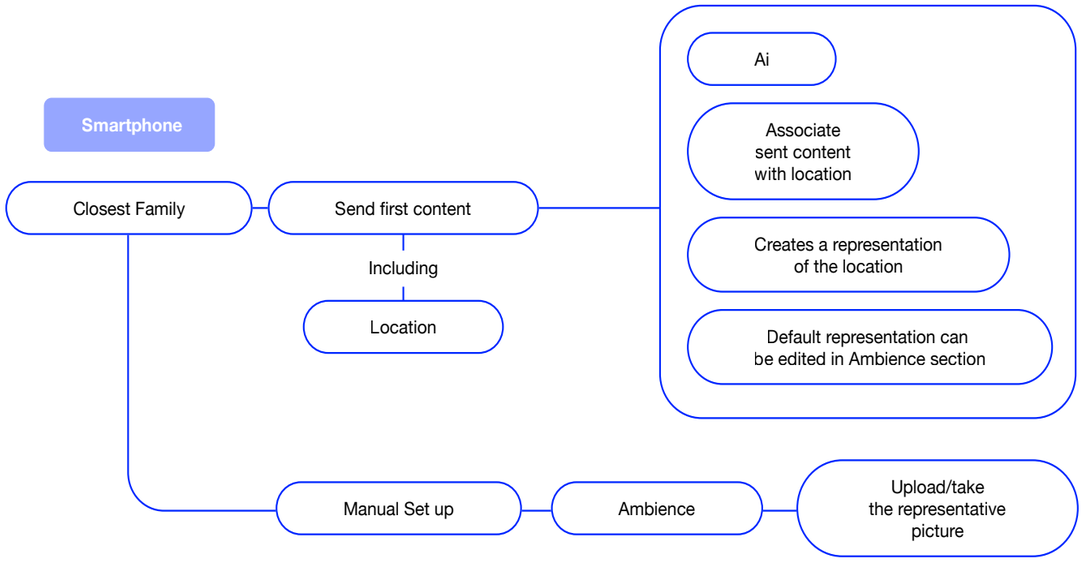


Figure 86. Process of setting up the Ambiance mode.

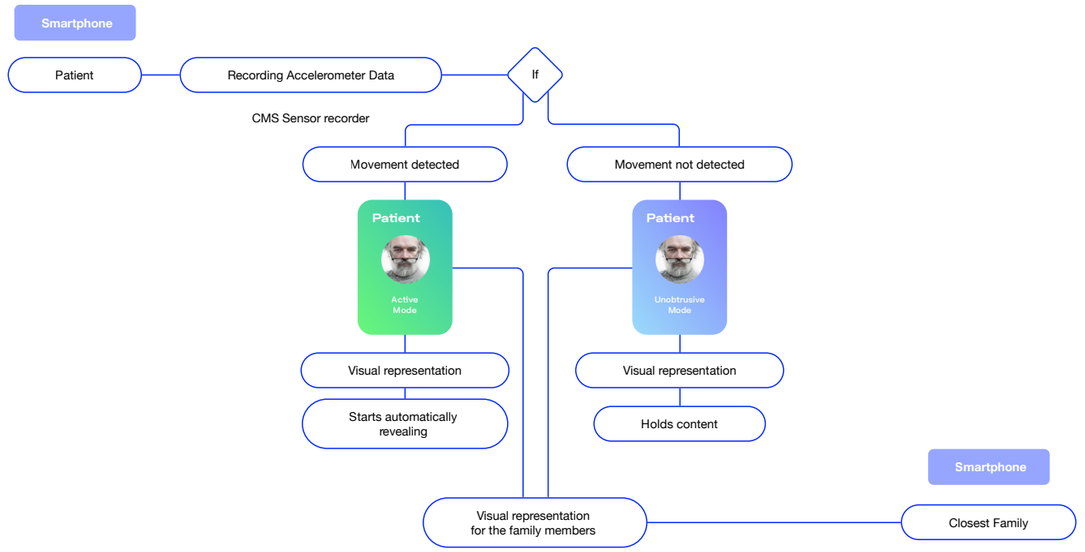


Figure 87. The flow of revealing the stories by the patient in unobtrusive mode

Evaluation – AttrakDiff

Goal

Validation of the usability of the user interface perceived pragmatic quality, the hedonic quality and measuring the attractiveness of the Close app concept. (Hassenzahl et al., 2006)

Method

The study was divided on the two sides of the application: family and patient, and had been assigned to the different groups.

Family side

An interactive prototype of the application was made and sent to the first group of participants, together with the booklet explaining the background of the study and the test manual. Subjects were introduced to two scenarios. The first scenario guides the user through the discovery of the app and timeline. The second is a role-played activity, where the user shares a memory of a trip to Japan. They share a picture, video, posts, a playlist, and a message to the patient.

Patient side

The procedure was similar. However, participants received two links with the prototypes. First was intended to present the TV application with Ambient mode and unobtrusive unrevealing of the memory sent by the family. Second led the participants to the prototype of the application were subjects were asked to cast the unraveled content on the TV and react on it.

The AttrakDiff1 survey was later sent to the participants as the final step of the study. The survey was created by a group of three researchers (Prof. Dr. Marc Hassenzahl, Prof. Dr. Michael Burmester, and Franz Koller) for UID Gmbh., and it is a free assessment tool made for researchers to rate the quality of interfaces.

The survey consist of the contrastive word pair describing four main categories: attractiveness (ATT), pragmatic quality (PQ), hedonic Quality (HQ), Hedonic - identity quality (HQ-I), Hedonic - stimulation quality (HQ-S).

There were some interviews conducted as a follow up for the participants to validate some answers based on the outcome.

Participants

The study was conducted with eighteen participants (n=18). The study was divided into two sections depending on the end-user functionality: family (n=12) and the patients (n=9). “Family” group consisted of 12 participants, mostly design students, Ph.D. candidates, and design professionals. The age of the participants ranged from 25 to 40. “Patient” group included three new participants not associated with the design field and 6 participants from the family group. The age of new participants ranged from 45 to 65.

Results & Discussion

The survey resulted in highlighted problematic UX aspects based on the Description of word pairs. The results for single participants group are presented in three figures: Portfolio of results - where the vertical axis displays the hedonic quality and horizontal axis shows the pragmatic quality, Description of the word pairs, and Diagram of average values - presenting the mean values of every subcategory based on the Description of word pairs.

The mean values of the word pairs, accordingly for the Patient and Family group, are presented here in Fig.91 and Fig.93. Of particular interest are the extreme values. The values leaning towards the left side of the axis (dimension below zero) suggest that the participants were not satisfied with the design outcome. However, it was unclear what caused his/her dissatisfaction.

Therefore the follow-up interview was conducted with 5 participants to receive more detailed feedback.

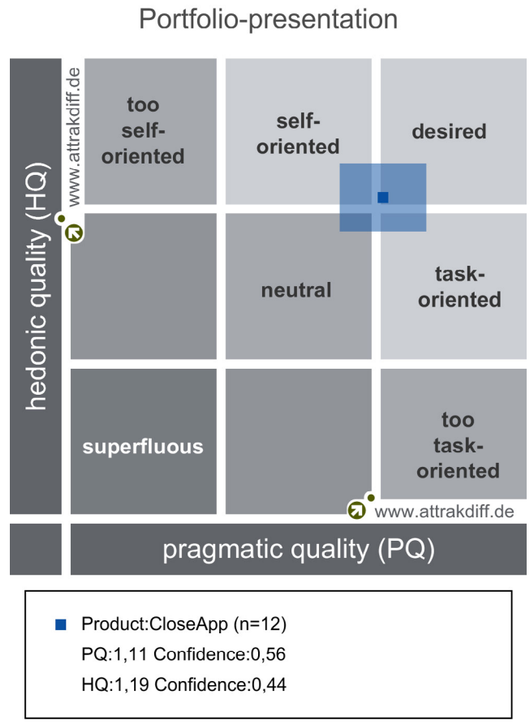


Figure 88. Results overview - Family’s side of the mobile application.

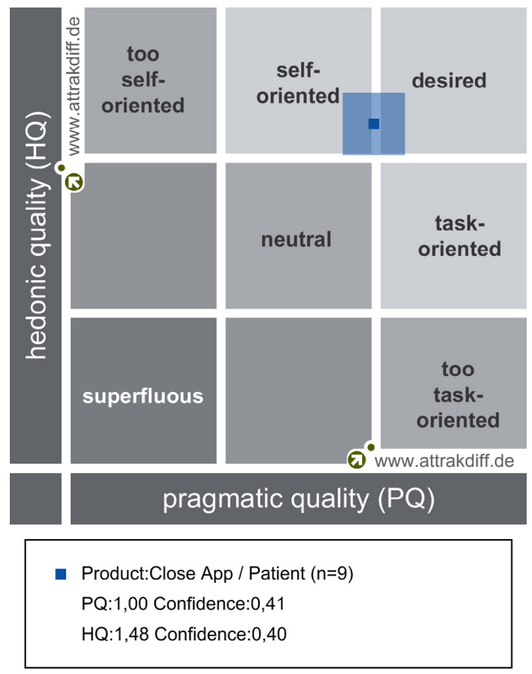


Figure 89. Results overview - Patient’s side of the mobile application.

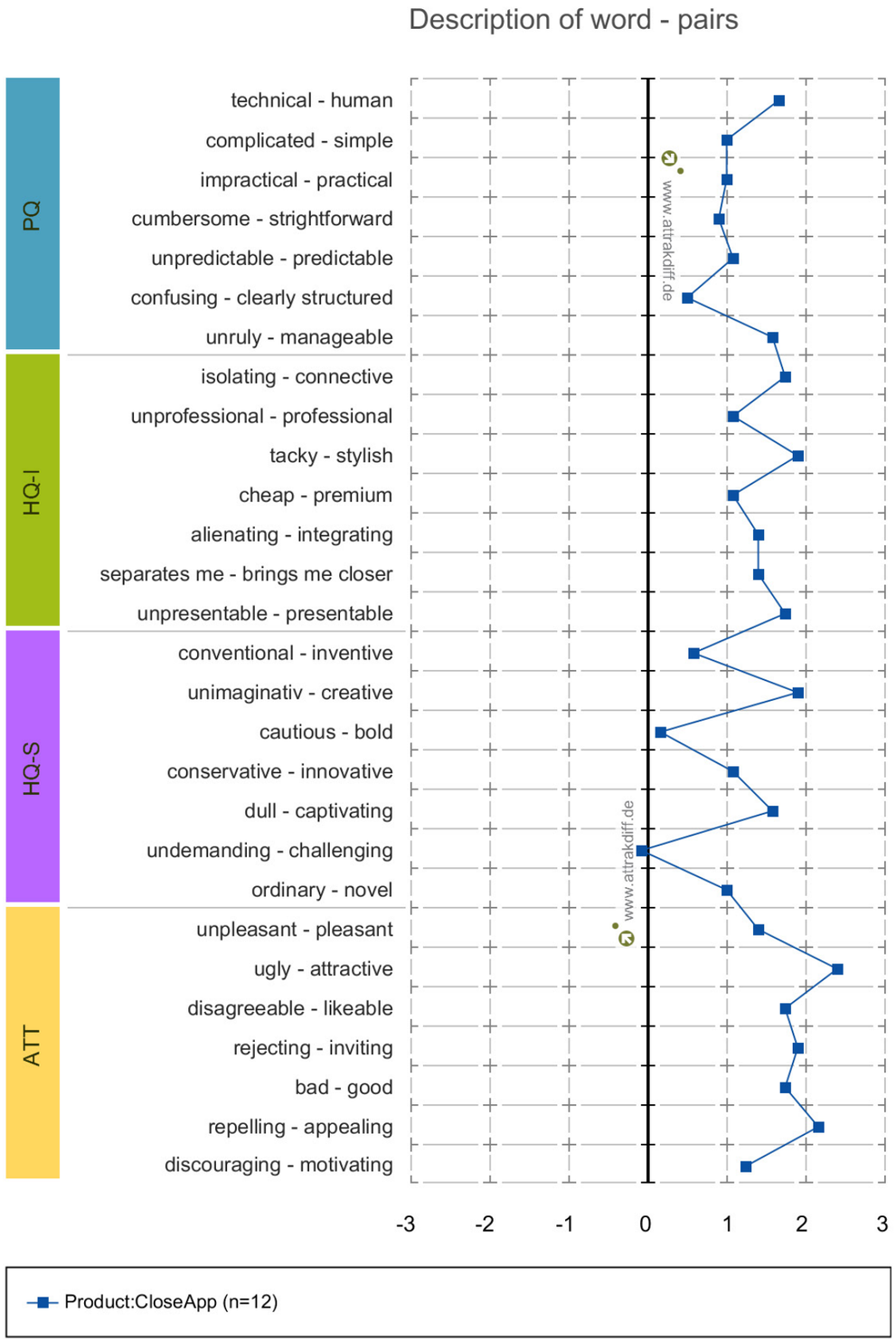


Figure 90. Description of the word pairs -result of the Family's side of the mobile application.

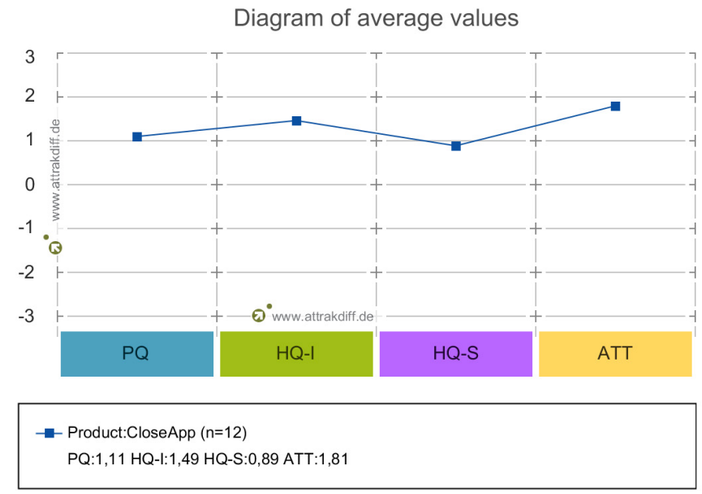


Figure 91. Diagram of average values -result of the Family's side of the mobile application.

Family

Twelve users participated in the evaluation. The Close app was rated well in both hedonic and pragmatic quality. The confidence rectangle Fig.88 shows that the hedonic quality and the pragmatic quality are more or less equal. For the CloseApp prototype, the confidence rectangle extends from the desired area and into the self-oriented area, touting slightly neutral and task-oriented. The medium value, however, indicates the desired area.

The only negative word-pair description is "undemanding - challenging" inside of the hedonic stimulation quality. The Attrak-Diff method assumes that undemanding is a negative quality. However, the concept is basing on the undemanding quality and therefore related ease of use of the application and unobtrusiveness. Similarly to cautious - bold word pair was the design intended to create a neutral and friendly interface.

Another low-scored word pair was confusing - clearly structured and conventional - inventive.

The follow-up interviews showed that the given instructions were not always clear for the participants. One of the interviewees suggested that the first use of the app might be essential to understand it since the app consists mainly from the created by the user content. During the study, the prototype consisted of mock-up content and users that increased the feeling of confusion. Participants also admitted that the user flow is not clear to them; however, the proposition of having an onboarding section of the app would help to better understand the functionality.

Onboarding is a crucial step that could help better to understand the structure and workflow of the app.

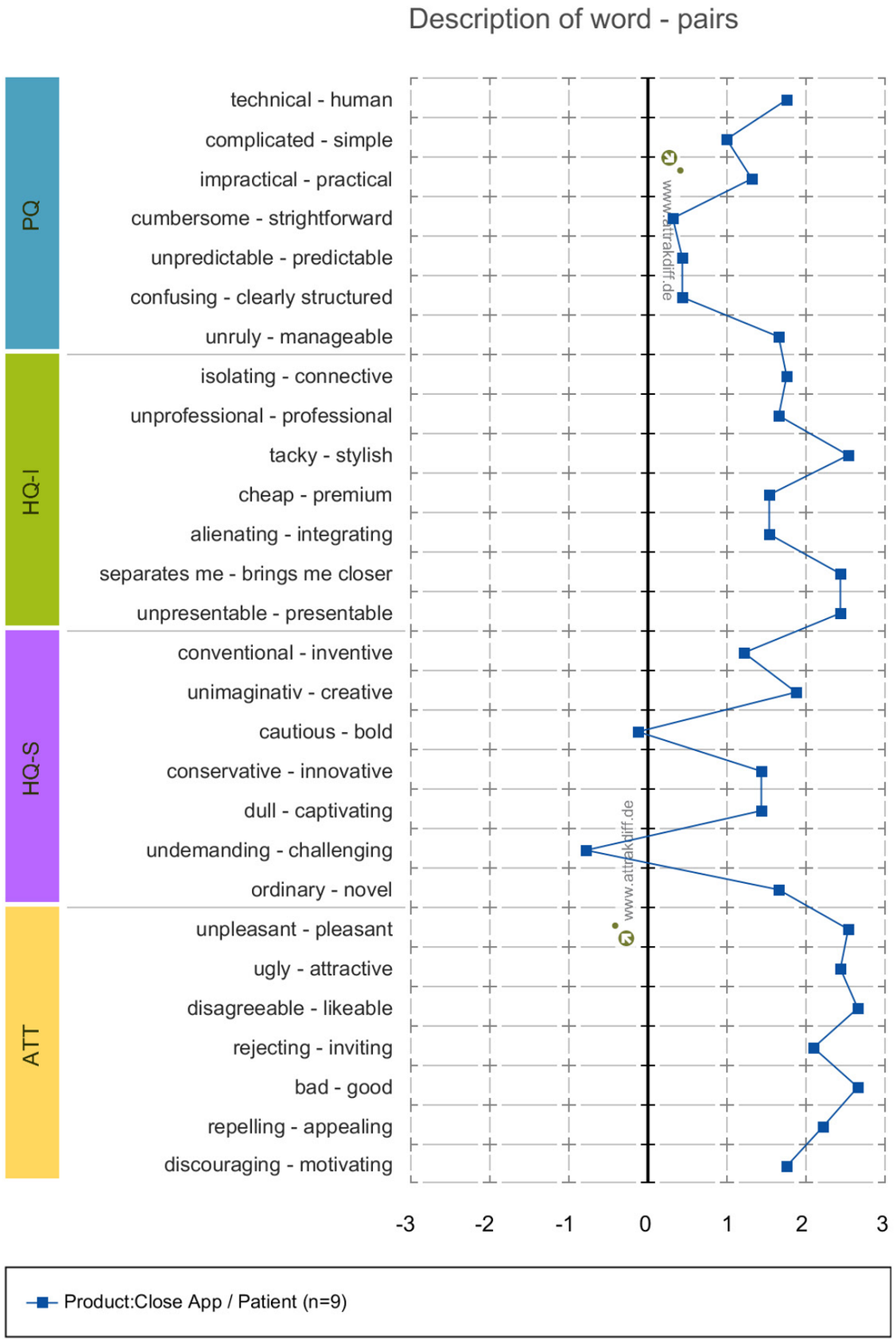


Figure 92. Description of the word pairs -result of the Patient's of the mobile application.

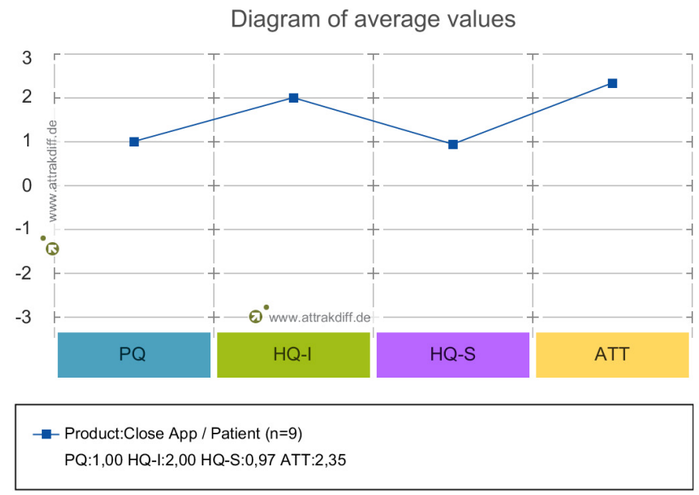


Figure 93. Diagram of average values -esult of the Patient's of the mobile application.

Patient

Nine users took part in the patient's side evaluation. Same as the family side prototype of the Close app for patients was rated well in hedonic and pragmatic quality, with the slight advantage of hedonic quality. The confidence rectangle seen on the portfolio result is located in between self-oriented and desired areas.

Similar to the family group, the patient side was marked to be more undemanding and cautious, which are the lowest scored word pair.

The follow-up interview showed that the unobtrusive side of the application (the TV view) was very intuitive and easy to use by the novel user. However, the new participants here had difficulty in finding the home button that undoubtedly led to frustration.

Limitations

Participants were asked to recreate given scenarios and immediately afterward to rate the application. The time spent on the actual use of the app might seem to be too short to assess it correctly.

Subjects could also experience a lack of familiarity due to the mockup pictures and events created not by them but by the researcher.

Participants should have more knowledge about the app and its structure. The study might have consisted of a more thorough introduction to the app's structure, or the prototype itself should have been built differently. The first possibility could be to leave the prototype as it is now and add the onboarding pages to understand the functionality better. The second would be to show the "empty" prototype where the app could guide the participant to learn its main functionality.

Testing the usability and attractiveness of the app could also exist for ex-patients and their families to see the opinion of main stakeholders instead of the test group.pair was confusing - clearly structured and conventional - inventive.

Evaluation – feeling of closeness

Goals

To evaluate the design of Close App on whether it evokes the feeling of closeness. To learn how the patients, patient's families, and healthcare professionals will interpret the application. The setup had been created to focus on the patients and family needs, found out in the research process before.

Main question:
Does the use of application evoke the feeling of closeness?

Method

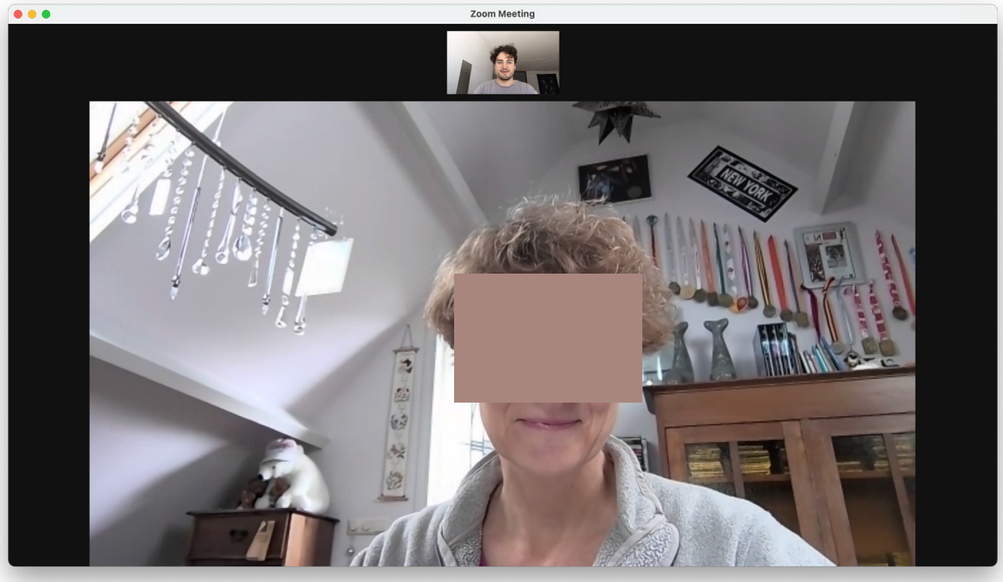
The study was conducted online. Participants were given the first short presentation visible in appendix L to briefly show and explain the project's outcome regarding main functionality and features. Presentations and scripts differ on the type of participant regarding patients, family, and healthcare professional. Every activity took time individually. Patients were familiarized shortly with the functionality of the family side of the app, same as a family member was briefly introduced to the functionality of the patients' side of the app. To track the progress of the tasks, participants were asked to share the screen with the researcher. To reduce the biases, the research outcomes were not presented to the participants. However, healthcare professionals had a more thorough presentation, including brief research outcomes and full functionality of the app, including the envisioned role-playing activity.

During the last part of the study, an open discussion with structured interview questions was done to validate the perceived value of the proposed solution.

Patients

The patient, after the presentation, was introduced to the role-play activity, depending on sending memory from "Our last day of summer Holidays" by the researcher to them. The patient role here was to open a given link with the app's prototype conveying the memory. Firstly, patients were introduced to the Ambiance mode and the process of unrevealing memory in the unobtrusive mode without using the app. Secondly, the following link was shared where participants were asked to imagine their slight improvement and the need to use this time mobile application to reveal the content sent by the researcher. In the first scenario, participants were asked to unravel the memory again by casting it on the TV. Participants here were able to share their reactions. Besides, participants had guided tasks such as open section "timeline," "loved ones," "reactions," and "ambiance," where they could pick the closest one to share the ambiance with.

Afterward, the relevant questionnaire Appendix L was done. Starting from the general questions regarding the use of the applications to the questions validating the



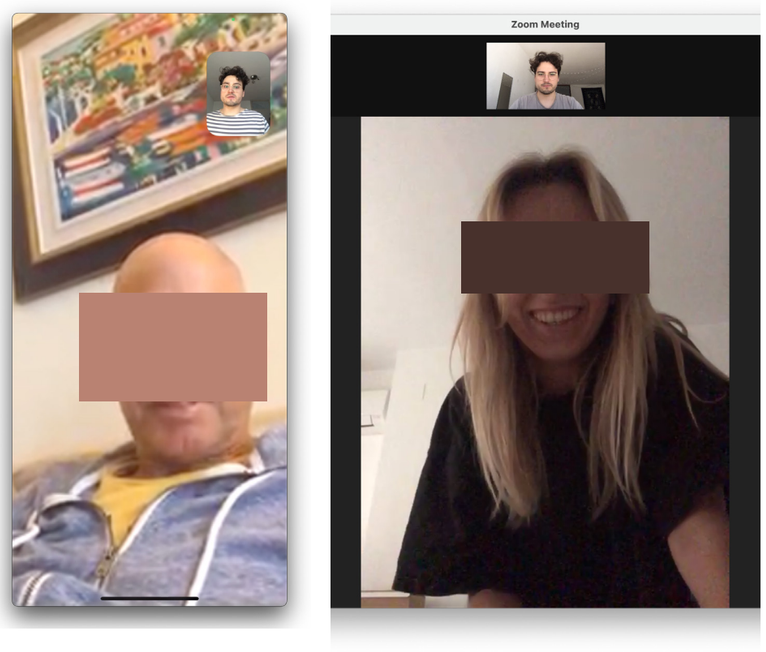


Figure 94. Screenshots of the participants that took part in the evaluation.

research outcomes. Patients were asked questions regarding relatedness, stimulation, and security. The closing section concerned the possible improvements and recommendations.

Family Member

Family similarly had the short presentation; however, this time focused on the functionality of the family side of the app. The role-playing activity was inverted. The researcher was the patient that the family was asked to send a memory. The participant was provided with the interactive link with the Close app prototype. Firstly participant was asked to composite memory, choose different modalities indicated by the researcher, and finally send it to the patient. After the main task was accomplished, the participant was guided again to dive into the other functionalities of the app, such as timeline ambiance mode, reactions, moments, prompts, and the patient's activity indicator.

The final discussion with the family member had a similar structure to the one conducted with the patient. However, different needs were validated, such as relatedness, competence, and purpose. The closing question concerned possible improvements.

Healthcare Professional

After the given introduction, the healthcare professional was presented with the entire application flow, including the two scenarios mentioned above. After the presentation, the discussion was conducted validating the patient's and family's needs from the healthcare professional's perspective.

Participants

COVID-19 hospitalized ex-patients (n=2), a non-COVID-19 ex-patient hospitalized during the pandemic (n=1), a family member of the hospitalized patient (n=1), and a Healthcare professional (n=1). Any ex-patients couldn't have a visitor during their stay at the hospital due to the strict COVID-19 measures. Additionally, the family member was diagnosed with COVID 19 and going through almost a month of isolation. Throughout the illness, the subject was not hospitalized. However, the participant's father was diagnosed with COVID 19 severe symptoms and hospitalized for a prolonged stay.

The patients' age was ranging from 28 to 65. Participants were from different nationalities, including The Netherlands, Poland, and Turkey. Participants were chosen to represent the primary stakeholder to have a complete rounded evaluation. The criteria were driven by the differentiated experience of the participant.

Results & Discussion

The interviews results were analyzed, quotes and interpretations were clustered by the different topics of the interview set up.

This section will be focused on discussing the results of the patients and family evaluation with additional comments from the Healthcare Professional.

Relating to the Close app overall experience

"An application was created for patients who are exhausted of the disease.
During my illness, I became very impatient. I was unable to concentrate. Talking too long or FaceTime made me angry." - Patient 3

"Nice organized things. If you are familiar with the phone, you should be familiar with how to use this app." - Patient 2

"I love to be close with my family - Major improvement is that you do not have to talk to communicate with your loved ones [...] this app could give them hope." - Family

The mobile application was described as easy to use and "nicely organized" due to its simplicity and unobtrusiveness. Participants described the mobile app as created especially for COVID-19 patients' needs.

Further, more family member mentioned that with the use of the app, there is no need to communicate with her hospitalized loved one verbally, and in addition, created by her content could give hope to the patient.

Unobtrusive

"With the unobtrusive application, you do not need to look at the phone." - Patient 3

"The patient is not able to see the phone - mostly patients are cognitively impaired" - Healthcare Professional

Participants highly appreciated the way of designed communication. Former patients mentioned here that it was hard for them to use their mobile phones, and at the beginning of hospitalization, they avoided it, focusing mainly on recovery. The only exception was to maintain the crucial text communication with the closest family member. Furthermore, former patients were astonished by the way how the application can unobtrusively evoke the feeling of closeness.

None of the participants indicated that the application consists of unnecessary components.

Moments vs Memories

"Moments can keep me updated about my family life, and it makes me feel more secure." - Patient 2

"My husband sent me a picture from our summer holiday. It was a strong positive feeling that motivated me to plan the following holidays with my family after the hospitalization." - Patient 3

Participants asked about the effect of two main functionalities expressed the different opinions associated with age and experience. Older participants (45+) pointed out that the memories could have a more substantial impact on positive feelings, and therefore memories could bring them closer to their families.

Patient 3, during her hospitalization, received the pictures from holidays sent by her family that evoked positive memories and triggered thinking about the planning following summer holidays together. This event certainly evoked positive emotions that served as a short distraction.

"Moments would have more value for me. They would help me to stay in the loop." - Patient 1

Former patients also indicated the importance of the moments to "stay in the loop" with their families. Only Patient 1 indicated that the Moments could evoke more positive emotions than memories.

Participants indicated that the memories could evoke sadness which is not a negative emotion looking at the context. Patient 3 justifies it that someone from loved ones put effort to compose this mindful memory

and sent it to her, which shows the support.

“This app trigger thinking about me by my loved ones, it shows their support.” - Patient 3

“Memories and moments are significant, Memories would give hope and strength, and later moments could help update the patient about his family, but maybe when a patient feels a bit better.” - Family

Furthermore, family members point out that both modalities could positively affect the patient’s well-being. However, Memories could work better at the beginning of hospitalization to give more hope and strength, while the updates could be sent later while the patient is recovering.

Distraction

“This app evokes the positive feelings triggered by the memories that could also distract me slightly from the hospital.” - Patient 3

“I can also imagine the scenario when I sleep during the day and when I cannot fall asleep. I could reveal the content made by them, which would make me calmer and help to fall asleep with ease.” - Patient 3

One of the participants marked that the content could distract her from the hospitalization as mentioned above, and additionally, it could be used as an aid while falling asleep.

Security

“You know what is happening with your loved ones. You stay in the loop.” - Patient 1

“In my case, my son and husband also got sick at the same time. Only I was hospitalized. I wanted to know how they are doing and what they are doing. This app would be very useful to just know how they are.” - Patient 3

Moments besides the informative function, in consequence, create the feeling of security. The example of Patient 3 shows that most of the time, the illness affects the whole household.

Purpose

“The app shows me how can I help, it gives the purpose” - Family

Family member point out that the use of the application shows how she can help the patient. She also indicated that the multiple modalities and different options to express the memory or moment also helps to look back at the past and see it from a different perspective.

Reactions/ Information

Former Patients agreed that the reactions to the content sent by their loved ones could also calm the family at home and show appreciation.

“Reactions would make me and the rest of our family calmer— also the possibility to see if the patient is active or not.” - Family

“For family, when my dad was almost dying, knowledge and ease, - it is hard to get any information.” - Family

“Patients are being overstimulated by their family - lack of information.” - Patient 1

Furthermore, the family member indicated that she suffered from a lack of information about her father. At the begging of the hospitalization, the patient was extremely weak and started to use his mobile phone on the 3rd day of hospitalization. The only communication channel with him was available through the medical staff that not always had time to update the family about the current patient’s status.

The participant was pleased that the application offers different ways of communication: reactions are the main feature, but besides, the family could see when the patient is active, and additionally family also will see if the patient reveals the sent content.

“I would feel worried if I would not get the reactions after sending the content to my father. It would mean only negative things for me.” - Family

The family member also mentioned the scenario of not receiving instant reactions or the scenario where the patient won’t reveal the content for a prolonged time. This action could possibly effect in negative emotions such as worry and insecurity.

Stimulation

One of the concerns was that the application might be overstimulating for the patient or consisting out of too many elements. Patients and families indicated that the Close app doesn’t have unnecessary or overstimulating features. Participants pointed out that the application is well balanced.

“With this unobtrusive application, you do not need to look at the phone.
My mother woke me up all the time. She wanted to ask if everything was ok.”
- Patient 3

Patient 3 indicated that thanks to the application frequency of calls could also be decreased, which will ultimately help in causing fewer frustrations and could result in faster recovery.

Ambience

“I could see the current information what she is doing to keep me informed. Now we are used to following our loved ones.” - Patient 2

“Usually, during the hospital stay, people watch TV, now by watching a TV, they could be distracted and informed about their families.” - Patient 2

“Seeing familiar places could also make me calmer” - Patient 3

“Ambiance - It is nice to see the familiar picture - something nice to look at.” - Healthcare Professional

For the ambiance mode, the biggest concern was privacy. However, every participant pointed out that they are using the location services within the family and the closest friends. Patients admitted that the ambient mode could bring them closer to their families. Furthermore, the familiar pictures could also evoke positive emotions.

Concerns

Privacy

Healthcare professional exposed privacy concerns to the app. However, the application will be installed on the personal devices owned by the patients, which will not make the hospital responsible for the data management. The content streamed to the TV will be securely cast by using the existing technology Chromecast, which has its privacy protocols.

Another technical issue was brought, including the data storage(servers), ownership, and financing.

Participant also pointed out that patients have a possibility to join the WiFi network provided by the hospital. This also shows that the solution doesn’t require any further investments or changes from the hospital

Additional workload

“It is very important during the development of such a solution to remember that it should not involve any workload from the healthcare professionals.” - Healthcare Professional

Healthcare professional indicated that the app should be fully manageable by its user so that it won’t require any help or additional work from the medical staff.

Improvements

At the end of the discussion, patients were asked about the potential improvements.

One of the participants indicated that besides seeing the location of our close ones, it would be a more immersive experience to be able also to listen to the ambient sound.

Another improvement could rely on creating the group Memories/Moments.

“Maybe instead of having every user send you a single memory, you could also create groups to

send more content at once.” - Patient 3

“The calendar would be nice to see the schedule of visits.” - Healthcare Provider. COVID-19 patients in the Netherlands can have up to 2 visitors for one hour. Visits can be scheduled almost every day.

“Memories could be made in the way that you can simultaneously prepare two or more. You could make drafts, and then later, you could send a bunch of them.“ - Family

Limitations

In an ideal scenario, the Adobe Xd prototype could give the user more freedom than the guided workflow. Participants were sometimes trying to click on the dummy buttons (not prototyped buttons), which was leading to confusion.

Due to the time restriction, the total number of participants was reduced to 5. The study was focused mainly on the patient’s side. Future research should also convey the family side participants. The ideal would be to conduct the study within one family to see the natural reactions.

One of the main limitations could be the lack of familiarity. The pictures shown in the prototype are not related to the patient nor the family. Participants could have been asked beforehand to share some related images, videos, links or stories, to create a more immersive study. Due to the high privacy concerns, this idea was omitted.

Having a whole experience of the app could also be necessary. Here the application had already predefined content. The mockup presented to the participants suggested that the app was already in use for a couple of days. This could lead to another confusion. For the perfect test, the scenario user should be able to start from creating the account, going through the entire process of onboarding where every functionality was explained, and additionally to have a guided first time revealing or sending instructions.

Another limitation could be the length of the study. Perfect scenario Application should be established as a long-term study where the user could get to know the app better and have more time to reflect upon its value.

Constantly changing regulations and measurements regarding the COVID-19 also created a knowledge gap.

Another limitation leading to possible confusion could be the way of experiencing the app. Prototype was made to fit the screen of iPhoneX and due to the limitations of Adobe Xd software the artboard could not be responsive (it could not fit every mobile phone). Therefore the participants were asked to open the prototype on their desktop computers.

Recommendations

Onboarding/Help

The onboarding section should be added to guide the user through the first use of the application - to minimize possible confusion during its use. Additionally, it is recommended to place the info buttons or the detailed description inside each main section.

Bottom navigation bar

During some interviews, it has been observed that the bottom navigation bar for some users was unnoticeable. It is suggested as a further recommendation to investigate the shape of the bar or the icon that symbolizes the main menu.

Sound

Memories always have multiple modalities. One of the strongest ones is sound, which can be an ambient sound, melody, or music. Music previously had been suggested to work together with the Ambience mode. As a result, patients, besides the visual modalities, could also receive the auditory. Since the creation of the content consists of recording the ambient sound, it could be automatically assigned to the ambiance's mode scene.

AR

In the early stage, augmented reality had been envisioned, and it can be recommended to investigate it further. However, due to the differentiated COVID-19 cases, where some of the patients being admitted to the ICU or with severe symptoms, the use of the phone is limited or excluded. The close app was intended to have a broad application without excluding any patient. Therefore the main requirement was made to be unobtrusive, and this solution had been discarded. However, AR could have the possibility to serve as a more immersive way of communication during the late recovery stage of hospitalization, where patients are getting bored and need more stimuli. AR is one of the emerging technology nowadays, and it will develop further in the near future. The newest generation smartphones are being equipped with the LiDAR scanner, and the development of 5G could bring the patient's environment closer to the power of immersive augmented reality.

Physical object

The physical object had also been developed, on the conceptual level, in the third cycle together with the application. The main reason to discard this idea came with the ownership, cleanability, development of the device, and the system that would maintain the user's data. Besides having unobtrusive communication, like warmth or breath, the envisioned physical object also had the possibility of verbal and visual communication. Therefore was a well-rounded solution consisting of both types of communication. Here the solution could also be different. The envisioned physical pieces could serve as an extension of the phone and already existing services that could be connected via Bluetooth. This solution could be easier to implement from the privacy, users' data point of view.

Besides the mention solution, the physical object could also serve a different function and be designed differently. Considered an early idea, created at the beginning of the first cycle, the smart pillow that could be connected between the patient's close one or any other physical object could also create a similar or maybe higher perceived level of closeness than the Close App.

Gestures

Gestures could be another addition to the new way of communication. The patient could use different gestures to reveal the sent content or to react to it. The gestures could be controlled by using a phone camera which could be supported by using the depth camera used in some smartphones. However, for more accurate gesture recognition, the special software and camera needed to be developed or embed the existing solutions such as the Leap motion sensor.

The patient could have multiple and differentiated input sources. For example, if the patient would swipe left, he would reveal only memories or swipe right, then the updates would be revealed, saving the reviling of the memories for later. Gestures would be definitively the next thing to look at developing the Close app further.

Further Research

Further research should be conducted, especially in the field of usability and the perception of the app. The AttrakDiff had been adequate to get to know the general attractiveness, hedonic and pragmatic qualities. However, there is little known about what influenced subjects' decisions. The research itself should also engage the whole family and possibly friends of the ex-patient to recreate the whole scenario and test it with accurate content.

Sensors

Nowadays, phones had been equipped with multiple sensors. There is a strong potential that further investigation could potentially lead to innovative solutions within the creation of an unobtrusive connection, similar to what the Close app does with the GPS sensor of the loved ones - capturing data and presenting it in the form of visual representation of the place on the patient's TV.

Circle is bigger

The use of the Close app can be broader than the COVID-19 patients. There are many other moments where people feel lonely, and the unobtrusive way of communication would help strengthen or even recreate a bond with their loved ones. The potential areas of development would be nursing homes and hospitals, especially during prolonged patient stays. Additionally, the Close app

could be used in any other situation where people are feeling lonely.

User flow – Creating content.

A similar recommendation was already mentioned after the final evaluation section concerning the possibility of editing/ sending multiple memories or moments at once. This could lead to creating the drafts, where users could start creating the content, verify it, edit it and send it.

Guided content creation

Furthermore, the way of creating the content could be less guided. On the other hand, shown multiple modalities give the sense of creating the memory and what modalities are essential. The created solution can be overcomplicated, especially for creating a "moment." Additionally, there can be slight confusion between the memory and the moment. It is suggested to provide the user with stories instead of moments that are already broadly used by other social media services.

Group Editing

Group editing could be an exciting feature recommended by one of the ex-patient during the last evaluation. The group could create the content similarly to how we can share and edit the google documents. Collaborative creation of the memory or moment could be even more mindful and could result in a better perception of the memory. Furthermore, it could also solve the problem of sending duplicated memories.

Voice over

The written stories by the family are now being sent and displayed on the screen. It has been observed that the TV size and distance vary from the location. In addition, some of the patients - especially the elderly patients might have difficulty seeing the text. The use of voiceover here is well justified. Therefore voiceover is recommended to be a part of guidance through the revealing process.

Furthermore, the guided voiceover could be connected with a virtual assistant such as Siri or Google Assistant. Here besides the guided revealing process patient would also have control over the system. However, such an option would not work for the COVID-19 patients.

Timing of the played memory The triggered once revealing will not stop till the patient does not shake the phone again to pause it. The future solution should use different modalities or, like in the case of gestures, the revealing of the content should be divided here. For example, shake to reveal - should reveal only one memory/ moment at the time.

Notifications

Another feature worth investigating is notifications. Currently, they will show up when the patient will unravel the content or whom the patient will send the reaction back to the family member.

Notification can also work as stimuli for the family. Notification that can be sent when the change in the patient's status is detected could, for example, stimulate the family to share a moment with the patient. - Patient decides to use the Close app, and his loved ones will be notified about it. This would trigger the patient's love ones to send him a moment.

Notifications could also help remind others about sharing the content regularly, at least once per day, which would provide the patient with consistency.

Unobtrusive/ Obtrusive

Another recommendation can be the future exploration of the two stages of the patient's hospitalization, unobtrusive and active, that were a part of the concept during the second cycle. The identified principles showed that the patient is mainly exhausted and cognitively impaired at the beginning of the hospitalization. After the recovery in the late stages, when the patient already recovered, he starts to feel bored. The main recommendation could be to offer the patient immersive stimuli based on the memories or moments.

Strategy

One of the most important recommendations is to create a strategy to develop and implement the application quickly. The business model should be created with a detailed list of requirements and possible stakeholders involved in the development.

Possible negative feelings The research conducted by Chen et al. 2015, describes the value of the positive memories and evoked by it positive emotions as "Positive memories evoke brain reward reactions similar to those by tangible and extrinsic monetary rewards." However, this mechanism works only with healthy people. Depressed subjects mostly tend to have problems with evoking positive memories, or due to the dysfunctional reward circuitry, they cannot think of up-regulating positive moods. However, the research conducted during the evaluation shows that the ex COVID - 19 patients would not evoke negative emotions. One of the participants mentioned that those memories.

Conclusions

The result of this project was an application that is intended to help COVID-19 patients to feel less isolated and lonely therefore closer to their loved ones with whom they cannot meet at the moment. At the early phase of the project, the main principle was identified - memories. In order to investigate what closeness means, interviews were conducted, which lead to another important finding - moments.

Memories and moments became the core of the project. Memories help us remember who we are and what we mean to others, but foremost, it shows that we have others who care about us. A similar principle works for moments; however, here, we share a moment with someone - by showing the nearest surrounding or sharing our current view, by sending pictures, videos, or video calling.

The project had many explorative phases and consisted out of three primary design cycles. Each cycle consisted out of research, exploration, ideation, and validation. The first design cycle was focused on the validation of principles found during the user and market research and the validation of the three concepts. Afterward, the two concepts were created basing on the outcome from interviews. Within the second cycle, the two concepts were developed further. The family and patient's needs had been assessed in order to understand their needs better. The outcome concepts evolved into the Digital Closeness - a mobile app and, Modular Closeness - series of modules. A comprehensive benchmark had been created to assess and validate the potential improvements and benefits of the mentioned concepts. The validation pointed out the benefits of the concept "Digital Closeness." The third cycle was the least explorative and was primarily focused on defining and evaluating the chosen concept.

Validation was conducted with ex-COVIS-19 patients, family members, and healthcare professionals. The outcome shows that the concept could evoke a moment of closeness between the family and the patient. The target group positively received the project.

The use of the application was also validated from the healthcare professional's perspective to be ensured if the Close app will not increase their workload.

Final design

The final design resulted in creating the mobile application to support the isolated patients and their families. Many iterations and objects were considered a solution throughout the process that could bring closer the two sides. The explorative approach resulted in multiple iterations and concepts were the most promising category was mobile application and object. During the second design cycle, the decision had been made, resulting in choosing the mobile application. The decision was made based on thorough research and showed the benefits and importance of the mobile app over the envisioned physical design.

Reflecting on research question

What interaction can evoke closeness between the isolated patient and their loved ones at a distance?

Multiple methods had been used to answer this question. It has been found that many different approaches are trying to solve the lack of closeness between people. The market research was conducted to evaluate current solutions, which resulted in the creation of three main categories: mobile applications, robots, and objects. Mobile applications had been divided into the subcategories: sharing experience, communicators, social media, community, supportive. The main categories for robots are communicator, companion, and therapeutic.

Finally, objects had been categorized as communicators, socializing, and evoking. The core interactions from founded solutions had been extracted: Video Call, Voice Call, Sharing same activity, Spontaneous interaction, Evoke memories, Share memories, Develop a relationship. Secondly, based on the found principles, brainstorming and ideation were done, resulting in three concepts: Evoke memories, Ambient participation, Rituals/ Active participation. Concepts were evaluated during the interview together with the questionnaire about the meaning of closeness. Results of the interview pointed out that sharing memories and sharing a moment and activity with loved ones are the main principles of closeness. The interview was done with two different age groups, Generation Y and Baby Boomers. The meaning of closeness was perceived differently. For participants from generation X, closeness means the easiness of connection, and for the baby boomers, closeness implies support.

To better understand the meaning of closeness based on the previous interviews with the ex-patient and healthcare professional, the assessment and comparison of Thirteen Fundamental Needs was created together with different scenarios picturing a day of patient's and closest family. The most deprived patient's needs turned out to be relatedness - to feel close and familiar, stimulation - to be distracted, security - to be informed. However, for the family, the essential needs are relatedness - to feel close, competence - to know the patient's feelings and state of health and purpose - to heave a meaningful connection, and foremost to know how to help.

References

aibo: More: Sony US. aibo | More | Sony US. (n.d.). https://direct.sony.com/aibo/.

Alice Morby | 17 November 2016 5 comments. (2019, July 10). Panic attack prevention device Calmingstone launches. Dezeen. https://www.dezeen.com/2016/11/17/calmingstone-panic-attack-prevention-device-ramon-telfer-alex-johnson-health-design-technology/.

AttrakDiff. (n.d.). http://attrakdiff.de/index-en.html.

AV1 – the robot for children with long-term illness. No Isolation. (n.d.). https://www.noisolation.com/global/av1/.

Benzer, H., Mutz, N., & Pauser, G. (1983). Psychosocial Sequelae of Intensive Care. International Anesthesiology Clinics, 21(2), 169–180. https://doi.org/10.1097/00004311-198308000-00012

Between. (n.d.). Best App for Couples. Between. https://between.us/?lang=en.

Borrel – the fun way to meet! Mibo. (n.d.). https://getmibo.com/.

Broadhead, W., Gehlbach, S., DeGruy, F., & Kaplan, B. (1989). Functional versus Structural Social Support and Health Care Utilization in a Family Medicine Outpatient Practice. Medical Care, 27(3), 221-233. Retrieved May 26, 2021, from http://www.jstor.org/stable/3765148

Chen, C., Takahashi, T., & Yang, S. (2015). Remembrance of happy things past: positive autobiographical memories are intrinsically rewarding and valuable, but not in depression. Frontiers in psychology, 6, 222. https://doi.org/10.3389/fpsyg.2015.00222

Conde Nast. (2015, August 7). Touch Room. Wired. https://www.wired.com/wiredinsider/2013/09/app-of-the-week-touch-room/.

Connecting women across fertility and motherhood. Peanut. (n.d.). https://www.peanut-app.io/.

Desmet, P., & Fokkinga, S. (2020). Beyond Maslow's pyramid: Introducing a typology of thirteen fundamental needs for human-centered design. Multimodal Technologies and Interaction , 4(3), 1-22. [38]. https://doi.org/10.3390/mti4030038

ElliQ robot by Yves Béhar helps older adults stay connected to the world. Dezeen. (2020, November 26). https://www.dezeen.com/2017/01/11/elliq-robot-yves-behar-fuseproject-helps-older-adults-stay-connected-world-design-technology/.

Face to Face Social Network. Houseparty. (n.d.). https://houseparty.com/.

FeelHey – HEY. HEY Bracelet. (n.d.). https://feelhey.com/.

Fernandes, L., & Bertolo, A. (n.d.). 'Unodois' concept. Behance. https://www.behance.net/gallery/36820417/Unodois-concept?tracking_source=search_projects_recommended%7Cloneliness.

Group session. Spotify. (n.d.). https://support.spotify.com/us/article/group-session/.

Harris profile. Harris profile - WikID, the Industrial Design Engineering wiki. (n.d.). http://wikid.io.tudelft.nl/WikID/index.php/Harris_profile.

Hassenzahl, M. (2006). Hedonic, emotional and experiential perspectives on product quality. In: C. Ghaoui (Ed.), Encyclopedia of Human Computer Interaction, p. 266–272

Huisman, E. R. C. M., Morales, E., van Hoof, J., & Kort, H. S. M. (2012). Healing environment: A review of the impact of physical environmental factors on users. Building and Environment, 58, 70–80. https://doi.org/10.1016/j.buildenv.2012.06.016

IDEO.org. (n.d.). Bundle Ideas. Design Kit. Retrieved from https://www.designkit.org/methods/30

IDEO.org. (n.d.). Create Insight Statements. Design Kit. Retrieved from https://www.designkit.org/methods/create-insight-statements

IDEO.org. (n.d.). Frame Your Design Challenge. Design Kit. https://www.designkit.org/methods/frame-your-design-challenge.

IDEO.org. (n.d.). How Might We. Design Kit. Retrieved from https://www.designkit.org/methods/3

KOMP – the communication device for seniors. No Isolation. (n.d.). https://www.noisolation.com/global/komp/.

Loades, M. E., Chatburn, E., Higson-Sweeney, N., Reynolds, S., Shafran, R., Brigden, A., Linney, C., McManus, M. N., Borwick, C., & Crawley, E. (2020). Rapid Systematic Review: The Impact of Social Isolation and Loneliness on the Mental Health of Children and Adolescents in the Context of COVID-19. Journal of the American Academy of Child & Adolescent Psychiatry, 59(11). https://doi.org/10.1016/j.jaac.2020.05.009

MacKellaig, J. M. (1987). A study of the psychological effects of intensive care with particular emphasis on patients in isolation. Intensive Care Nursing, 2(4), 176–185. https://doi.org/10.1016/0266-612x(87)90130-1

Magnus, V. S., & Turkington, L. (2006). Communication interaction in ICU--Patient and staff experiences and perceptions. Intensive & critical care nursing, 22(3), 167–180. https://doi.org/10.1016/j.iccn.2005.09.009

Mental Wellness, Redefined. HearMe. (n.d.). https://www.hearme.app/.

NHS. (n.d.). NHS Choices. https://www.leicestershospitals.nhs.uk/patients/covid-19-information-hub/additional-ways-to-stay-in-touch-with-patients/.

O'dea, S. (2021, April 14). Netherlands: smartphone user penetration 2018-2025. Statista. https://www.statista.com/statistics/568200/predicted-smartphone-user-penetration-rate-in-netherlands/.

Oliveira, E., Parikh, A., Lopez-Ruiz, A., Carrilo, M., Goldberg, J., Cearras, M., Fernainy, K., Andersen, S., Mercado, L., Guan, J., Zafar, H., Louzon, P., Carr, A., Baloch, N., Pratley, R., Silverstry, S., Hsu, V., Sniffen, J., Herrera, V., & Finkler, N. (2021). ICU outcomes and survival in patients with severe COVID-19 in the largest health care system in central Florida. PLOS ONE, 16(3). https://doi.org/10.1371/journal.pone.0249038

PARO Therapeutic Robot. (n.d.). http://www.parorobots.com/.

Peer Support Network For Mental Health - Support Group. TalkLife. (n.d.). https:/www.talklife.com/.

Phillips-Salimi, C. R., Haase, J. E., & Kooken, W. C. (2012). Connectedness in the context of patient–provider relationships: A concept analysis. Journal of advanced nursing, 68(1), 230-245.

Ploeg, R. van der. (n.d.). CRDL [Cradle]. CRDL. https://crdlt.com/crdl.

Polikandrioti, Maria & Ntokou, Mariana. (2011). Needs of hospitalized patients. Health Science Journal. 5.

RCA students design licking phones that turns speech into physical sensations. Dezeen. (2020, June 12). https://www.dezeen.com/2020/05/27/sandeep-hoonjan-xianzhi-zhang-haptic-phones/?li_source=LI&li_medium=bottom_block_1.

Rees, E. M., Nightingale, E. S., Jafari, Y., Waterlow, N., Clifford, S., Pearson, C. A., Jombert, T., Procter, S. R., & Knight, G. M. (2020). COVID-19 length of hospital stay: a systematic review and data synthesis. https://doi.org/10.1101/2020.04.30.20084780

Rijksoverheid. (2021). Hospital admissions: Coronavirus Dashboard. Government. nl. https://coronadashboard.government.nl/landelijk/ziekenhuis-opnames.

Rusting, C. L., & DeHart, T. (2000). Retrieving positive memories to regulate negative mood: Consequences for mood-congruent memory. Journal of Personality and Social Psychology, 78(4), 737–752. https://doi.org/10.1037/0022-3514.78.4.737

Stappers, P. J., & Giaccardi, E. (2017). Research through Design. In M. Soegaard, & R. Friis-Dam (Eds.), The Encyclopedia of Human-Computer Interaction (2nd ed., pp. 1-94). The Interaction Design Foundation.

Tada, R. T. (n.d.). FULU Haptic Finger Nail for Augmented Reality. FULU . https://www.fulu.site/.

Talkspace. (n.d.). Online Therapy. Talkspace. https://www.talkspace.com/.

Teleparty. (n.d.). https://www.netflixparty.com/.

The Community Engagement Platform. Panion. (n.d.). https://panion.com/. Together for you.

Jibo. (2020, August 3). https://jibo.com/.

VA.gov: Veterans Affairs. Mobile App: COVID Coach. (2020, April 20). https://www.ptsd.va.gov/appvid/mobile/COVID_coach_app.asp.

Verhaeghe, S., Defloor, T., Van Zuuren, F., Duijnstee, M., & Grypdonck, M. (2005). The needs and experiences of family members of adult patients in an intensive care unit: a review of the literature. Journal of Clinical Nursing, 14(4), 501–509. https://doi.org/10.1111/j.1365-2702.2004.01081.x

vicenews. (2017, October 7). Robotic Pets Are Helping Dementia Patients (HBO). YouTube. https://www.youtube.com/tch?v=cFvGAL9tesM&t=2s&ab_channel=VICENews.

Visser, T., Vastenburg, MH., & Keyson, DV. (2010). SnowGlobe: the development of a prototype awareness system for longitudinal field studies. In K. Halskov, & M. Graves Petersen (Eds.), Proceedings of the 8th ACM Conference on Designing Interactive Systems (pp. 426-429). Association for Computing Machinery (ACM).

Webb, P. (n.d.). Separate Togetherness. Penny Webb. http://pennywebb.co.uk/separate-togetherness/.

World Health Organization. (n.d.). News. World Health Organization. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/media-resources/news.

Appendix

Appendix A

DESIGN FOR our future

TU Delft

IDE Master Graduation

Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT
Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME
Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy".
Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !

family name: Torbus
initials: M.M. given name: Marek
student number: 4758994
street & no.:
zipcode & city:
country:
phone:
email:

Your master programme (only select the options that apply to you):
IDE master(s): ★ IPD ○ DfI ○ SPD
2nd non-IDE master:
individual programme: - - (give date of approval)
honours programme: ○ Honours Programme Master
specialisation / annotation: ★ Medisign
○ Tech. in Sustainable Design
○ Entrepeneurship

SUPERVISORY TEAM **
Fill in the required data for the supervisory team members. Please check the instructions on the right !

** chair: Dr. Elif Ozcan Vieira dept. / section: IDE/DA
** mentor: Dr.ir. Marieke Sonneveld dept. / section: IDE/AED
2nd mentor: Dr. Merijn Bruijnes EEMCS
organisation:
city: country:
comments (optional)

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..

Second mentor only applies in case the assignment is hosted by an external organisation.

Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

TU Delft

Procedural Checks - IDE Master Graduation

APPROVAL PROJECT BRIEF
To be filled in by the chair of the supervisory team.

chair Dr. Elif Ozcan Vieira date 01 - 11 - 2020 signature EÖZCAN

CHECK STUDY PROGRESS
To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair.
The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: _____ EC
Of which, taking the conditional requirements into account, can be part of the exam programme _____ EC
List of electives obtained before the third semester without approval of the BoE

○ YES all 1st year master courses passed
○ NO missing 1st year master courses are:

name date - - signature

FORMAL APPROVAL GRADUATION PROJECT
To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **.
Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: ○ APPROVED ○ NOT APPROVED
Procedure: ○ APPROVED ○ NOT APPROVED
comments

name date - - signature

Creating a feeling of closeness between isolated patient and loved ones — project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 01 - 09 - 2020 — 10 - 03 - 2021 end date

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

COVID-19 is an infectious disease caused by a newly discovered coronavirus. The virus affects people differently, most common symptoms are high fever, dry cough, and tiredness. Around 1 in every 5 people who are infected with COVID-19 develop difficulty in breathing and require hospital care. Most people (about 80%) recover from the disease without needing special treatment, and for the majority – especially for children and young adults – an illness due to COVID-19 is generally minor. However, for some people, it can cause serious illness. People who are aged over 60 years and people who have underlying medical conditions such as diabetes, heart disease, respiratory disease, or hypertension are among those who are at greater risk. (WHO)

The virus that causes COVID-19 is mainly transmitted through droplets generated when an infected person coughs, sneezes, or exhales. These droplets are too heavy to hang in the air and quickly fall on floors or surfaces. Therefore infected patients should be isolated.

Patients admitted to the general ward spend there on average 7 to 8 days. The very first days of the treatment are the most exhausting due to high fever and breathlessness. Their oxygen level is monitored, and in some cases, it is necessary to use oxygen therapy. Patients with severe symptoms are sent immediately to ICU where they spend up to 20 days and around additional 7 days in the general ward. Those patients need to be intubated and connected to a respirator. If treatment is not effective enough, in the most severe cases patients are sedated and turned in a prone position, to improve the effectiveness of the device.

In both cases treatment involves the use of masks or tubes which block their ability to speak. Consequently, it causes impaired communication with family and nurses. This problem touches on the communication between the patient, their family, and caretakers. Contact with the patients has been banned in most of the hospitals, due to the high risk of contamination and the possibility of spreading the virus. Patients are not allowed to meet or touch with their loved ones.

Family plays a very important role during the patient's stay in the hospital ward, by creating the feeling of safety in the new unfamiliar environment, mostly by being present, providing mental and physical comfort (M.MacKellaig, J. 1987).

This may lead to patients having low mood and feelings of anger, possibly disturbing the rehabilitation process (Magnus and Turkington, 2006). Isolation is devastating for patients and in 60% of cases creates irreversible changes in patient's behavior, leading to the development of PTSD (Benzer H. et al 1983).

Overall, COVID patients experience isolation from family, friends, and have very limited contact with healthcare professionals. This extended period of isolation can be traumatizing for patients.

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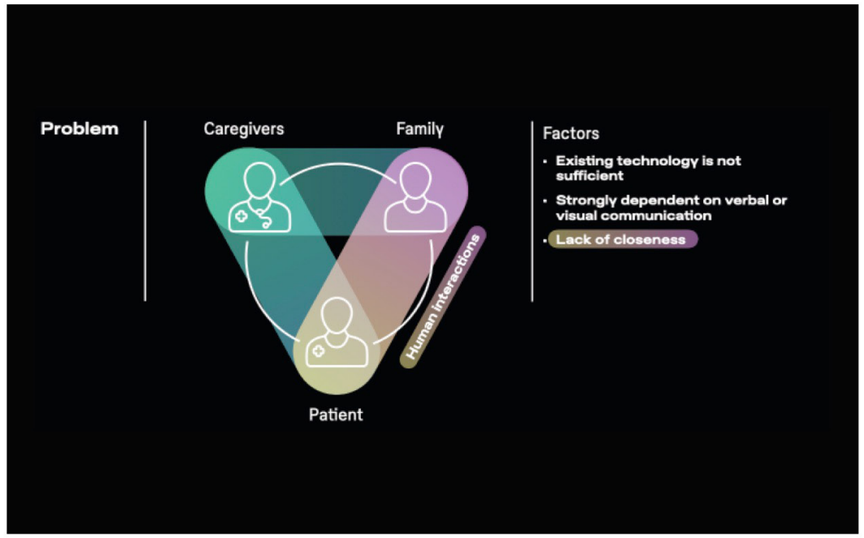


image / figure 1: Main stakeholders and the focus of the project

image / figure 2:

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

The project will focus on the enhancement of the relationships with the patient's loved ones by creating a new way of interaction to enhance the feeling of closeness. Main targets are isolated COVID-19 patients, admitted to the general ward and ICU patients after the relocation to the general ward. Patients need emotional support which had been impaired due to the COVID-19 pandemic:

Loved ones can not visit in person, both have to be supported through technology to feel that they are close while being at the distance. Patients suffer from loneliness and detachment from the family and society, which have a strong negative influence on well-being. Having their family close has a tremendously positive effect on the patient and helps the recovery process.

Current technologies mostly focus only on visual and verbal communication (FaceTime/Whatsap) rather than on strengthening the feeling of presence or intimacy. Existing technologies are not fully supporting closeness – the feeling of being there, during their prolonged stay in the isolation.

Verbal communication for COVID-19 patients in some cases might be difficult due to high fever and tiredness, which can affect the patient's willingness to talk. Other interactions need to be created or supported, that do not rely on mutual verbal and visual communication, which will create the feeling of being close to each other.

Healthcare professionals are overloaded by the increased demands under the COVID pandemic and can suffer from burnout. While trying to save patients' lives, they also have to save their own and prevent them from being infected, they wear protective suits and masks. This makes them unrecognizable and more distant for the patient. Health prov--iders trying to be as quick as possible when they visit the patients in their isolated room, to reduce the risk of infection.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

Enhance the feeling of closeness between the isolated and hospitalized COVID patients and their loved ones by creating a new way of interaction.

The project aims to explore different ways of communication between isolated patients and their families and possible facilitating technologies. To better understand the existing interactions between the patients and their families, a map of interactions and associated emotions will be created. Moments of loneliness will be found and used as intervention points to help patients feel more connected to their families.

The design solution envisioned should consider the context of adult corona patients, their families, and healthcare professionals, to create the feeling of closeness, provide a way for the patient and their loved ones to connect to each other emotionally in a non-verbal way, and investigate the phenomenon of feeling close to someone. The design should facilitate a bidirectional way of communication and be unobtrusive.

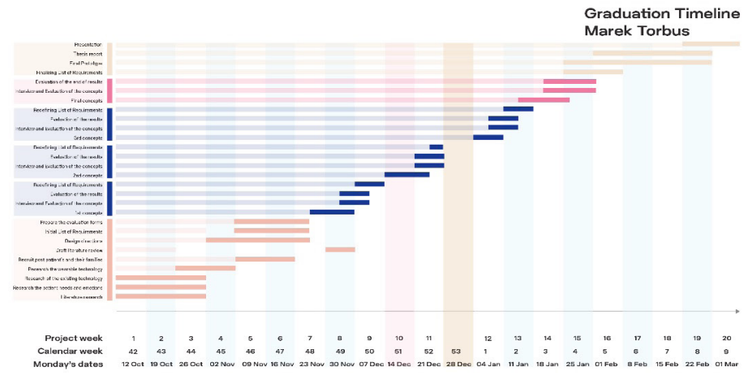
As this project is a part of medisign specialization, the concept design will fit into the healthcare setting.

Research Questions:
What interaction can evoke closeness between the isolated patient and their loved ones at the distance?
What is the existing technology to support closeness at a distance?
What are the needs of COVID19 patients during isolation?

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 1 - 9 - 2020 10 - 3 - 2021 end date



Project consists of three main stages initial research, iterative design cycles and evaluation, and the final design.
1. Research: To get a better understanding of presence, first literature research will be done on this topic. Existing technologies will be investigated to better understand the market and what is possible to create a realistic design concept. The exploration of main interactions that evoke closeness and the use of supportive technology will be done. To understand main stakeholders needs and emotions, research will be done by interviewing patients, family and healthcare providers, to find the valuable insights. As the final outcome of the first stage Initial list of requirements and the evaluation form for the first concepts and design directions will be made.
2. Design process: Project will pursue a research through design methodology by creating a design directions at the first cycle, and solutions which will be tested with stakeholders during the interactive sessions and interviews. Second cycle is a diverging phase where the decision towards the final technology shouldn't been made. During the third cycle the concepts will be turned into low fidelity mock-ups, which will be made on sufficient level to conduct the user experience and interaction testing. By the end of each cycle first the evaluation of tested solutions and new insights will be made, and second the new insights gathered within the previous cycle will be interpreted and implemented in to the design. It is planned as the outcome to have relevant design insights gathered during the final evaluation of the third cycle and together with defined list of requirements lead to the final design cycle.
3. Final design: Final design cycle will be based on the insights from the three previous sessions and more concrete and detailed concepts will be created. Concepts will result in detailed experiential-quality prototypes which will be adjusted for detailed user and usability testing that will be conducted with the end users - post COVID-19 patients. The final goal of this phase is to conduct final evaluation and pick the most valuable prototype, which will be developed further in the final stage. 4. Finishing the project: During the fourth phase of the project the main focus will be on finalizing the chosen design prototype, completing the thesis report and presentation.

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... Stick to no more than five ambitions.

We\Visit
Living in the pandemic pushes us towards social distancing and creates a higher rate of disconnection, changing our habits and routines. These hard times touch the most people who are closed in the hospital ward and need to spend time in isolation. I took part in a project organized by the Hospital Reinier de Graaf, my main motivation was to create an impact. The goal of the project was to provide the hospital with a solution that can help to bring patients and families closer. To answer the hospital needs, We\Visit was created. The core of the service is a video communication platform to easily connect patients with family and friends who are not able to visit.

We\Visit was lead by Dr. Elif Özcan-Vieira and Dr. Merijn Bruijnes, and inspired me to create this thesis project, and ask this question again – What can be a different way of communication and how to create the feeling of presence over a distance?

Medisign
During my first year of a master's program, I had an opportunity to work on the last phase of the ICU monitor. The main objective of the project was to redesign and add additional product behavior to reduce the stress and anxiety of the patient and visitor - mute the alarms showing that simple solutions can greatly improve patients' stay at the ICU. I've realized that I want to pursue the Medisign track and gain the knowledge and experience in this field to create an impact.

The next project I worked on focused on the implementation of Value-Based Healthcare for cleft lip and palate patients at VU University Medical Center Amsterdam. Extensive research was conducted including interviews with doctors and medical staff, patients, and their parents which lead to the development of journey maps for all the stakeholders. The outcome showed the importance of the first examination room, especially for kids at a young age, as it creates the perception of the whole examination. My main objective was to create a distraction element for the children and a tool for doctors that facilitate the unpleasant examination of mouth and ear.

Within this project, I would like to learn and better understand the needs of the stakeholders by diving deeper into the emotion-driven design and user experience.

Design for interaction
Following the IPD track, I got to know technical knowledge, conceptualization, and embodiment design integrating user, technology, and business aspects. However, I feel that I couldn't call my self a fully integrated designer without deepening into the user centered design. I want to learn how to map user needs to translate desired interactions into designs.

Project management
This project will involve a lot of planning and arranging meetings with multiple stakeholders that will have to test the design that I'm creating. Each of them will bring new ideas and valuable insights. Although it is a great source of knowledge it can also make it complex to keep everyone on the same page and to manage their expectations.

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

Initials & Name M.M. Torbus Student number 4758994

Title of Project Creating a feeling of closeness between isolated patient and loved ones

Appendix B

Table 1

	Summary – HP	Summary - Patient 1
Who?	Eramsus MC - Healthcare professional	Personal trainer
Visits	1 per day per visitor	Not allowed
Time per visit	1 Hour	Not allowed
Visitors	• 1 Visitor per patient (April) • In life threatening situation or (when everything shows that the patient won't survive next 24h) now family can visit the patient • Due to the COVID-19 visits are very restricted, feeling the presence of the closest ones might have a positive influence	
Sedation	• Only the patient with severe symptoms • critical symptoms (low oxygen saturation etc.) is going to be admitted to the ICU where will be sedated	None
Duration of sedation	Less than 10 days?	
ICU Stay	Maximum of 7-10 days	
Stay in the Hospital	Average - 23 days	7 days
Patients	27% of COVID-19 patients is being admitted to the ICU / 60% of the patients admitted to ICU are patients younger than 70 years old / 65% of all the patients have one underlying condition (Leidraad Nazorg COVID19)	

COVID – 19 Severity Illness	• COVID-19 in the most severe cases causes sepsis
	• Most of the patients is not conscious and can't feel any stimuli (End of life)
	• Patient's health condition can rapidly change without any kind of symptoms
	• Patient's are intubated in order to use the ventilator
		• First two-three days of hospitalization were the most difficult
		  • High fever
		  • Tiredness
		  • Uncertainty about the severity of COVID
		  • Constant measurements of oxygen, blood pressure etc.
		• Through the patients stay, most of his time spent in the bed

	Summary – HP	Summary - Patient 1

Emotions Feelings	• Loneliness
	• Loneliness is worse than during the non COVID-19 - caregivers spend as much time as it is possible
	• Anxiety
	• Having the family around has a tremendous positive effect in the patient and helps to recover quicker.
	• Patient wants to see the closest family, spouse and children
	• Frustration – From not being able to see caregivers and family due to use of the protective gear (hazmat suit, masks, gloves)
	• Patient feels helpless - can't communicate with the family (after moving to the general ward)
	• Patients always want to be close to their family
		• Safety
		  • Patient had very good relations with the doctors, and nurses
		  • Nurses had regular visits to check all vitals (sometimes even at 23:30)
		  • Patient could (and was able to) stay in touch with his loved ones using his iPad
		  • After two days patient experienced significant health improvement
		• Staying positive - being optimistic
		• Staying in touch
		  • Receiving some food (Turkish specialities)
		  • Some needed products (T-shirts)
		• Missing a normal life
		  • Patient can't leave the room
		  • Patient can't be a part of his routines (playing tennis, having a coffee with his wife)
		
		• Most of the patients can't communicate with their families during the stay at the hospital especially during the first days and especially when they are intubated.

	Summary – HP	Summary - Patient 1
Feeling of safety	• Patients feel safe during their stay at the ICU, mostly because they are monitored by the doctors and nurses, they receive a lot of attention, also because of the medical equipment • After the relocation from ICU ward to General ward patient experience “relocation stress”, less attention and less monitoring is the main cause • Relocation to the general ward causes negative emotions – loneliness and anxiety	_
Opportunity to test the patients needs **Placement of the product**	When patient is awake during it’s recovery time during the winding off the ventilator and moving into the general ward	
Senses / Memories / Objects	• Sense of smell of something familiar can evoke some positive emotions • Sense of sight – pictures of the family • Pictures of the patient it self before the illness • Religious objects are also found in the ICU environment (brought by family) - Placement - below the pillow • Some patients (or patient’s family) bring Teddy Bears or small mascots with them to comfort the patient • Family tries to evoke positive memories by bringing the objects (from holidays) or by listening to the certain music • **Touch - is the only way to show the engagement and empathy touching the patient’s hand by the nurses and family – Bringing the feeling of “I am here”**	

	Summary – HP	Summary - Patient 1
Patient's Communication	• Patients can’t communicate while they are intubated • After switching the patient to the general ward patient can use their phone to communicate with the family but in most of the cases patients are still to weak to be able to use their phone • Using the phone might be possible only during the last days of the patient’s stay at the hospital • Patients are asking nurses for a help to call their close ones	
PTSD	• It is predicted that due to the coronavirus the PTSD will have a stronger effect on the patients • Patients mostly don’t remember what happened during the their stay at the hospital • Main factor of minimizing the PTSD would be preventing the delirium • Close contact with the family can help to minimize the PTSD	

Activities		• Watching TV – staying updated
		  • Distraction
		  • Reading a book
		  • Most of the information on the TV was related to COVID, which evoked negative
		• Sending e-mails to closest friends as a newsletter with the updates
		• Using iPad - as a “window to the world”
		• Browsing Facebook/Instagram/Houseparty
		• Calling friends and family (after first 2 days)
		• Working (preparing future training sessions)

	Quotes – HP	Summary – Patient 1
Who?		
Visits **Time per visit** **Visitors**	"In the ICU, it was one hour per person, per patient, and one person. So one hour, one person. And now we see it's a little bit more, it was a little bit more, just I think, two times a day." "And what we usually do, even with the COVID, that we say, okay, it is we are expected that your loved one is going to die within 24 hours, then we allow more people to be with the patient. " It depends with the also the period when they are awake and on the ventilator. There's also an anxious period, because they are awake, sometimes not that comfortable. So it is very nice to have your family around in that period. And that's that's a difficulty now because the family is not allowed to be there all the time. So that could also be very nice to have something **to feel from your partner or your children.**	
Sedation	"What we saw by the COVID patients, they all have problems with breathing, the saturation was low. Sometimes if you are really in a septic situation, your blood pressure is low, your heart rate is high. So that are the signals that we say this patient is really sick, severely threatened, and he or she should go to the ICU" "So he will be sedated. The tube is going in, he will be and then because of the COVID. And then really in the first we knew they had to be they were really very, very sick. So we had to sedate them heavily."	
Duration of sedation	?	
ICU Stay	ICU is now I think, 7 to 10 days. All right. Yeah. And I really don't know how long they are staying in the general ward	
Stay in the Hospital	NVIC	
Patients	NVIC	
COVID – 19 Severity Illness	"Of course, it's not only the lung, it's also the head, it's also how your stomach and all because your whole body is sick if you have severe sepsis." "That was a problem in the beginning. And maybe you can imagine that if you have a bleeding in your head and if that you have to motivate but they also have consequences on how you will recover and how quick you will recover. So that's our that's ICU. That's that's very it's not only one thing." "Some patients are awake. Most of them are too sick to be conscious. " (End of life, highly sedated) "So he will be sedated. The tube is going in, he will be and then because of the COVID. And then really in the first we knew they had to be they were really very, very sick. So we had to sedate them heavily." "With a COVID patients, what we saw it was stable. And in the next five minutes, it could be a very low blood pressure, for example, or a very low blood saturation." "I think there are very few stimuli that come to the patient, not by touch, maybe by hearing… But for the touch, I think this is not the right moment to do something."	Well, I think the most stressful thing was in the first days watching TV and looking at all the bad news about COVID because remember when you when you go back to march ever more doubts, more unknown things, more stressful people and so on. And the country's didn't know what to do, and you are laying in the hospital with COVID. So it is very stressful. Of course, that's number one. Number two, when nurse comes, of course, and when she tells you, you still have high fever, it was, you know, I was giving back. And, and of course, the most stressful thing was you couldn't really get out of the room. It was like in a prison. But, of course, I am an optimistic person. So I always thought to myself, that this is a temporary time. So don't worry. And think about the people in the hospital, who are in the room for years, for some reason. Yeah. Think about the people in the prison, who cannot move out of the room for years. So I was feeling better when I talk process.

	Quotes – HP	Summary – Patient 1
Emotions Feelings	"I noticed and read from the literature is that they think the feelings is loneliness, anxiety." "During COVID, we spent as less as possible time in the room just to protect ourselves. " "It's difficult, because they don't know what they need. But if we go from the emotions, and I think, to be reassured, and to be to have the feeling they are not alone, to see people to talk to people, to have someone around" "No, of course, we know that if the family's around that has a **tremendous positive effect on the patient, it really helps to recover quicker."** **"**but just the most close the partner the maybe children, but that is in the non COVID." "maybe also a kind of frustration that they don't see anyone… Now where to the COVID because we as professionals, also wear the glasses, the mouth mask, so we are not recognized. Or we look like people like aliens, and you don't see the faces so there is less reassuring from from the professionals." "That's really lonely and helpless, as you cannot do. You cannot make contact to anyone." 'in my whole career, I do not remember a patient who said, I don't want my family. And sometimes it's, well, of course, there is some there are aquarelles in the families and then they see I don't want to see yam or, or him. Yeah, there's just a specific person that they don't want to see"	Sure, because the hospital I went to, that was the reason I went to that hospital. I knew, I knew very closely, some good doctors. So it was helping, because they came to my room. And we discussed and they told me I am going, you know, I am doing much better compared to first day and so on. So it was good for me to hear from doctors that things were going okay. That could help COVID patients to feel less isolated and lonely to be optimistic, first of all, because I always told, you know, during my stay, you shouldn't ask why it happened to me because it's already happened. Because we could see each other through FaceTime I cannot imagine this disease or make friends like 20 years ago, because without seeing your loved ones, but now it is not very difficult. Because like we are doing right now, we you know, we talked and we saw each other so it was really nice. I was very lucky. I knew nurses, I knew that the head doctor in the hospital, the chief, Chief doctor, so they were telling me that things are going well. And they were explaining to me, my, my blocks, test results. So I could see myself, indicators getting better and better. I am a legal expert on emotional intelligence, and emotional intelligence, positive. feeling to be positive is extremely important. I am a legal expert on emotional intelligence, and emotional intelligence, positive. feeling to be positive is extremely important. So almost every day, I send to all my friends to about 50 people, some case, some nice little letters. Oh, and I mentioned there because everybody was, of course worried about me, and they wanted to call me but you know, **I couldn't talk.** Yeah. And this gives the opportunity for my friends and family to understand how I feel how I am and I also gave a little you know, little notes Posting notes about life. That, for example, I told them that if they are at home, if they are with their loved ones, and if they drink your coffee together, there must be right they must be very happy. Because you cannot do that in the hospital. Nobody can visit you and so on. So every message and this way, you know, communicated with them through my WhatsApp messages every single day. they really follow me every single day. And especially one friend of mine, when I told him, I am sweating a lot. He sent me a bunch of T shirts. Which was very helpful really, because I really use them each one of them. And, and also, another friend sent me some nice food to the hospital. I got the permission that they could bring to the room. So I had nice food almost most of the time. That question will not help you. Instead of that, you should think what can I do in the hospital, so my time will go much better, much quicker. I think people should be optimistic, because there is always a positive thing that you can think even in the hospital. There are there were some cases, they didn't go with their oxygen levels get higher. They fever didn't go down. So they didn't know how long they will spend in the hospital. But in my case, since the indicators were going red, I was very positive that I was going to go home very soon. So I was not, you know, bothered _____ Some of my friends, relatives are in ICU, the biggest problem was, they couldn't get any news from the patient. You know, I mean, he said disaster. And they cannot, of course, call all the families every day, twice a day and let them know how the patients how their relatives are doing. This was the biggest problem that I have heard from my friends they hit they have no idea how their relatives are

	Quotes – HP	Summary – Patient 1
Feeling of safety	"So that all that anxiety is real. What I also know is that people admitted to the ICU feel safe, really, most of the times she'll say, because they are monitored, because there's a lot of personal they are if something happened, immediately, there is a nurse or a doctor. And that gives a feeling of safety." "...**relocation stress**, because they go into the ward, there are less nurses, they don't have the monitoring, they there is less time for them. Less awareness. So that that gives them that **feeling of loneliness of unsafety,** yeah, and we cannot prevent that, well, maybe a little bit. But of course, it's a normal step to go to the ward. And of course, it's it's that stable, that there is less monitoring."	
Opportunity to test the patients needs **Placement of the product**	**you want to test the feeling of the family nearby.** This is (winding up from the ventilator) , I think that and also on the general Ward, might be the best time to test because here the patient is awake, and still can feel the family nearby. So I think that is reassuring, if the if there is loneliness here that can help.	
Senses / Memories / Objects	Well, what you already said the feeling of touch. But also maybe, I think all kind of your senses because also, when you smell something that is familiar to you, it comes into your, into your brain so that we know that from our research, so that you can know, the smell of your family. what also began reassuring, what we are now experiencing or not experiencing, experimenting with, **but I know from Philips is now put on the on the on the ceiling, all kinds of beautiful picture, that kind of thing**. So I would say all our sentences can have an effect on feeling better on your, on your well being. sometimes also a picture of the patient, him or herself in good times. We know some religious attributes, for example, sometimes we see something laying below the pillow. **we also see that some people bring a teddy bear or something nice to get in the bed and to have them. Okay, I was with you. And oh, look at it.** Okay, I think now we know that has a positive effect on people, of course. So sometimes your own bring your own music, the memories of good times together or from a holiday or Yeah, whatever. is also nice to do for the patient. **"And, and I think that touch is one of the important things that we have and that we can do and then you can show your empathy and your engagement... And, and your connection to the patient. Yeah, yeah. And I think that's one that that is really one of the most important things we still can do even how severely ill one is. But that's to let let the author know, I am here. And I, of course, I cannot feel him or her. But I can be there. And that is the connection that I want to bring over. Even if the patient is in sleep. And by touch you can you can do you have that connection by**	

	Quotes – HP	Summary – Patient 1
Patient's Communication	"But most of the patients are still too groggy, and too, even too ill to do all that kind of things. So most of them, maybe they can have a WhatsApp to the family. But I almost never see patients who are really awake and active." "The patient is still very groggy, still don't know what's happening, or sometimes he or she knows. But if you don't, you don't notice all kinds of things in your in your surroundings. So that that is what's happening here. So to make contact with your family, by yourself is nearly impossible. No, it's not impossible, but it's not easy." Of course, that's also communication. If the patient can do an app, of course, it's allowed is the fingers are swollen, and the touch is most of the times not like it used to be because of the illness. So sometimes not most of the times doing an SMS, which are your little phone is not doable for you. Yeah. So there is not much they can do in the first and then we are talking about this period. Yeah. And of course, if they are going to if they recover and more, then they get more and more do so then there comes a time they can have contact and they can phone by themselves or make contact. "most of them are not capable by themselves. So they need someone who can do that for them. Well, they in this in this face, they need someone to help them with that. And I can assure that most of the nurses don't have time to help them."	
PTSD	"But what we already saw from some very quick literature, there is, but what we talked about is higher anxiety, there is more isolation, there is more delirium. So we know the ingredients and the risk factors to have post traumatic stress are there. " I've talked to a lot, but to patients, what I heard, is that the patient say, **Well, I don't know anything about that period, because I was because they were heavily sedated. And I wake up, and then I wasn't in the general Ward, so they have no memories.** Well, I think it's the same as with non COVID patients. And we can do now, maybe not a lot, but we can do things and we could do interventions to prevent post traumatic stress. And that's, that's, that's mostly in to **prevent delirium**. "I really believe that if the family is close, that will help because you are less anxious."	
Activities		No, I didn't. I watched also TV. In the first days, I was following the news. But then I saw in the news, all the disasters. People are dying. I said, What am I doing? So I started watching animal shows. Oh, exactly. And some other nice, you know, tiny TV shows

Appendix C

Interview for 1st cycle

Introduction of the project

Hi! I'm Marek. I'm a graduate student of TUDelft following my master in Integrated Product Design track. I'm working on my graduation which topic is "Creating the feeling of closeness between the isolated patients and their families".

The design goal is to **Reduce the feeling of isolation** to Covid19 patients by creating an unobtrusive connection with their family and a warm home environment. Interview will consist of two parts. First I will ask you couple of questions about closeness. Second part will be focused on evaluation of the directions that I previously created, and will consist of 3 short sets of questions.

Interview about the presence/closeness

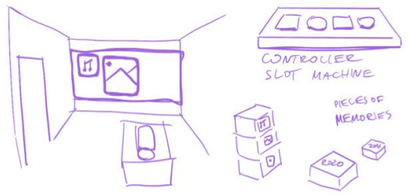
I would like to ask you some questions to better understand what closeness means to you to have a deeper and more personal understanding of this phenomenon.

1. Could you recall a moment when you have missed your loved one?
2. What important interaction with your loved-ones makes you happy?
    1. Why this is important for you?
3. What does the presence of your loved one means to you?
    1. Why this is important for you?
4. What interactions can bring your loved ones closer?
5. How would you describe closeness?

1st concept – Evoking Memories

First concepts' principle are memories. Positive memories are an instant source of positive emotions like joy, inspiration, and gratitude.

This concept evokes the users memories in non conventional way by leading the user to the deeper exploration. That at the end could evoke a more meaningful conversation or memory.



1. Could you recall the last time you had a chat about the past events that made you happy?
2. How does thinking about the positive past events, like holidays spent together, affect the perception of loneliness?
    1. Why this is important for you?
3. What activities(interactions) could help you in evoking or sharing the memories?
4. Why do you think does interactions are important?
5. How would that affect your stay at the hospital(during the isolation)? Why?

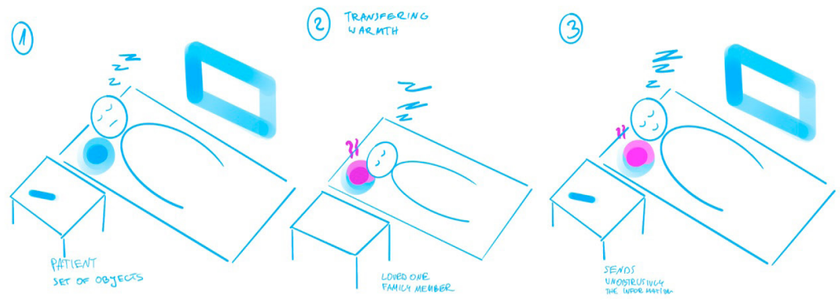
2nd concept – Ambient Participation

Feeling the presence doesn't have to be always bidirectional and it can be a passive participation.

Ambient participation (in the activity) - refers to the activities where you don't communicate with other people and or you are not dependent upon other person during the activity (like watching a movie, being in the same space).

The second concept addresses feeling the surrounding of the family house, where you don't always have a conversation but you feel the presence by it self by being a part of the space.

Interaction will consist of the two identical products, one located at home and second will be placed in the isolated room were the patient is recovering. Once the one object will be touched, the second object on the other side will change its state to indicate that it is used by one of the users.

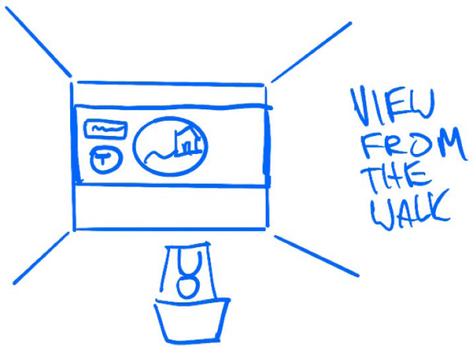


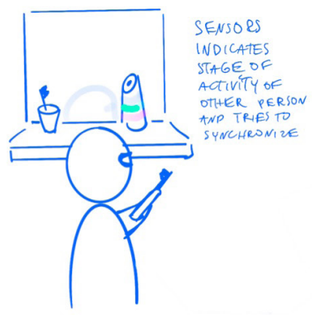
1. From this definition of ambient participation, can you recall a time where you passively participated in a family activity?
2. How would you feel If you could remotely participate in an ambient activity?
3. Why this feeling is important for you?
4. How do you usually spend time with your family, without the shared activity?
    1. What does it mean to you?
    2. Why it is important for you?
5. How would that affect your stay at the hospital(during the isolation)? Why?

3rd concept - Rituals/Active participation

Third concept addresses the same phenomena as second concept, however the main difference is the active way of spending time. Sharing same activity influence the feeling of togetherness, both users can actively participate to create a feeling of closeness.

Active participation might be used in many activities and re-create meaningful interactions and and family rituals like going for a walk.





1. From this definition of active participation, can you recall a time where you actively participated in a family activity?
2. How would you feel If you could remotely participate in an activity?
    1. Why this feeling is important for you?
3. How do you usually spend time with your family ?
    1. What does it mean to you?
4. How would that affect your stay at the hospital(during the isolation)? Why?

Final Questions

1. Which concepts would be the most beneficial? Why?

Planned outcome

Get to know the users needs and emotions, understand why they are important for creating the feeling of closeness. Find out and understand which design direction is the most impactful for the user.

Wywiad – Cykl pierwszy

Wprowadzenie do projektu
Cześć! Jestem Marek. Jestem studentem TUDelft na kierunku Integrated Product Design. Pracuję nad moją pracą dyplomową, której tematem jest „Stwarzanie poczucia bliskości między odizolowanymi pacjentami a ich rodzinami w czasie pandemii".

Celem projektu jest zmniejszenie poczucia izolacji u pacjentów, poprzez stworzenie dyskretnego połączenia z rodziną i ciepłego środowiska domowego.

Jeśli nie jesteś nie byłeś/łaś pacjentem przebywającym w izolacji, wywiad z Tobą jest równie wartościowy jak z osobą która była podana hospitalizacji.

Wywiad będzie składał się z dwóch części. Najpierw zadam ci kilka pytań dotyczących bliskości. Druga część poświęcona będzie ocenie interakcji, które wcześniej stworzyłem i będzie składać się z 3 krótkich zestawów pytań.

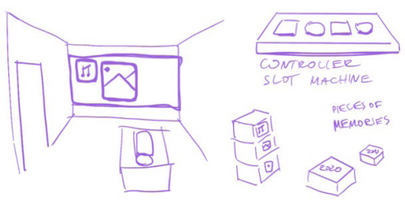
Całość może zająć ok. 1h. Jeśli stwierdzisz że nie chciałbys uczestniczyć w wywiadzie bądź chciałbyś go przerwać albo pominąć pytanie, możesz to zrobić w dowolnym momencie.

Bliskość
Chciałbym zadać ci kilka pytań, aby lepiej zrozumieć, co oznacza dla ciebie bliskość, aby mieć głębsze i bardziej osobiste zrozumienie bliskości.

1. Czy możesz przypomnieć sobie moment, w którym tęskniłeś za bliską Ci osobą?
2. Jaka ważna interakcja z bliskimi cię uszczęśliwia?
3. Dlaczego to jest dla Ciebie ważne?
4. Co oznacza dla ciebie obecność bliskiej Ci osoby?
5. Dlaczego to jest dla Ciebie ważne?
6. Jakie interakcje mogą zbliżyć twoich bliskich?
7. Jak opisałbyś bliskość?

Pierwszy koncept – wywoływanie wspomnień
Główną ideą pierwszego konceptu są wspomnienia. Pozytywne wspomnienia są natychmiastowym źródłem pozytywnych emocji, takich jak radość, inspiracja i wdzięczność.

Koncepcja ta przywołuje wspomnienia użytkownika w niekonwencjonalny sposób, prowadząc do głębszej eksploracji. To może wywołać bardziej znaczącą rozmowę lub wspomnienie.

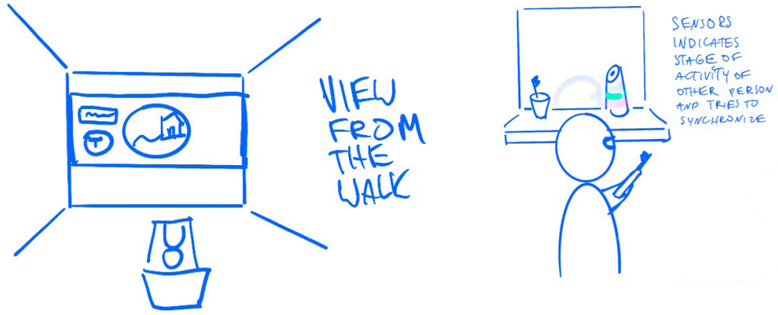


1. Czy z tej definicji uczestnictwa w otoczeniu przypominasz sobie czas, w którym biernie uczestniczyłeś w czynnościach rodzinnych?
2. Jak byś się czuł, gdybyś mógł zdalnie uczestniczyć w tej interakcji?
3. Dlaczego to uczucie jest dla Ciebie ważne?
4. Jak zazwyczaj spędzasz czas z rodziną, bez wspólnych zajęć?
5. Co to dla Ciebie znaczy?
6. Dlaczego jest to dla Ciebie ważne?
7. Jak wpłynęłoby to na Twój pobyt w szpitalu (podczas izolacji)?Dlaczego?

Trzecia koncepcja – Rytuały / Aktywne uczestnictwo

Trzecia koncepcja odnosi się do tych samych zjawisk, co druga, jednak główna różnica polega na aktywnym sposobie spędzania czasu. Dzielenie się tą samą aktywnością wpływa na poczucie wspólnoty, obaj użytkownicy mogą aktywnie uczestniczyć w tworzeniu poczucia bliskości.

Aktywne uczestnictwo może być wykorzystane w wielu zajęciach i odtworzyć znaczące interakcje i rytuały rodzinne, takie jak np. spacer.



1. Czy z tej definicji aktywnego uczestnictwa możesz przypomnieć sobie czas, w którym aktywnie uczestniczyłeś w czynnościach rodzinnych?
2. Jak byś się czuł, gdybyś mógł zdalnie uczestniczyć w tej interakcji?
3. Dlaczego to uczucie jest dla Ciebie ważne?
4. Jak zazwyczaj spędzasz czas z rodziną?
5. Co to dla Ciebie znaczy?
6. Jak wpłynęłoby to na Twój pobyt w szpitalu (podczas izolacji)? Dlaczego?

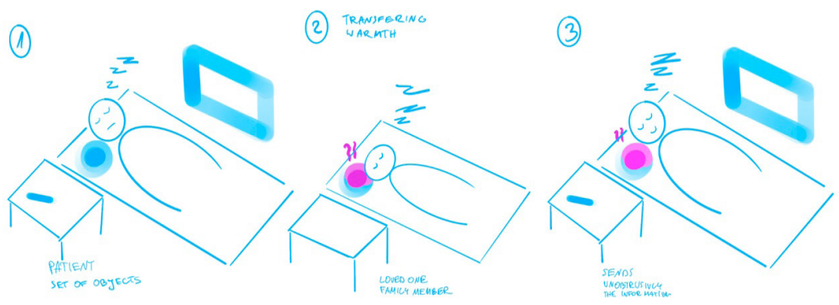
1. Czy pamiętasz, kiedy ostatnio rozmawiałeś o minionych wydarzeniach, które cię uszczęśliwiły?
2. Jak myślenie o pozytywnych wydarzeniach z przeszłości, takich jak spędzone razem wakacje, wpływa na postrzeganie samotności?
3. Dlaczego to jest dla Ciebie ważne?
4. Jakie czynności (interakcje) mogą Ci pomóc w przywoływaniu lub dzieleniu się wspomnieniami?
5. Jak myślisz, dlaczego interakcje są ważne?
6. Jak wpłynęłoby to na Twój pobyt w szpitalu (podczas izolacji)? Czemu?

Drugi koncept – Partycypacja otoczenia
Odczuwanie obecności nie zawsze musi być dwukierunkowe i może być biernym uczestnictwem.

Uczestnictwo w otoczeniu (w działaniu) - odnosi się do działań, w których nie komunikujesz się z innymi ludźmi lub nie jesteś zależny od innej osoby podczas działania (np. Oglądanie filmu, przebywanie w tej samej przestrzeni).

Druga koncepcja dotyczy odczuwania otoczenia domu rodzinnego, w którym nie zawsze rozmawiasz, ale czujesz swoją obecność, będąc częścią przestrzeni.

Interakcja będzie składać się z dwóch identycznych produktów, jednego znajdującego się w domu, a drugiego umieszczonego w izolowanym pomieszczeniu. Gdy jeden obiekt zostanie dotknięty, drugi obiekt po drugiej stronie zmieni swój stan, wskazując, że jest używany przez jednego z użytkowników.

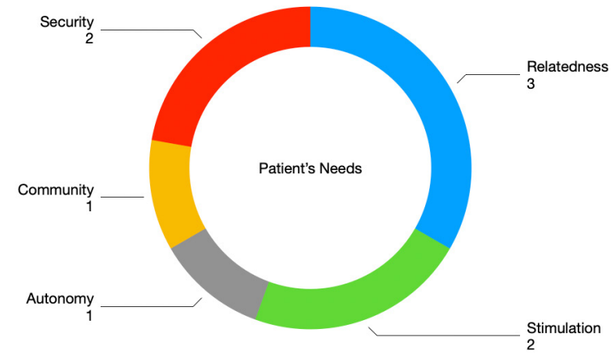


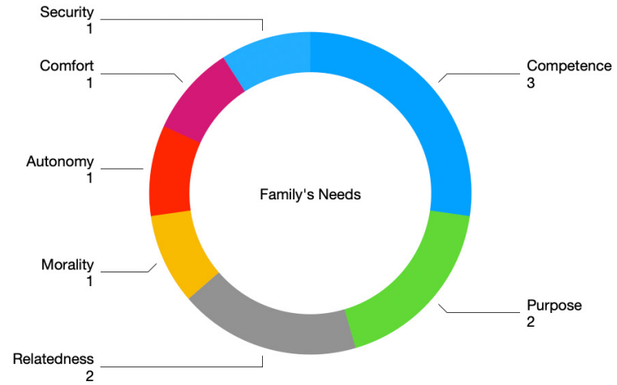
Pytania końcowe
Które koncepcje byłyby najbardziej korzystne? Czemu?

Appendix D

Emotions	13 fundamental needs	Needs	Needs – Scenarios	Activities – Potential improvements
Dissatisfaction	Autonomy	Being able to meet in person with his loved ones	Staff doesn't allow visitors	Not applicable
Desire	Community	Quick way of sending small messages	Ted would like to send some quick updates to his wife	Those updates could intend to inform patient's family and provide the better understanding of what the patient currently is going through.
	Competence	To know the current health status and procedures		
Boredom	Purpose	To be busy	Ted feels better now and he would like to be more involved into his family life	
Loneliness	Relatedness	To feel closeness	Ted would like to feel that someone is close to him.	The solution should mimic the feeling of **being here and now** – without having a conversation
Desire	Relatedness	To feel someones presence	He is missing the presence of other people	Presence doesn't mean communication. Patient sometimes needs to feel the presence of close people without the communication. This is one of the way to show a support. However, it can be also interpreted as a easiness to communicate with the loved ones. Feeling that other people are available and are gonna answer the phone or message anytime
Sadness	Relatedness	Having same interactions over the distance as it would be possible to have at home	Ted is missing small interactions that he would have with his wife	Patient refers to interactions that would have normally while living together, such as: starting the day having a dinner together, spending the time together at the same place, having a small snacks, going to sleep. Patient could be provided here with the personalized activities or created by the patient itself to share and cherish the moments.
Excitement, Gratitude	Security	Quick way of updating about the current health status	Ted wants to catchup with everyone to tell that he feels better	Patient could have a public status visible for certain group of friends were they could get a notifications on the patient's health status
Anxiety	Security	To be informed, to know the steps	Ted feels disoriented, he doesn't know how his illness will impact his future life and how the procedures looks like	The first step could be to provide the patient with overview, wich would ensure the patient that he is in a good hands and that his loved ones will be always close to him.
Desire	Stimulation	To be distracted	He would like to have a distraction that would help him to feel better.	A positive distraction could be based on positive memories. The creation of **the space were family and friends could upload memories** in the form of text messages, voice messages, pictures videos and places could be highly beneficial
Nostalgia, Gratitude	Stimulation	Positive distraction	Received pictures help him to bring back positive thoughts	Positive distractions could incorporate different activities, such as taking the time together with the family to browse the memories or small mini games, quizzes etc. WHAT GENERATES POSITIVE DISTRACTION?

Emotions	13 fundamental needs	Needs	Needs – Scenarios	Activities – Potential improvements
13 fundamental needs:				Count:
▸ **Relatedness**				**3**
▸ **Stimulation**				**2**
▸ **Autonomy**				**1**
▸ **Community**				**1**
▸ **Security**				**2**
▸ **Competence**				**0**
▸ **Purpose**				**0**



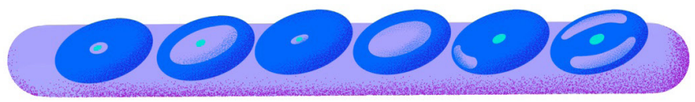


Emotions	13 fundamental needs	Needs	Needs – Scenarios	Activities – Potential improvements
Frustration	Competence	To know when and how to communicate with the patient	She would like to know when is the best time to connect with her father or if he is able to do it.	Usually at the hospital patients are having rounds once a day and also multiple visits of healthcare providers depending on the situation. Most of them is already scheduled, having the information about the hours where the Patient cannot be available might help in adjusting the times of **patient's availability.**
Anxiety	Competence	To know the health status of the patient	Kate would like to be informed about her dad's health status.	Family of the patient feels anxious not knowing the health status of their loved ones. Due to the pandemic hospitals are closed for visitors. The only possible way to get to know the patient health status is to call the patient or the ward if the patient is not able to answer. Health status of the patient is being placed in to the hospital system. Patient could receive daily a notifications regarding the health status of their loved ones. It could be a visual representation.
Guilt	Morality	To remind, to show the availability, or to be unobtrusive	Due to her busy schedule Kate sometimes forgot to check on her father.	Kate sometimes forgets to call or she calls in not the right moment. The schedule of the patient should be made.
Gratitude	Purpose	To evoke positive memories, distract	Kate wants to send the pictures from holidays to her dad	Family member here shows gratitude towards the memories created together with the patient and wants to share it with the patient.
Annoyance	Relatedness	Unobtrusive connection	Busy at work - wants to connect with Ted.	In this scenario patient's family member can be close mostly with thoughts This situation shows also that the family tries to be in touch with the patient all the time, but due to the fact that they can't visit the patient at the hospital and also they have to "live their life" The proposition of having a wearable here for the family side might switch the annoyance into the emotions like satisfaction and safety Wearable could also serve as a non communication tool made to embrace the presence.
Kindness	Relatedness	To distract the patient	Kate want to show her father a new place and at the same time distract him from where he is now.	Family member tries to show around the new place to take the patient for a walk to the places that are meaningful. It could be solved by a video call or just a video recording.

Emotions	13 fundamental needs	Needs	Needs – Scenarios	Activities – Potential Improvements
Annoyance/Anger/ Disappointment	Autonomy	To be close to the patient	Irene feels frustrated that she can't go and visit him She would love to feel close to him.	———
Annoyance	Comfort	To have a longer conversation (lack of privacy/time/energy)	She wish to be able to talk with him longer	Time of the conversation may vary and it is dependent upon many variables, however prompts or small instructions on how to talk about given situations might be helpful. Especially when family is dissapointed and worried sometimes they forget on what is the most important for the patient
Disappointment	Competence	To know the patient's feeling	Irene don't know how his husband is doing	Combined informations from rounds same as self assesment form might be beneficial to estimate the patient's wellbeing
Disappointment	Competence	To know the patients health status	She wants to know how he is doing but she doesn't want to ask him about it all the time.	
Annoyance	Purpose	To have a meaningful connection	She would like to have a meaningful unobtrusive connection with Ted during the whole day	This could happen by looking deeper into the wearable devices or apps – something that could be all the time with both sides. This connection could be also achieved by looking above the communication platform
Sympathy	Reletedness	To make the patient happier	Irene likes to talk about their memories she see that it makes Ted happier	Sharing the memories
Fear	Security	To feel safe (To give the presence of the patient to the family	She wants to feel safe	Easiness of communication

Emotions	13 fundamental needs	Needs	Needs – Scenarios	Activities – Potential improvements
13 fundamental needs:				Count:
▸ **Competence**				**3**
▸ **Purpose**				**2**
▸ **Relatedness**				**2**
▸ **Morality**				**1**
▸ **Autonomy**				**1**
▸ **Comfort**				**1**
▸ **Relatadness**				**1**
▸ **Security**				**1**

Appendix E



Modular Closeness

Scenarios

Description of the concept
"Modular Closeness” consists of the modules that represent the human senses, such as speech, sight, and touch. The concept focuses on creating a feeling of closeness that can be adaptive to the patient's current needs, and where also interactions can be spontaneous. Family and patient have the full set of modules. Additionally screen consist of the function feature which can show the current activity of the patient.

Ted x Irene

(Husband/Patient x Wife)

Irene's set of modules consist of a microphone, camera, speaker, screen, breath and warmth.

Waking up
T: Ted wakes up and would like to feel close with his wife - Irene. The device is placed on the bedside table. Ted takes the speech module from the stack and sends the small voice message updating Irene about his current state.

I: Irene can’t currently answer but she is in hurry to get ready for work. She saw the blinking red stripe on one of the modules. She comes closer and notices that there is a message waiting for her from Ted. Hearing his warm and calm voice in the morning helped her to understand that his recovery is in a good way. She decided to say “Hi” back to him and remind him to stay connected throughout the rest of the day.

Irene felt really happy. At the beginning of Ted’s stay at the hospital, she used to record and send messages to him but he wasn't able to respond. The first days were the most difficult for them. Ted felt exhausted he wants to respond to every message she was sending.

Sharing Moments
I: Irene is passing by the place where they usually were going for the Sunday walks. She knew that she will follow the same path and she decided earlier to take the camera module with her to snap some moments and share them with Ted.

T: Ted saw the blinking lights on the module with the screen. He received the picture from Irene. He immediately recognized the place, he picked the microphone module and sent her a sound message expressing the loneliness and willingness to join Irene soon for “the next walk”.

Just being here
I: Irene's work demands all her attention, she wants to feel close with her husband. She decided to take the “warmth module” with her to manifest “I’m here”. She put the module in her pocket to send the warmth but also to receive it back from Ted.

T: The warmth module got highlighted. Ted after noticing it picked up the module from the bedside cabinet and placed it on his chest. It helped him to relax - It felt like Irene’s touch. This interaction was there since the beginning of Ted’s stay at the hospital, it helped him to effortlessly respond to the messages or just give the feeling that he is hearing them. (Every use of each module highlights the activity on the one placed on the other side.)

Calling
T: During the late afternoon Ted decided to call Irene. He chose to contact Irene from the list on the device and picked up two modules this time one with the microphone and the second with the speaker.

I: This time Irene was having a lunch break, after noticing blinking lights on the two modules she picks them and they are having a conversation.

T: After the conversation, Ted asks Irene to leave the modules still on, and besides her so, Ted will be able to listen to her voice, it helps to calm him down and imagine that he is back at home where he could hear her voice all the time.

Having a Dinner
Preparing and having a meal together used to be an everyday activity.

I: Irene knows at what time Ted is having dinner she adjusted her schedule to fit into Ted's dinner time, to continue their ritual. This time Irene is going to use three modules - camera, microphone, screen, and speaker module to recreate the feeling of having dinner together.

T: Ted saw the highlighted stripes on three modules that were used by his wife. Ted was waiting still for his meal he sent the short audio message that he is expecting to have dinner in 5 min and that he will be ready in a moment to pick up the call.

I: Irene decided to record a small video message to him while she was waiting for Ted, as the answer to his voice message.

T: Ted received his food and set up the modules. They enjoyed the moment talking about the previous pictures Irene sent him and their day. It gave Ted a sense of being almost at home.

Sharing the Memories

I: Irene unexpectedly found the picture from their holidays. She decided to take a photo and to send it to Ted in order to remind him of the great moments they had together.

T: Ted was surprised to see it. He decided to comment on it by taking a camera module and mimicking the same expression as he had when the picture was taken. He decided to send it as a response to the message from Irene. The picture evoked positive emotions and helped him to remind him that his stay at the hospital is temporary and he needs to stay positive.

Sharing an information

T: Ted had visiting physicians who updated him about his state of health. Due to the pandemic rounds are being moved to different irregular times. At the beginning of the round, he asked them if they agree with his wife to join the meeting. Ted set up the connection picking up the four modules to have a video call.

I: Irene was informed beforehand that she might expect the call from the round. She was stressed to hear something negative about her husband. Fortunately, she got only ensured that her husband is doing better. She wasn't taking an active role during the meeting she just wanted to hear what the physicians are going to say about her husband.

After the round, they stayed connected for a short while and had a short conversation to plan the next day.

Falling asleep

T: Ted is about to fall asleep, unfortunately, he is missing his wife. He reaches out to take the two modules: breath and warmth in order to reproduce the feeling of someone being close to him.

I: Irene is being notified that Ted wants to feel closer, she also knows that Ted wants to communicate by chosen by him modules. (It shows directly what Ted's needs are.) Irene takes two modules and combines them in the same way as Ted did. She placed them around the shoulders in a way that she can feel Ted's warmth and breath astray would regularly do falling asleep.

Ted x Kate

(Father/Patient x Daughter)

Kate doesn't have as many modules as her mom. Her set consists of a microphone, camera, speaker, and a screen.

Sharing moments

K: Kate same as Irene want to share some pictures of her day to update her father and give him impression of her day. She is using the module with the camera to capture some moments of her day. Today she picked to send a short video while preparing their favorite meal from her father's recipe. They used to cook together when Kate was visiting them during the weekend.

T: Ted got the notification on the "vision module"(the module equipped with the screen). Unfortunately Ted wasn't feeling well and he was in the middle of his afternoon nap. After waking up he saw blinking white light on one of the modules which signalizes that he received the message from his daughter. Ted was surprised seeing the preparation of the food that he used to make for her. He felt remembered.

T: Ted decided to pick the microphone module to send small voice message asking about having a call later.

Calling

K: Kate wanted to check on how her dad is doing she tried to call him but while she about to pick up the modules she got the notification that her dad is currently on the call with her mom. Kate decided to still pick up them to join the group call.

T: Ted started the call with Irene shortly before Kate joined them. They have updated each other asking firstly about the Ted and giving small updates about their day.

Voice memos
K: Kate's most often way of connecting with her father is to send him small updates she loves sharing her moments, comments and thoughts. Besides sharing a small videos and pictures she also sends him small voice messages.

T: Ted always not always read all of the messages sometimes he sends back the voice message back but mostly they have one longer conversation during the day when they talk about all of the messages (which create the timeline/story).

Sharing memories
K: Same as Irene she sends from time to time pictures or short videos from past, as a memories. Kate by doing this tries also to distract her father and cheer him up.

T: Ted enjoys every received message, it shows him that someone is thinking about him and creates the feeling.

Appendix F

Digital Closeness
Scenarios

Description of the concept
"Digital Closeness" is basing on the the Modular Closeness concept however the concept doesn't provide the user with any physical pieces.

App can be connected with the TV or other display placed in the patient's room.

Waking up x Mood Diary x Voice message
T: Ted wakes up at the morning and wants to send small update to his wife. He decided to send her a voice message. He takes his phone from the bedside table and opens the app and sends quickly the message. Afterwards the application asked him some questions to rate his todays well-being. Results of this questionnaire helps to better understand how the patient is feeling at the moment but also will give the overview that will be visible for the patient and the family.

I: Irene can't currently answer she is in hurry getting ready for work. She saw that her phone buzzed. She glanced at it and saw that Ted messaged her. She quickly listened to the message and sent the short response to him. She also got a notification that Ted just have finished his mood check - it seems that Ted is tired and he would like to feel that someone is close.

Feeling Close x Sharing Moments
I: Irene's work day is quite packed in meetings which are really draining for her, however she tries to share some highlights of her life with him. Irene works mostly from home at the moment but whenever she goes out or founds something interesting - something that makes her think about her husband she is capturing a small video and sends it to Ted.

T: Ted appreciate receiving those small updates that can let him feel closer to his loved ones. Shared moments sometimes also serve for them as a prompts that they use during their conversations.

Updating the status - Connect
T: Ted picks the phone and opens the "Connect" section. The app at the same time updates automatically his status and send the notification about his willingness to connect with his family.

I: Irene saw the notification and decided to pick up her phone and enter the room to talk with Ted, after having a short conversation, Irene goes back to work. She just wanted to have a short update on his health status.

T: Ted would like to spend some more time, he decides to stay longer active in the “connect” section.

K: Kate saw the notification and she decides to join her father. Sometimes they talk together with three of them.

T: Ted is being connected over the “voice call mode” with his daughter. Ted before entering the room can choose on what type of call he would like to have currently. He could choose between voice call and video call.

Updating the status – Activity
Status can be also set in order to share the activity like for example having a dinner together, watching a movie together.

Sharing a Digital Activities
Watching the movies together, listening to the same music, sharing the same view. Connected Netflix accounts

Eating Together
T: Ted feels lonely, but especially during the activities they used to have together like dinner. Ted have predefined system of notifications that he can send to the family just to let them know that he is having a dinner at the moment asking if someone can join him.

I: Irene saw the notification. Luckily she was currently finishing the preparation of a dinner for her own. She decided to connect with Ted. They talked about their day and enjoyed the dinner. Ted was happy to be a part of their daily routine activity.

K: Kate is also joining them from time to time however her work environment is slightly different and sometimes she can’t have dinners at that early time.

Sharing Memories (live it again)
Besides sharing the moments app also offers sharing the memories option. Users can upload the picture and send it to the patient. The app could recognize the memories by it self - reading the informations from the file making also the memory con the timeline and map.

I: Irene is browsing the old family album she found the picture from family holidays. She takes the phone opens the app and takes the picture in order to share it with Ted. While sending the picture Irene attached also small voice message - she wanted to say what this picture means to her.

T: Ted received the memory together with the voice message. The memory cheered him up and helped him to imagine to think about what they - as a family - will do after the hospitalization.

Falling asleep
T: Can’t fall a sleep he doesn’t want to call her wife and doesn’t want to disturb Irene. Ted and Irene set up a bedtime routine that they follow together. Both of them like to read before falling a sleep. They have created a small checklist were they can see how far are they before falling a sleep. When everyone is finished, eventually they call each other and talk shortly about something pleasant that occurred today. In addition Irene talk about the plans for tomorrow, especially positive things.

Optional: After their short conversation they are placing their phones on their chest and going through the breathing exercise were they are synchronizing the breath.

Ted can only feel the breath through the haptic engine installed in the phone. (Same as PT timer)

Family Notification – Nurse

Patient – planner

Just being here

Appendix G

Modular Closeness

Requirements	Qualites assessed	2 minus	minus	plus	2 plus
To be easily accessible	**Feasibility** (including cost and the way of implementing)				
To create a meaningful entertainment	**Entertaining**				
To facilitate mindful conversations	**Facilitating Mindful Conversations**				
To be unobtrusive	**Unobtrusiveness**				
To evoke positive memories	**Evoking Positive Memories**				
To create a new way of communication	**Innovative** (in the way of creating the connection)				
To be accessible for the patient in every stage of the treatment	**Adaptability**				
To support closeness – the feeling of being there, during the patients prolonged stay in the isolation	**Closeness**				
To enable a positive distraction from the place and situation, that could serve also as a reminder of a better times.	**Distractive**				
To show the support given by the loved ones	**Supportive**				
To enable an easiness of communication	**Easiness of communication**				
To recreate a feeling of togetherness – while sharing the same activity	**Togetherness**				
	Ownership				

Digital Closeness

Requirements	Qualites assessed	2 minus	minus	plus	2 plus
To be easily accessible	**Feasibility** (including cost and the way of implementing)				
To create a meaningful entertainment	**Entertaining**				
To facilitate mindful conversations	**Facilitating Mindful Conversations**				
To be unobtrusive	**Unobtrusiveness**				
To evoke positive memories	**Evoking Positive Memories**				
To create a new way of communication	**Innovative** (in the way of creating the connection)				
To be accessible for the patient in every stage of the treatment	**Adaptability**				
To support closeness – the feeling of being there, during the patients prolonged stay in the isolation	**Closeness**				
To enable a positive distraction from the place and situation, that could serve also as a reminder of a better times.	**Distractive**				
To show the support given by the loved ones	**Supportive**				
To enable an easiness of communication	**Easiness of communication**				
To recreate a feeling of togetherness – while sharing the same activity	**Togetherness**				
	Ownership				

Appendix H

Fig.XX Leaving the patient in the hospital

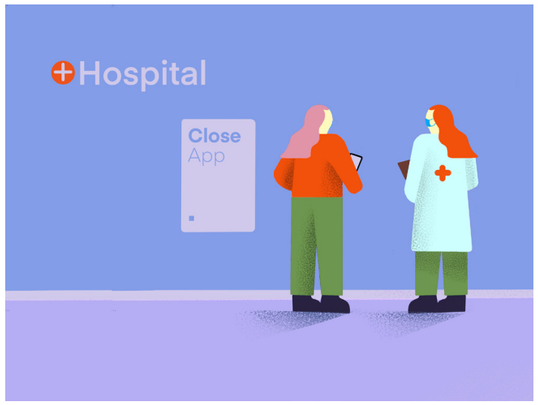


Fig.XX Getting to know about the app

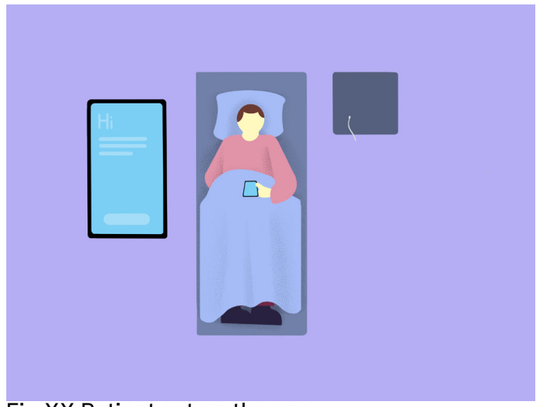


Fig.XX Patient set up the app

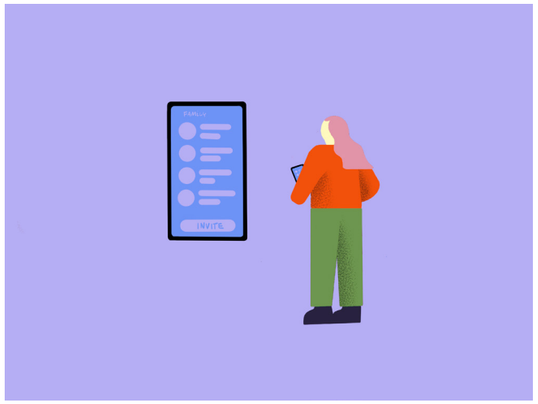


Fig.XX Setting up

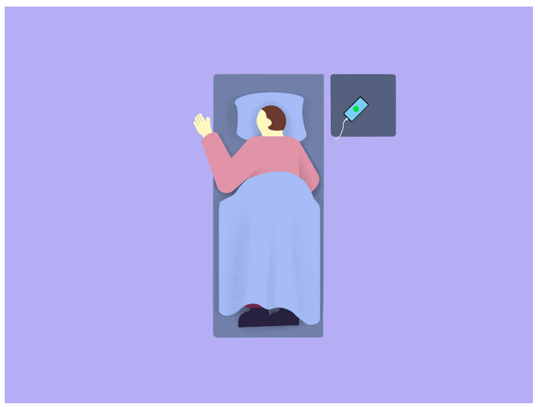


Fig.XX Patient feels exhausted after the admission mostly napping

Fig.XX Patient received the notification

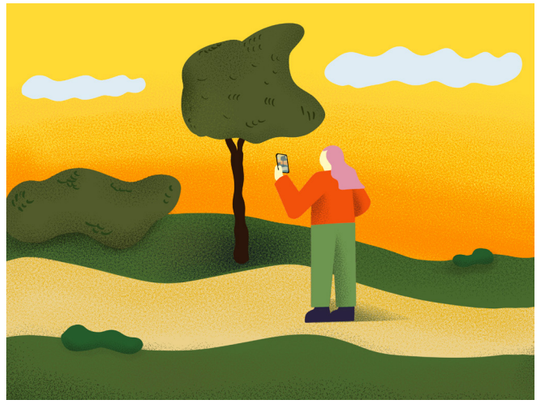


Fig.XX Kate walks through the park and diced to take the picture

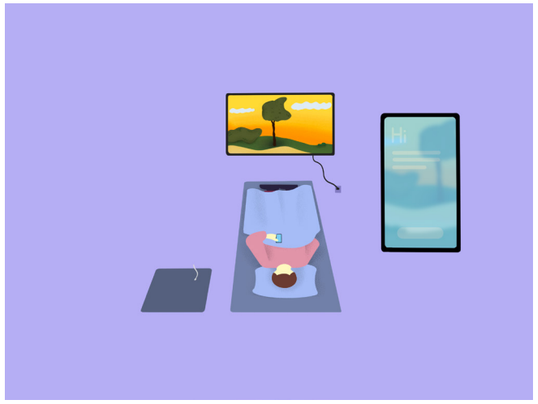


Fig.XX Patient received the picture and the message on his phone

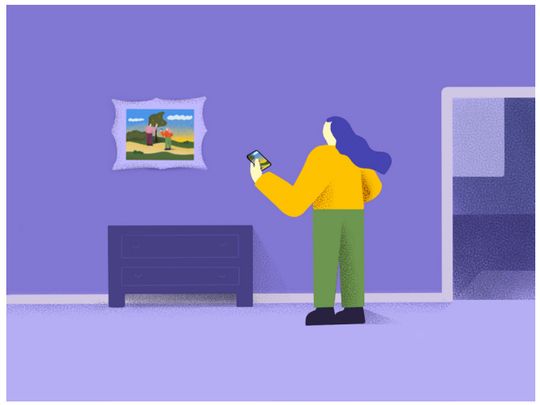


Fig.XX Irene took the photo of the picture taken furing the holidays and shares it with patient

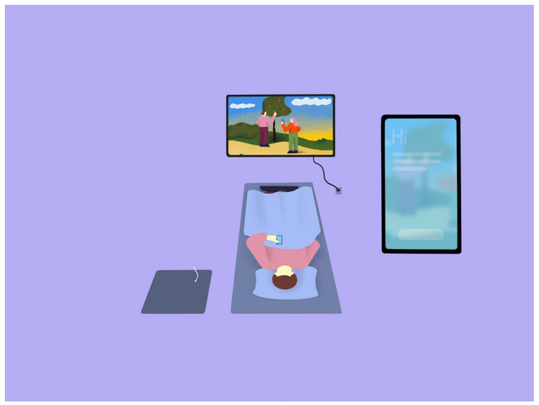


Fig.XX Patient received the picture and the message on his phone

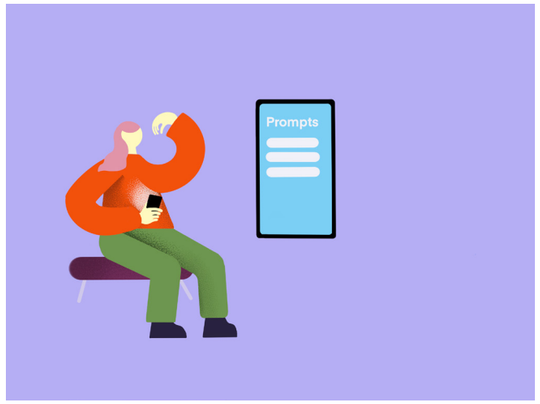


Fig.XX Irene took the photo of the picture taken furing the holidays and shares it with patient

Fig.XX Patient received the picture and the message on his phone

Appendix I

Closeness

Creating a feeling of closeness between isolated patients and their families during a pandemic

Generative session

25.03.2021

Design Goal

The design goal is to **Reduce the feeling of isolation** to Covid19 patients by creating an unobtrusive connection with their family and a warm home environment.

Back-ground

Patient/Covid19

During the hospitalization related to COVID-19 patients are being isolated, without the possibility of having visitors. The main emotion during the prolonged stay at the hospital in isolation is lone-liness. The patient couldn't leave the room and couldn't be part of the family's daily routines.

Patients' activities during the isolation are very limited. After switching the patient to the general ward patients can use their phone to communicate with the family but in most cases, patients are still too weak to be able to use their phone.

Patient's isolation room – General Ward

Concept

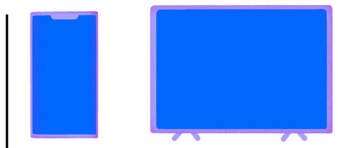
Digital Closeness

Concept consist of the mobile application/service focusing on creating the feeling of support by sharing the memories and moments with patient.

This activity provides the patient's loved ones with purpose. It shows also the support of the patient's loved ones, serves as a distraction, and is a source of positive emotions.

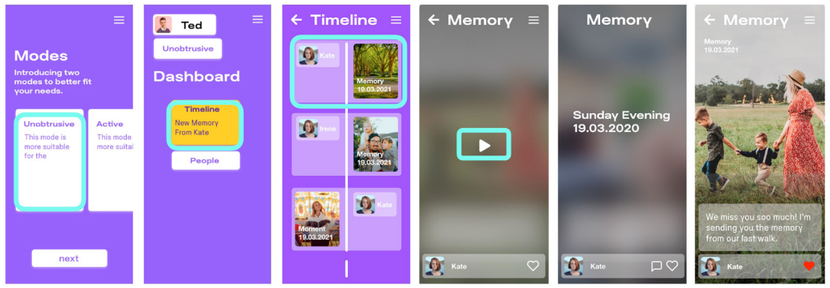
Sharing moments creates memories x Sharing memories creates moments.

Moments are very important they can amplify the feeling of support and increase the easiness of communication by creating a informative content for a patient.



App Possibly TV

Exemplary User Flow



At the beginning Patient will be able to chose the mode that represents the current needs.

Dashboard

Timeline – displays the feed and all content sent to the patient.

By clicking on the memory, patient will reveal the memory.

Memory can consist of multiple modalities such as music, location, story, voice message, video recording or picture.

Patient in Unobtrusive mode can send a small reaction

I need your help!

1 What the unobtrusive way of communication means to you?

How it can be achieved?

2 How the patient should interact with the application in unobtrusive way?

Taking for granted that every patient has phone and a TV at the isolated room.

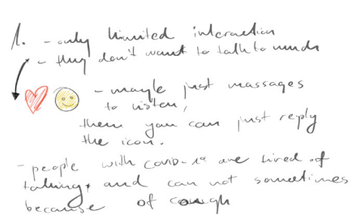
3 How would you evoke memories?

Any answer/idea/sketch or description will be highly valuable for me!

I will accept every form of your ideation!

Thank you!

Mi



Insight from the family of covid patients staying in the isolation at the hospital

Patients suffering from covid are tired of talking and can't sometimes because of cough.

Reactions

Me

1. I think the unobtrusive way of communication means a form of communication that does not draw attention. It happens smoothly, and you are not aware it has happened. There is no need for extra talk about it that this communication had occurred. I had thought of some examples from the daily life interactions we have with people or objects around us.

   For instance, let's imagine it is fantastic sunny weather and you and some of your friends decided to have ice cream outside. You went to an ice cream shop, and you realized three people were waiting in line to buy some ice cream. In that case, you and your friends go to the end of the line without talking about it. Because everyone is waiting for their turn to order their ice cream. This line of people communicated that you have to wait to get your ice cream.

   Another example could be the moment we are waiting on the escalator. If someone prefers to stay and relax while the escalator takes this person upstairs or downstairs, they should stand on the right side. So, other people who would like to walk can use the left side because nobody stands in front of them. This attitude is unconsciously in your mind, and if someone is mad at you while you are standing on the left side, you know the reason is you are standing on the wrong side. Besides, I believe that this is a cultural or regional attitude. Waiting on the right side of the escalator in Istanbul is a usual thing to do. People do it without talking about it. But, once I have met with a person who was very surprised that there was such an attitude in the city, she never had that before. She lived in a small town in Turkey, so maybe they did not have escalators or a crowd of people hurrying to go somewhere else.

   A final example is two people who have spent a lot of time together and probably have improved a silent communication between them (probably nobody else´s can understand their secret language). These people could be siblings, a couple, or close friends. If they are in a crowded place, they might use a silent communication language to talk without other people recognizing them. For example, I had this very close friend that we have spent every moment together during our university life, whenever we were in a club and getting bothered by someone we used to do a particular way of hand communication in order to let another one that we need to go away or need help.

   How to achieve that?
   So, in those examples, these people learned this attitude with time, and at some point, it became a very usual way of communicating. Maybe they need to feel some kind of familiarity with the applications you are creating. For example, a button that they can choose if a place in a picture is familiar to them, and this button collects these pictures in the same file. It can be like the save button on Instagram. The things that are familiar to the patient might get to priority to be seen by the patient.

2. Maybe they can use gestures. They can communicate by talking, just like Siri or Alexa. I assume that there might be some challenges in moving their body parts. So it should not require complex bodywork for them. I thought about using the Pepper robot for them to feel less lonely. This is a robot that looks like a 12 years old kid, and it has an Ipad on it. So this Ipad screen is a communication channel for Pepper. I think Ipads are very useful for people who would have problems playing with small phone screens. I believe, therefore, kids like Ipads more than phones. On the other hand, TV´s are great because they can see pictures or text messages on the big screen. Maybe they can use an Ipad to control the TV. It will probably be easier for them than using a remote control. Because with the remote control, you have to push buttons a little bit harder.

3.
   - A song they used to listen together
   - The smell of their favourite cake (this can be sad if they cannot eat the cake, of course)
   - An old picture (This can also be sad if they think they are old and they want their young days back)
   - A letter from a beloved one
   - A picture of a cafe (or any place) that they used to go before
   - A cloth that reminds them of a specific moment. For example, I have this dress which I wore once and had a wonderful day. And whenever I wear this dress after that day, I feel like I will have a wonderful day again. So it is like an object that brings you luck.
   - A piece of note. I used to write small letters to my friends whenever I visit them, and I hide them somewhere that it is not easy to find (but make sure they will find it one day). And whenever they find it, they feel super happy. I try to include nice elements from the day I wrote the letter. So they remember that day, and they feel happy about it.

A song
An old picture
Picture of the place they have visited together
A piece of note

Tho

New memory pops in and wait to be revealed

Phone as a remote

Ko


Designing Moments of Meaning and Pleasure.
Experience Design and Happiness

Marc Hassenzahl, Kai Eckoldt, Sarah Diefenbach, Matthias Laschke, Eva Lenz, and Joonhwan Kim

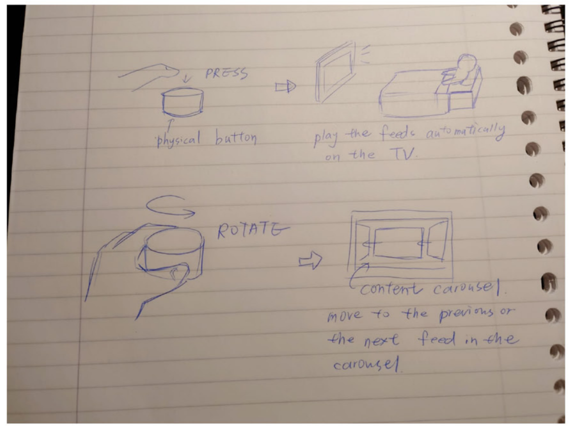
Introduction

Understanding Experiences: From Happiness to Affect, Needs, Practices, and Things

In this example you can play chess (communicate unobtrusive) with your partner when you live together but working in different shifts. It's a solution for play there's almost no quality time together

So unobtrusive communication for me is like non verbal communication, or sounds or smell. That type of communication that is used in 'nudging' people to make desired actions or choices

Sc



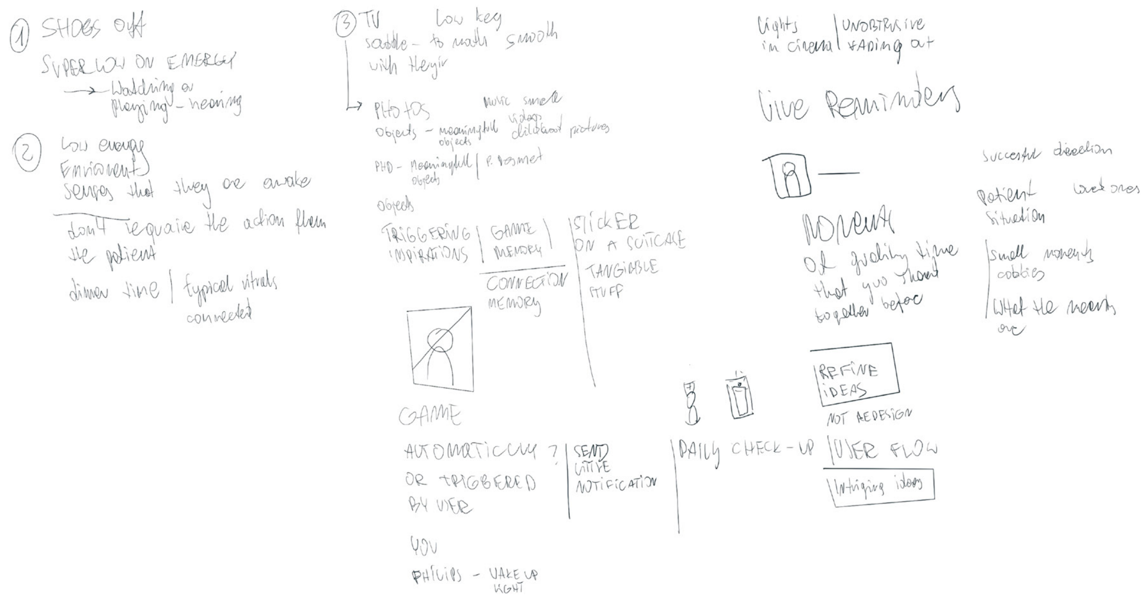
1. the unobtrusive way of communication means I can check anytime I want. Shouldn't disturb me while I need to rest.
It can be achieved by sending some silent notifications, which won't disturb my sleeping but still easy to spot when I want to check the messages.

2. In my opinion, I'd use the unobtrusive mode when I'm weak or when I need to rest. Taking into account that the patient will probably be weak during the isolation, maybe even holding a phone can be tiring, I'd like the interaction to be easy. Maybe just a click on the button or a rotation of a knob triggers the carousel of the memory feeds.

3. I think what evokes my memory is the old photos, the music I used to listen and the familiar smell of something I like. Maybe when hearing the story of something me and my friends or family used to do.

**But tbh I would like to hear the new stories rather than the memories. Sometimes memories can bring me down cuz it would remind me that I'm trapped in the ICU.

Ko



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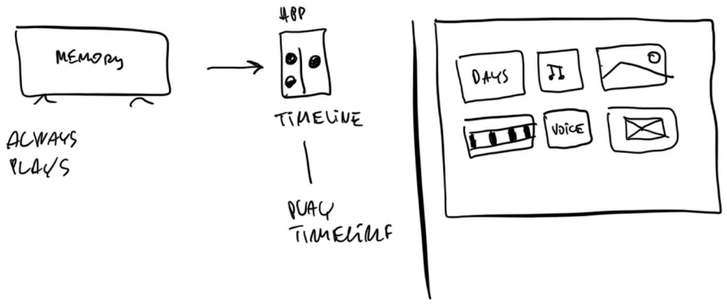


No notification
No voice
Gesture control

Moments organized in the timeline

MOMENTS OF A DAY BECOMES THE MEMORY OF THE DAY

Ta

1. What the unobtrusive way of communication means to you?

Unobtrusive way of communication means that it will not influence my behavior. The unobtrusive mode of the app would for me be without notifications when somebody posts something.

2. How should the patient interact with the application in unobtrusive way?

The corona patients will be mainly old and weak so a way to start the app without having to use voice activation or hold you phone and stare at a small screen would be the way to go. I'd say using apple TV and developing an app that works on TV which you can access through an apple remote (has a very intuitive touchpad) would be the best way to implement it.

3. How would you evoke memories?

I would organize the moments in a timeline. When the app is not active and a moment is shared it becomes an unwatched moment. Once the app is active the unwatched moments pop up in the timeline. When a moment is shared while watching a memory a notification would pop up. Once the day is over the moments become a memory of that day. The individual moments also become memories which should be organized like Netflix organizes its genres. The 'genres' could be memory of the days, movies, photos, voice messages. When there are locations and text messages with these sources they should be displayed when opening the memory.

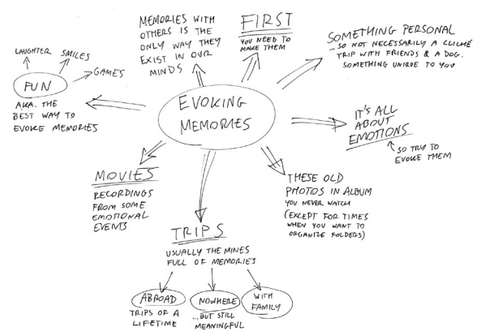
One should also be able to search for memories of different contacts.

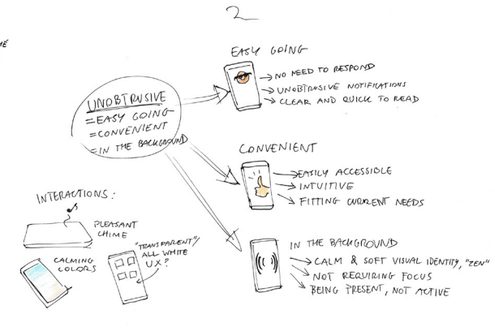
Side note 1: The thing that I would miss most and would therefor contribute most to my loneliness is physical touch and physical presence of the person. An app or TV would again be a 2D screen which is why I think that embedding social XR is the way to go in your app such that you can call people and have a 3D experience.

No notification
No voice
Gesture control

Moments organized in the timeline

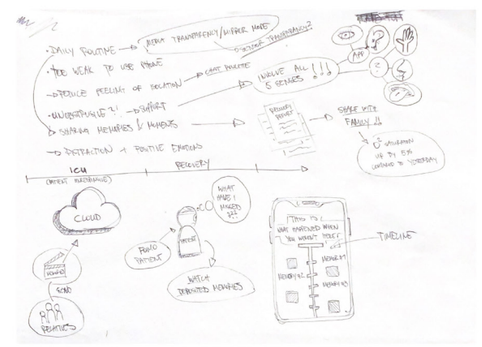
Mac

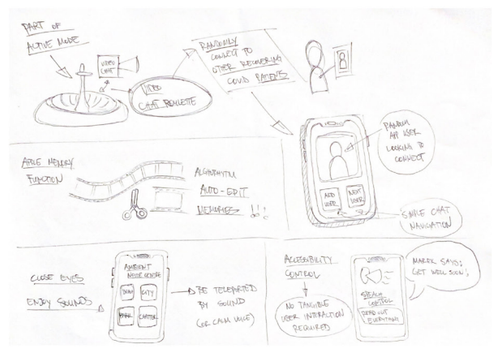




Insight from the family of covid patients staying in the isolation at the hospital

Ja





Sensor transparency mode

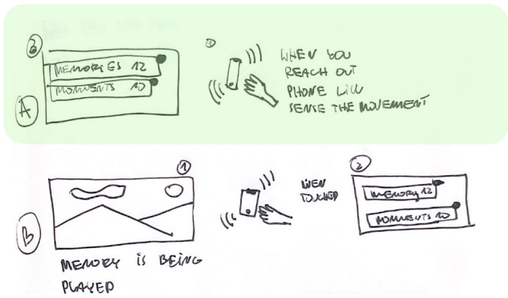
Important sound - ambient noises that evokes memories

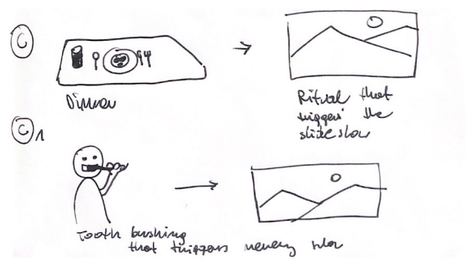
Story can be read - Accessibility

Summary

From generative session

Scenarios of displaying moments and memories





Main insights

Patients

Insight from the family of covid patients staying in the isolation at the hospital

Patients suffering from covid are tired of talking and can't sometimes because of cough.

Control

No gestures
No voice command

Mobile device should be used as the main controlling device

Suggested a physical button - knob

Unobtrusiveness

System shouldn't consist of notifications instead Memories or Moments should be displayed when the user interacts with his phone to make sure that user is awake and wants to interact.

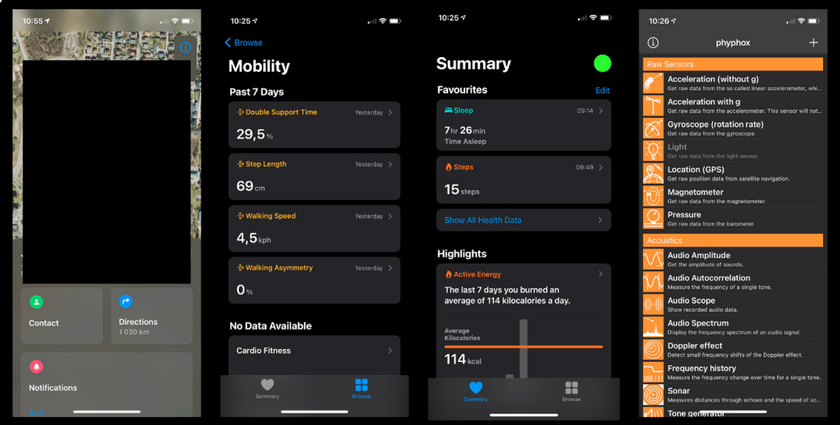
Story can be read - Accessibility

Closeness with the closest

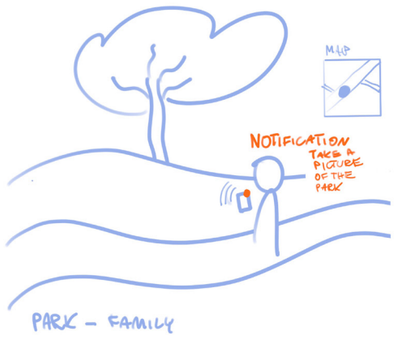
Sensor transparency mode

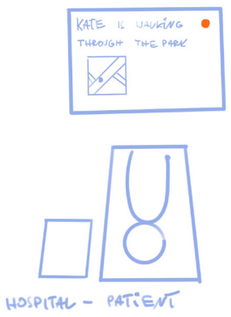
Important sound - ambient noises that evokes memories

Main insights



Scenarios with the use of sensors





Purpose

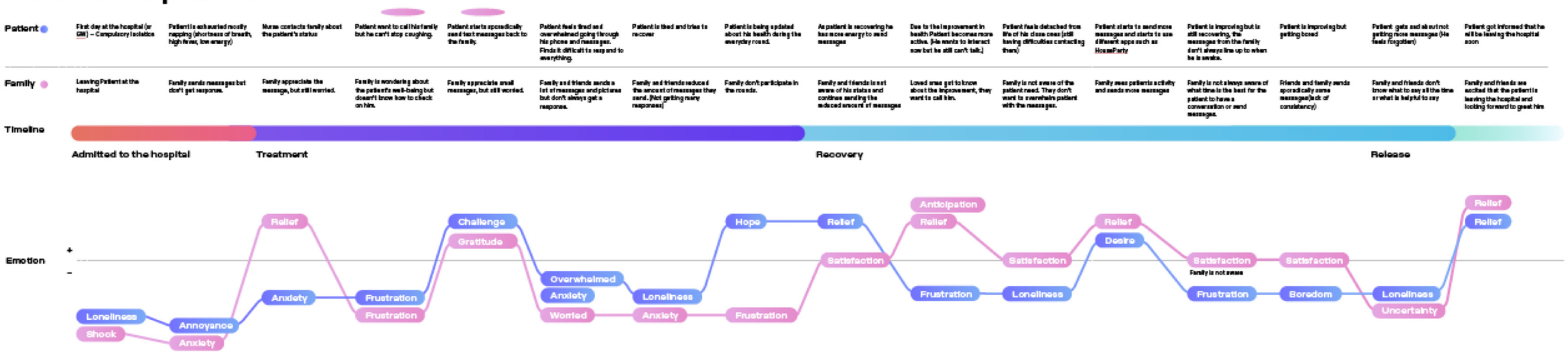
Sensors for the family could serve as the reminder to share moments (prompts based on sensors, location, proximity)

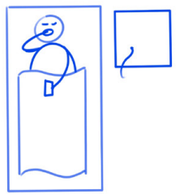
Information/Stimuli

Patient can experience the feeling of almost living with his loved ones

Appendix J

Current Experience

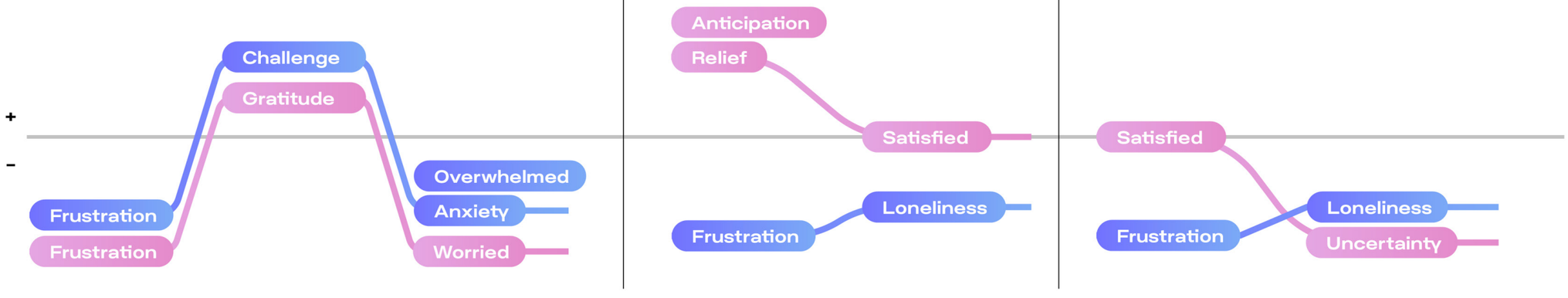


Patient								
	Patient want to call his family but he can't stop coughing.	Patient starts sporadically send text messages back to the family.	Patient feels tired and overwhelmed going through his phone and messages. Finds it difficult to respond to everything.	Due to the improvement in health Patient becomes more active. (He wants to interact now but he still can't talk.)	Patient feels detached from life of his close ones (still having difficulties contacting them)	Patient is improving but is still recovering, the messages from the family don't always line up to when he is awake.	Patient gets sad about not getting more messages (He feels forgotten)	
Family								
	Family is wondering about the patient's well-being but doesn't know how to check on him.	Family appreciate small messages, but still worried.	Family and friends sends a lot of messages and pictures but don't always get a response.	Loved ones got to know about the improvement, they want to call him.	Family is not aware of the patient need. They don't want to overwhelm patient with the messages.	Family is not always aware of what time is the best for the patient to have a conversation or send messages.	Family and friends don't know what to say all the time or what is helpful to say	

Timeline

Admitted to the hospital | **Treatment**

Emotion



Appendix K

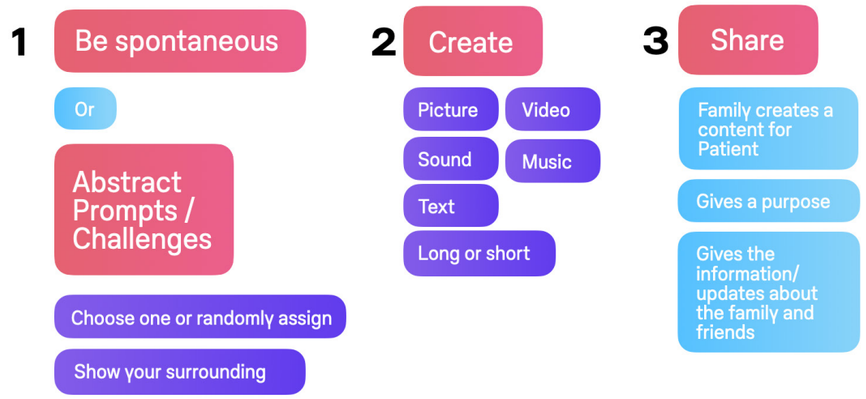


Fig.XX Flow of Moments in Unobtrusive Mode – Family's side

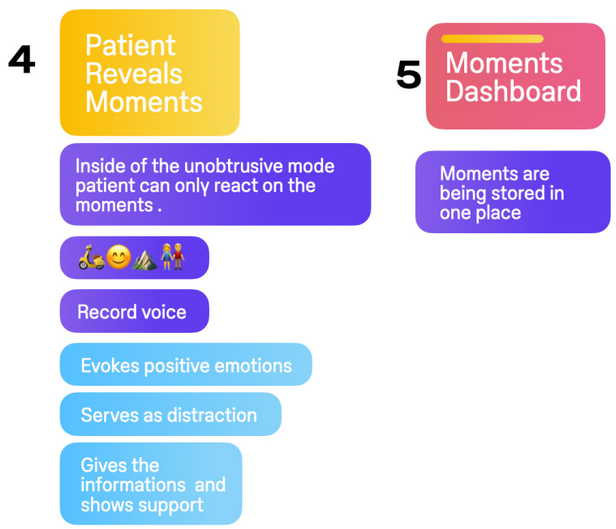


Fig.XX Flow of Moments in Unobtrusive Mode – Patient's side

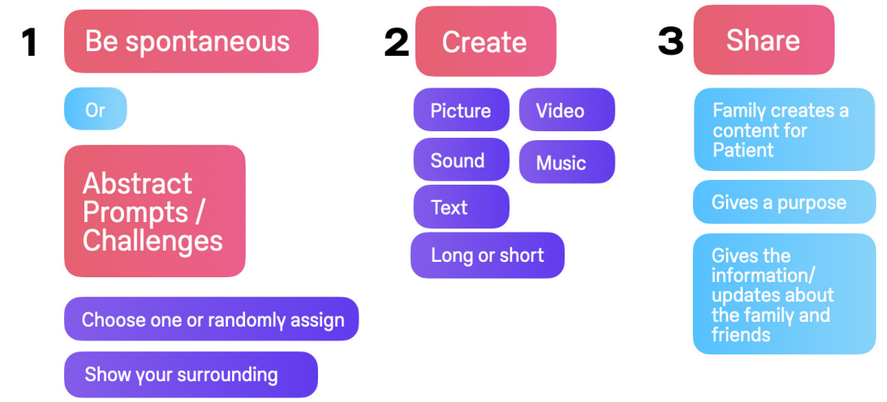


Fig.XX Flow of Moments in Active Mode – Family's side

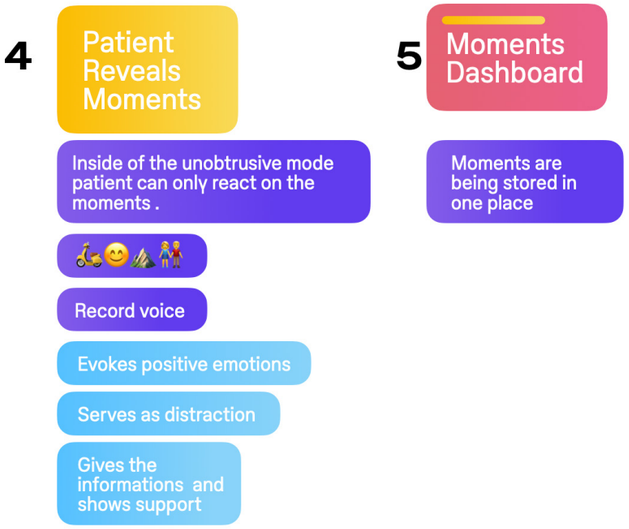


Fig.XX Flow of Moments in Active Mode – Patient's side

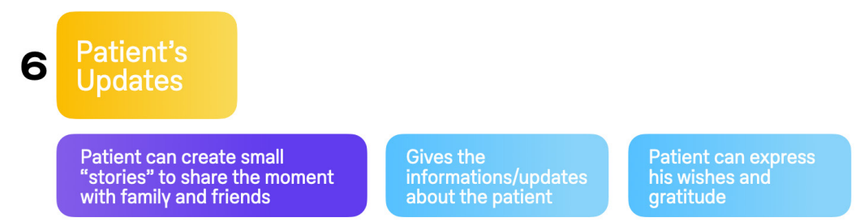


Fig.XX Flow of Momenta in Active Mode – Patient's side – additional funcionality for patients added in the Active mode

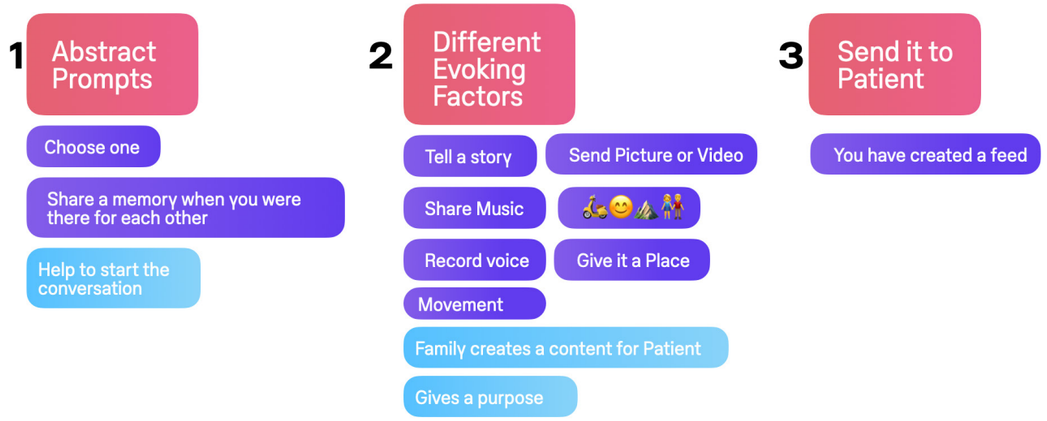


Fig.XX Flow of Memories in Unobtrusive Mode – Family's side

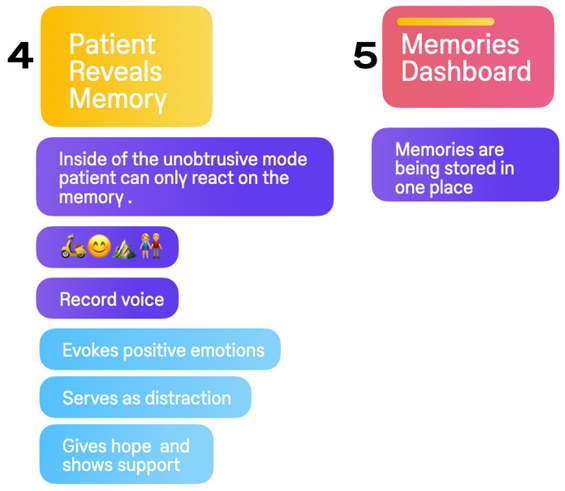


Fig.XX Flow of Memories in Unobtrusive Mode – Patient's side

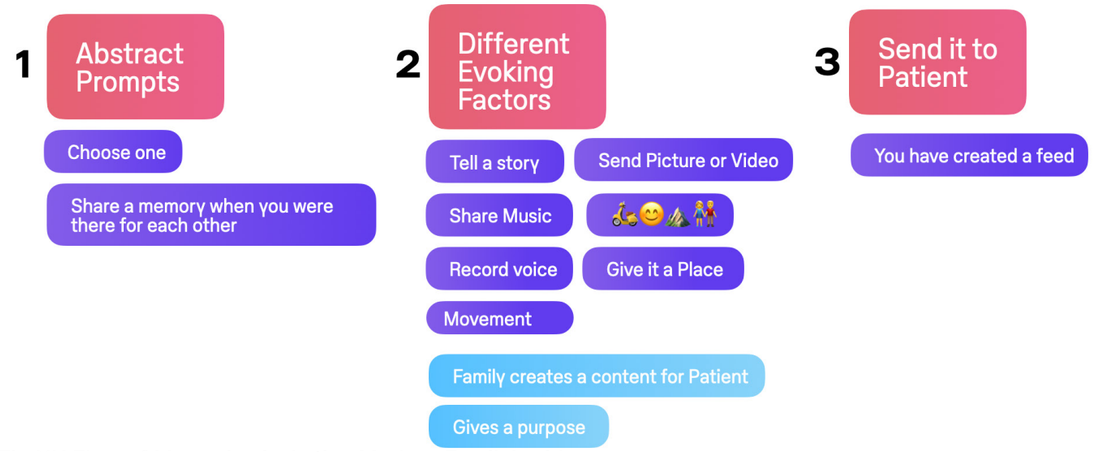


Fig.XX Flow of Memories in Active Mode – Family's side

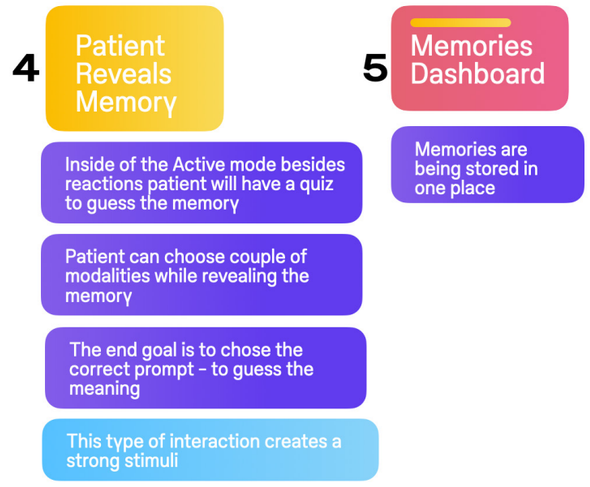


Fig.XX Flow of Memories in Active Mode – Patient's side

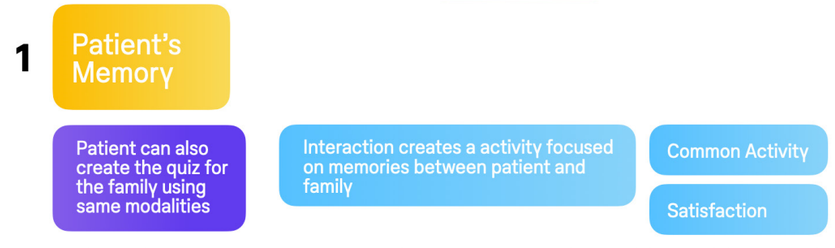
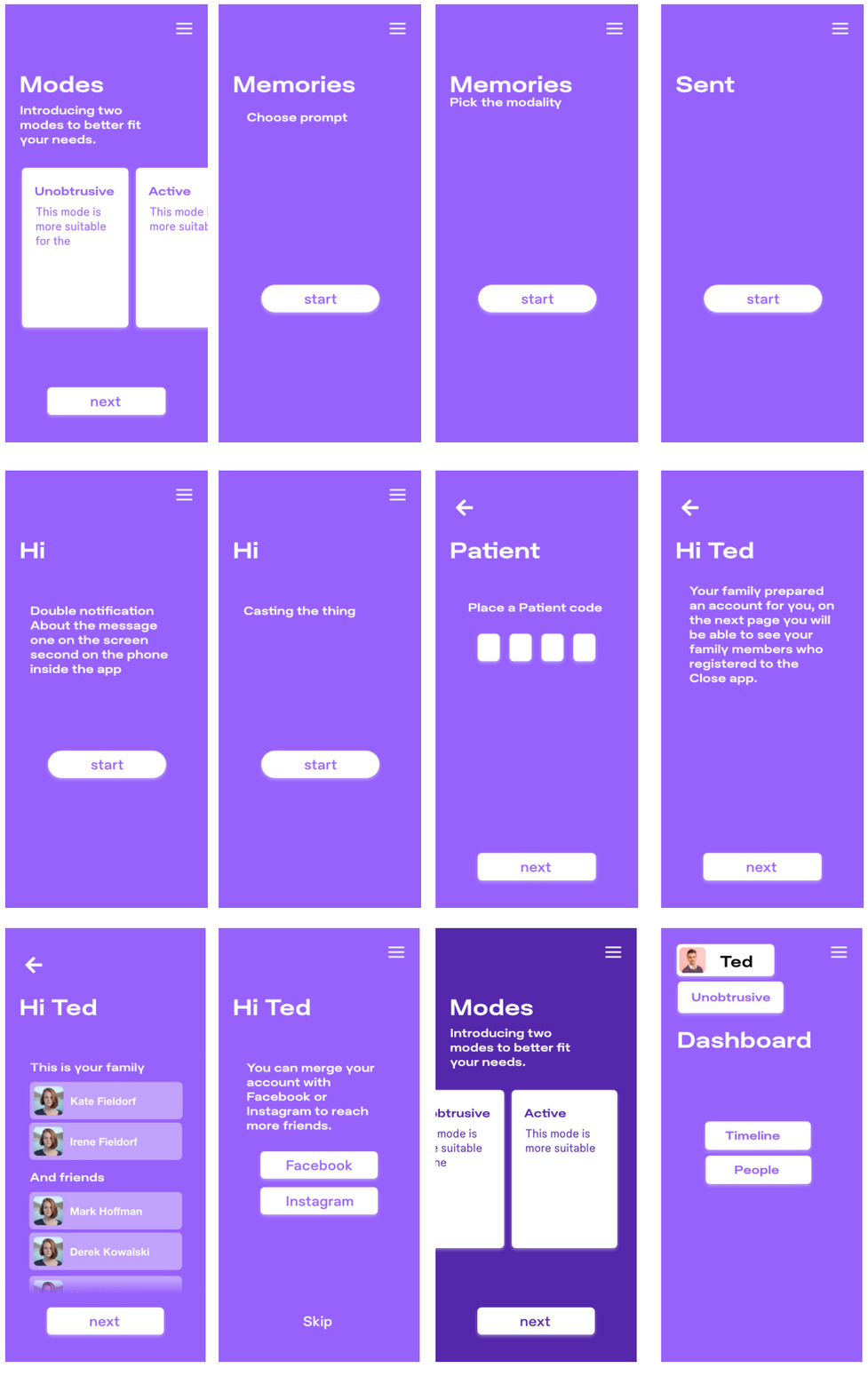
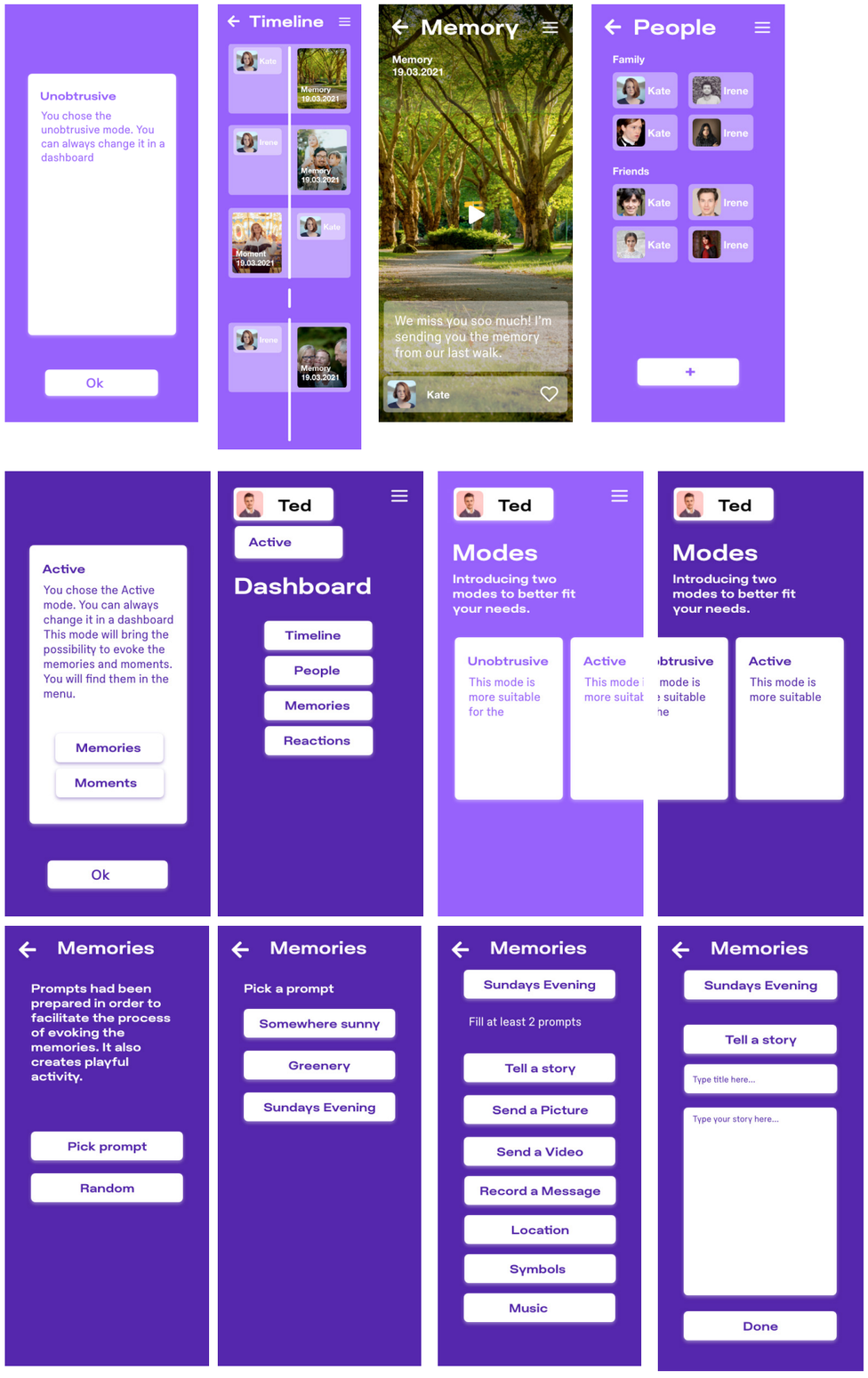
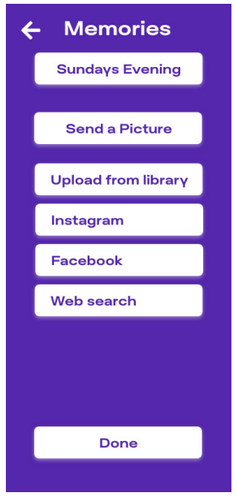
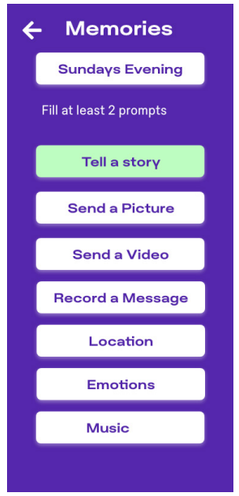


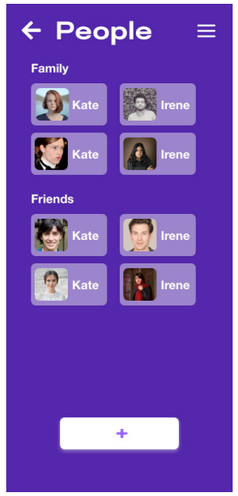
Fig.XX Flow of Memories in Active Mode – Patient's side – additional funcionality for patients added in the Active mode

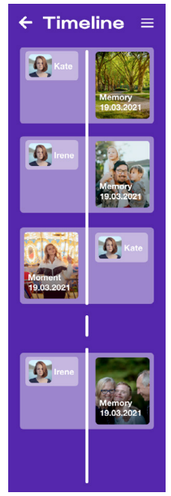

Modes
Introducing two modes to better fit your needs.
Unobtrusive
This mode is more suitable for the
Active
This mode i more suitat
next
Memories
Choose prompt
start
Memories
Pick the modality
start
Sent
start
Hi
Double notification About the message one on the screen second on the phone inside the app
start
Hi
Casting the thing
start
Patient
Place a Patient code
next
Hi Ted
Your family prepared an account for you, on the next page you will be able to see your family members who registered to the Close app.
next
Hi Ted
This is your family
Kate Fieldorf
Irene Fieldorf
And friends
Mark Hoffman
Derek Kowalski
next
Hi Ted
You can merge your account with Facebook or Instagram to reach more friends.
Facebook
Instagram
Skip
Modes
Introducing two modes to better fit your needs.
btrusive
mode is suitable he
Active
This mode is more suitable
next
Ted
Unobtrusive
Dashboard
Timeline
People

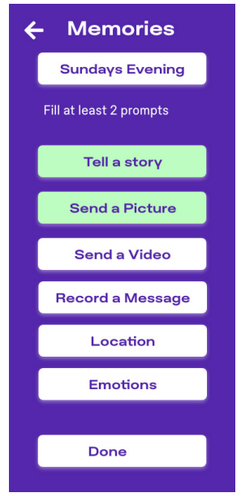

Unobtrusive
You chose the unobtrusive mode. You can always change it in a dashboard
Ok
Timeline
Kate
Memory 19.03.2021
Irene
Moment 19.03.2021
Memory
Memory 19.03.2021
We miss you soo much! I'm sending you the memory from our last walk.
Kate
People
Family
Kate
Irene
Friends
+
Active
You chose the Active mode. You can always change it in a dashboard This mode will bring the possibility to evoke the memories and moments. You will find them in the menu.
Memories
Moments
Ok
Ted
Active
Dashboard
Timeline
People
Memories
Reactions
Modes
Introducing two modes to better fit your needs.
Unobtrusive
This mode is more suitable for the
Active
This mode i more suitat
btrusive
mode is suitable he
Active
This mode is more suitable
Memories
Prompts had been prepared in order to facilitate the process of evoking the memories. It also creates playful activity.
Pick prompt
Random
Memories
Pick a prompt
Somewhere sunny
Greenery
Sundays Evening
Memories
Sundays Evening
Fill at least 2 prompts
Tell a story
Send a Picture
Send a Video
Record a Message
Location
Symbols
Music
Memories
Sundays Evening
Tell a story
Type title here...
Type your story here...
Done

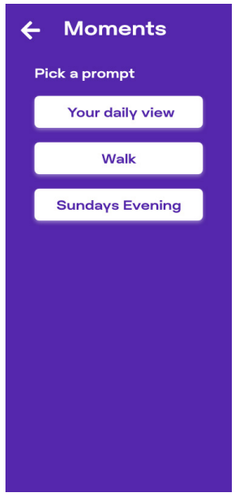

Memories
Sundays Evening
Send a Picture
Upload from library
Instagram
Facebook
Web search
Done

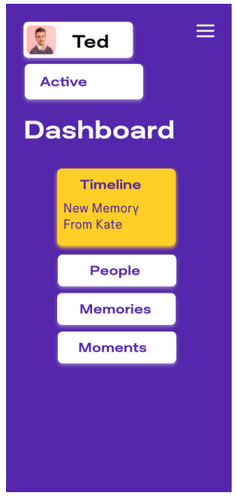

Memories
Sundays Evening
Fill at least 2 prompts
Tell a story
Send a Picture
Send a Video
Record a Message
Location
Emotions
Music

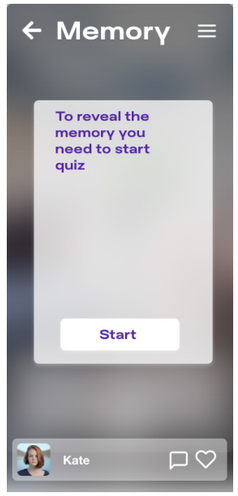

People
Family
Kate
Irene
Kate
Irene
Friends
Kate
Irene
Kate
Irene
+

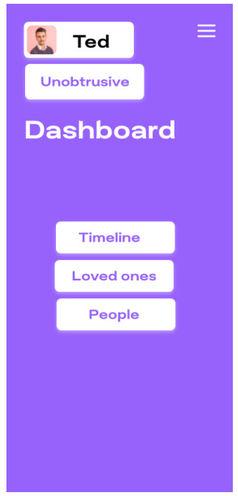

Timeline
Kate
Memory
19.03.2021
Irene
Memory
19.03.2021
Moment
19.03.2021
Kate
Irene
Memory
19.03.2021

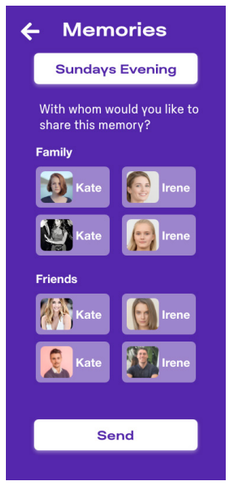

Memories
Sundays Evening
Fill at least 2 prompts
Tell a story
Send a Picture
Send a Video
Record a Message
Location
Emotions
Done


Moments
Pick a prompt
Your daily view
Walk
Sundays Evening


Ted
Active
Dashboard
Timeline
New Memory
From Kate
People
Memories
Moments

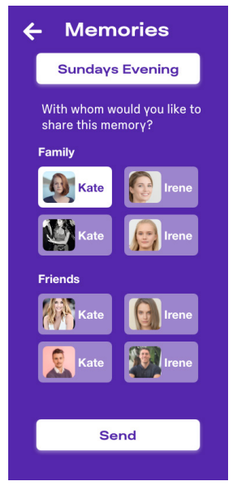

Memory
To reveal the memory you need to start quiz
Start
Kate

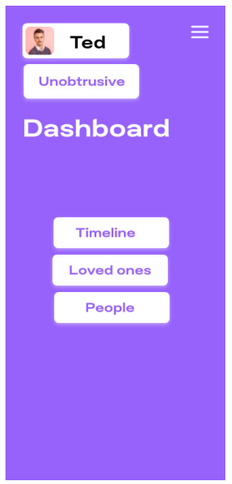

Ted
Unobtrusive
Dashboard
Timeline
Loved ones
People

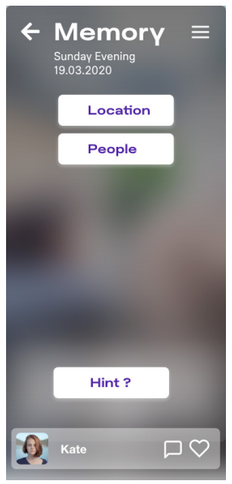

Memories
Sundays Evening
With whom would you like to share this memory?
Family
Kate
Irene
Kate
Irene
Friends
Kate
Irene
Kate
Irene
Send

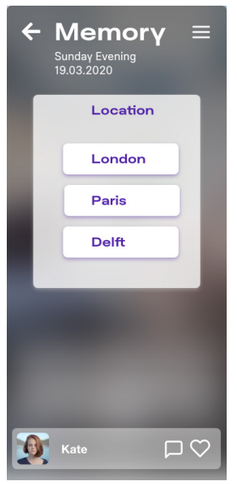

Memories
Sundays Evening
Memory was sent

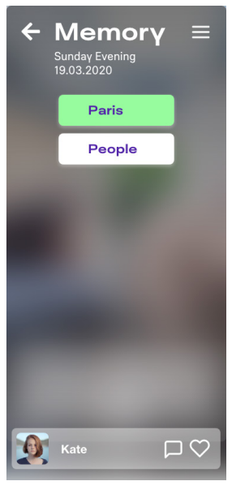

Memories
Sundays Evening
Fill at least 2 prompts
Tell a story
The first thing that crossed my mind was the time when we together visited place...
Send a Picture
Send

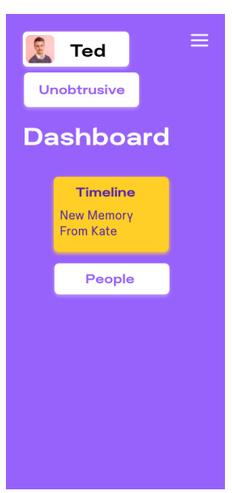

Memories
Sundays Evening
With whom would you like to share this memory?
Family
Kate
Irene
Kate
Irene
Friends
Kate
Irene
Kate
Irene
Send

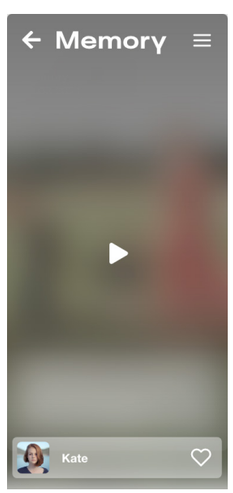

Ted
Unobtrusive
Dashboard
Timeline
Loved ones
People

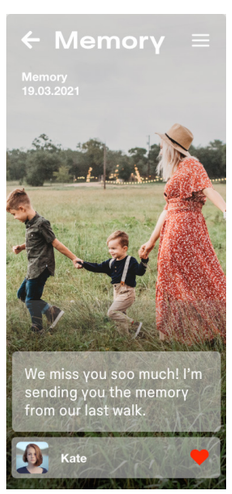

Memory
Sunday Evening
19.03.2020
Location
People
Hint ?
Kate

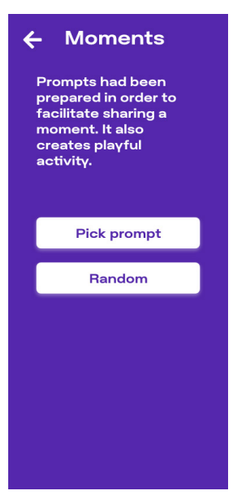

Memory
Sunday Evening
19.03.2020
Location
London
Paris
Delft
Kate

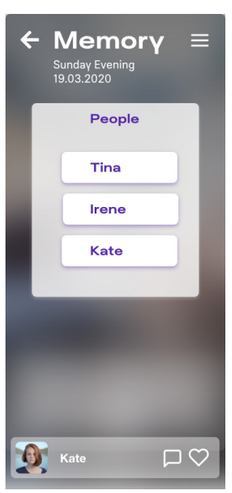

Memory
Sunday Evening
19.03.2020
Paris
People
Kate

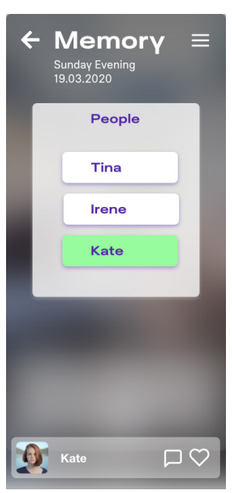

Ted
Unobtrusive
Dashboard
Timeline
New Memory
From Kate
People

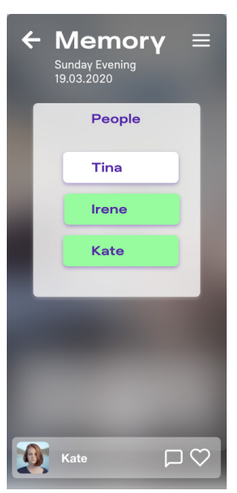

Memory
Kate

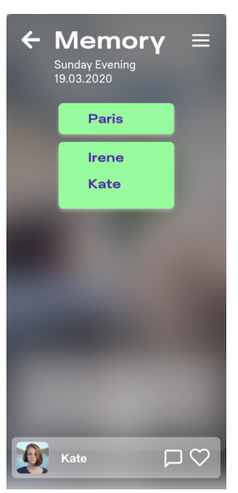

Memory
Memory
19.03.2021
We miss you soo much! I'm sending you the memory from our last walk.
Kate

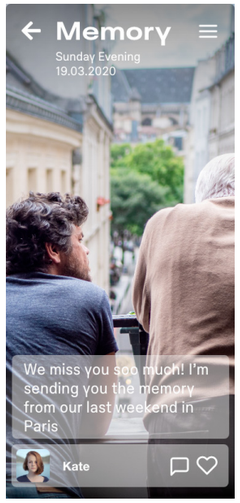

Moments
Prompts had been prepared in order to facilitate sharing a moment. It also creates playful activity.
Pick prompt
Random

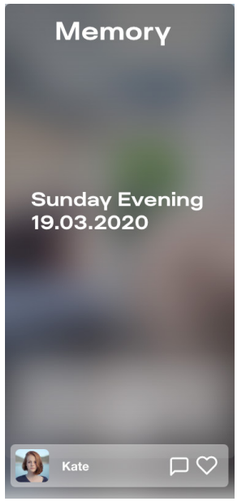

Memory
Sunday Evening
19.03.2020
People
Tina
Irene
Kate
Kate


Memory
Sunday Evening
19.03.2020
People
Tina
Irene
Kate
Kate


Memory
Sunday Evening
19.03.2020
People
Tina
Irene
Kate
Kate

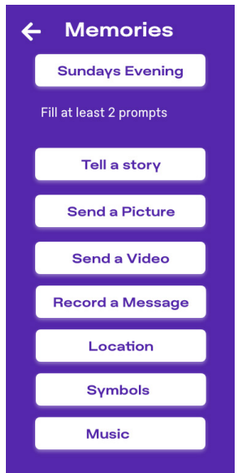

Memory
Sunday Evening
19.03.2020
Paris
Irene
Kate
Kate

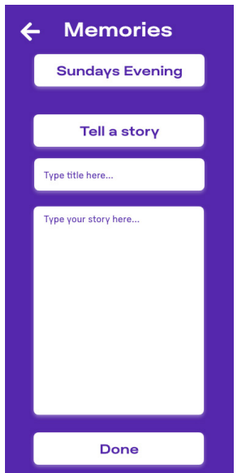

Memory
Sunday Evening
19.03.2020
We miss you soo much! I'm sending you the memory from our last weekend in Paris
Kate

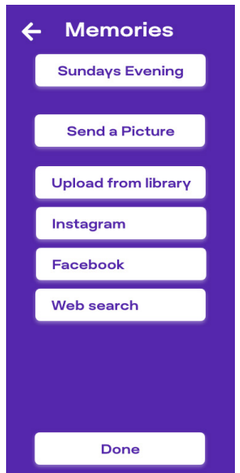

Memory
Sunday Evening
19.03.2020
Kate

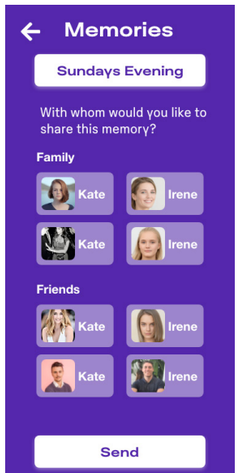

Memory
Got it!
Kate


Moments
Pick a prompt
Your daily view


Memories
Sundays Evening
Fill at least 2 prompts
Tell a story
Send a Picture
Send a Video
Record a Message
Location
Symbols
Music

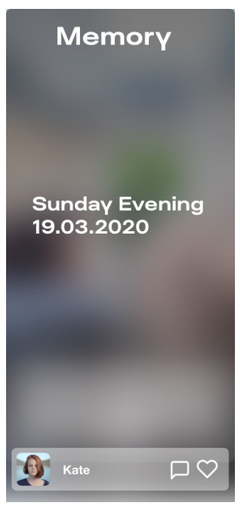

Memories
Sundays Evening
Tell a story
Type title here...
Type your story here...
Done

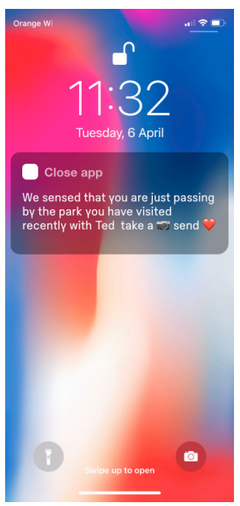

Memories
Sundays Evening
Send a Picture
Upload from library
Instagram
Facebook
Web search
Done

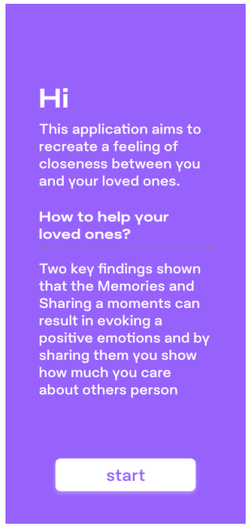

Memories
Sundays Evening
With whom would you like to share this memory?
Family
Kate
Irene
Kate
Irene
Friends
Kate
Irene
Kate
Irene
Send

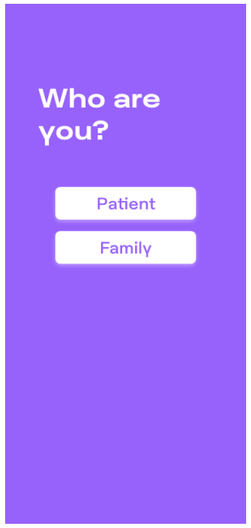

Memories
Sundays Evening
Fill at least 2 prompts
Tell a story
The first thing that crossed my mind was the time when we together visited place...
Send a Picture
Send
Send a Video
Record a Message
Location
Symbols
Music

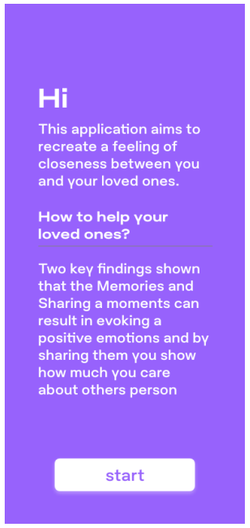

Memories
Sundays Evening
Memory was sent


Memory
Sunday Evening
19.03.2020
Kate


Orange Wi
11:32
Tuesday, 6 April
Close app
We sensed that you are just passing by the park you have visited recently with Ted take a send
Swipe up to open


Hi
This application aims to recreate a feeling of closeness between you and your loved ones.
How to help your loved ones?
Two key findings shown that the Memories and Sharing a moments can result in evoking a positive emotions and by sharing them you show how much you care about others person
start


Who are you?
Patient
Family


Hi
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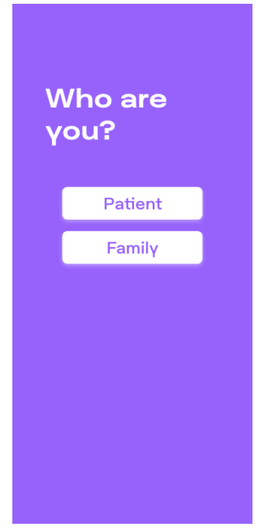
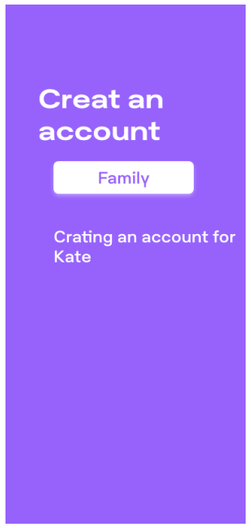
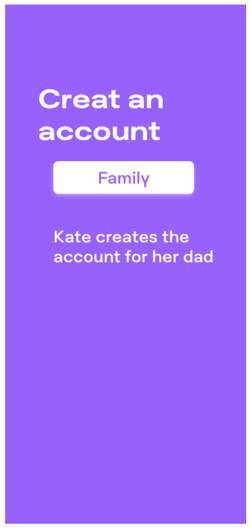
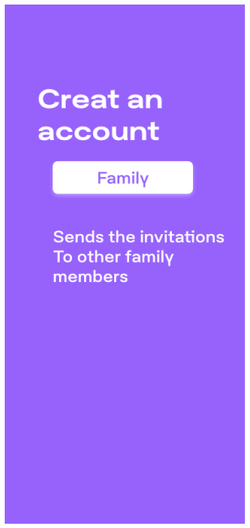
start


Who are you?
Patient
Family


Creat an account
Family
Crating an account for Kate


Creat an account
Family
Kate creates the account for her dad


Creat an account
Family
Sends the invitations To other family members

Unobtrusive Mode

What others are doing?

Kate
New moments

Irene
Wants to connect

What would you like to do?

Active Mode

Weekly Overview

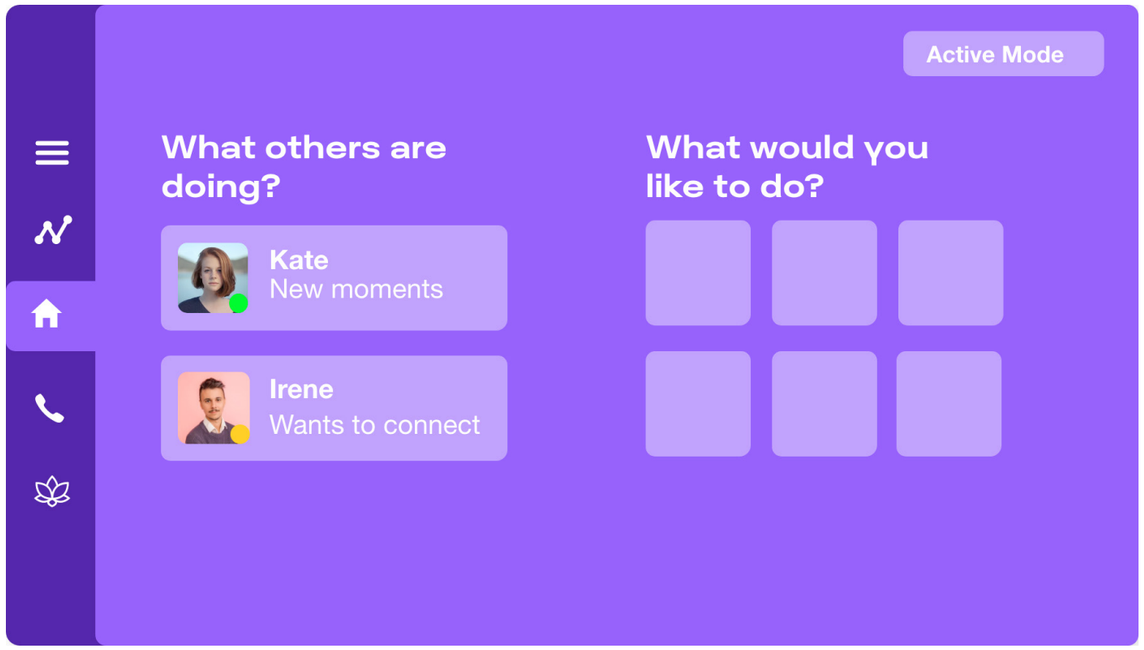
M T W T F S S

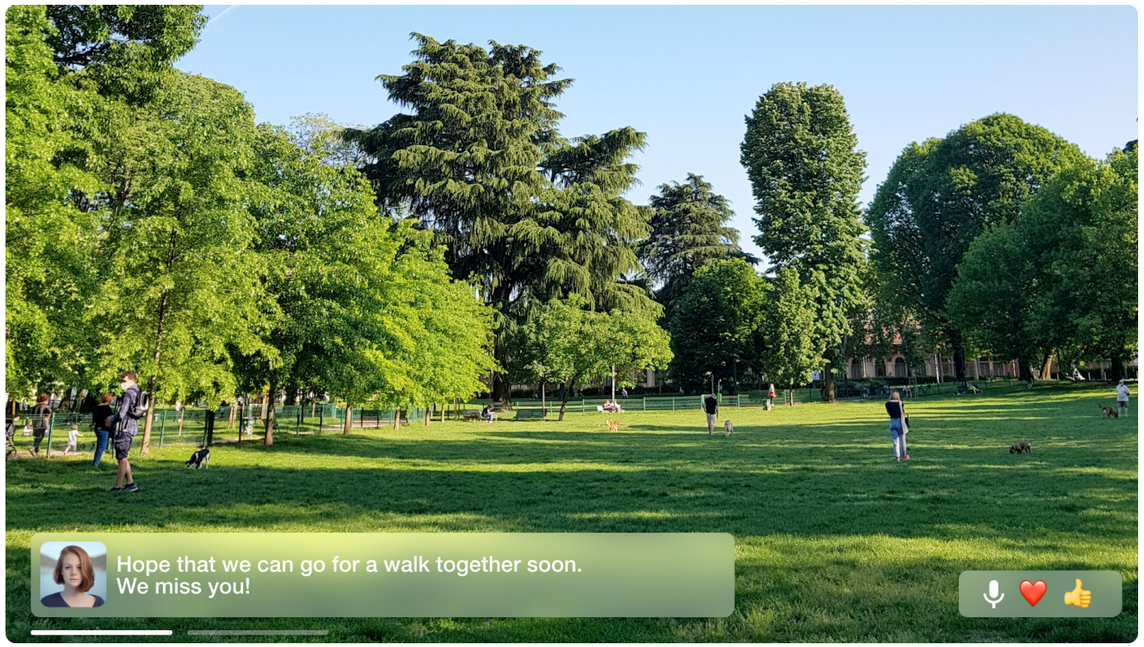
Good Morning!

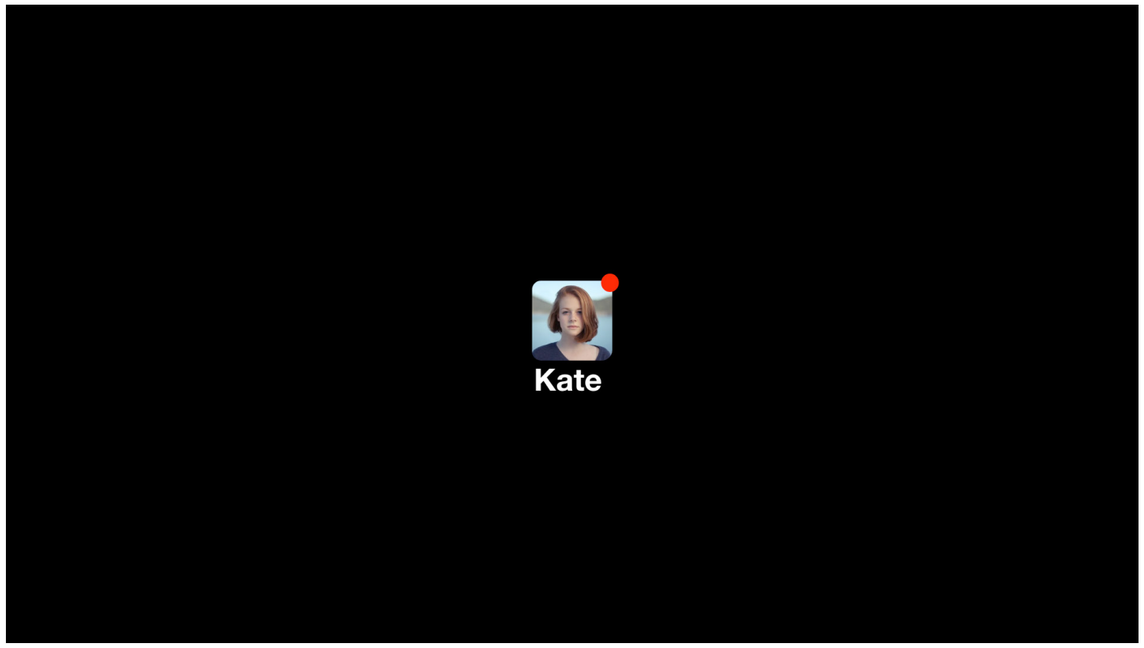
It’s time to check how are you today!

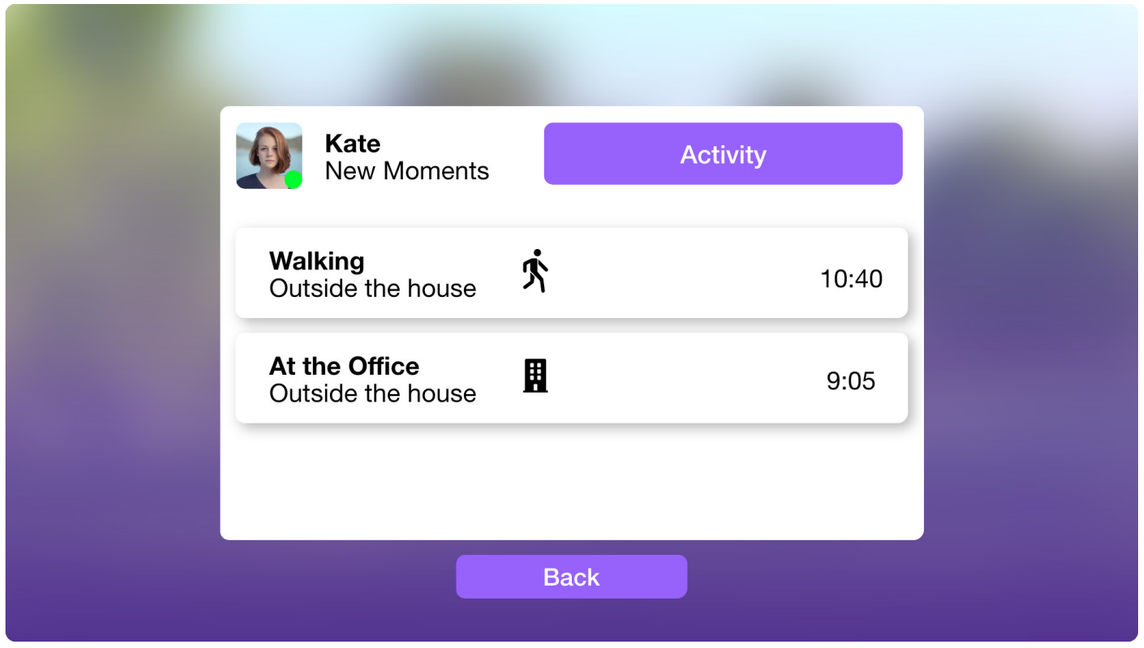
Pick your phone and answer some questions

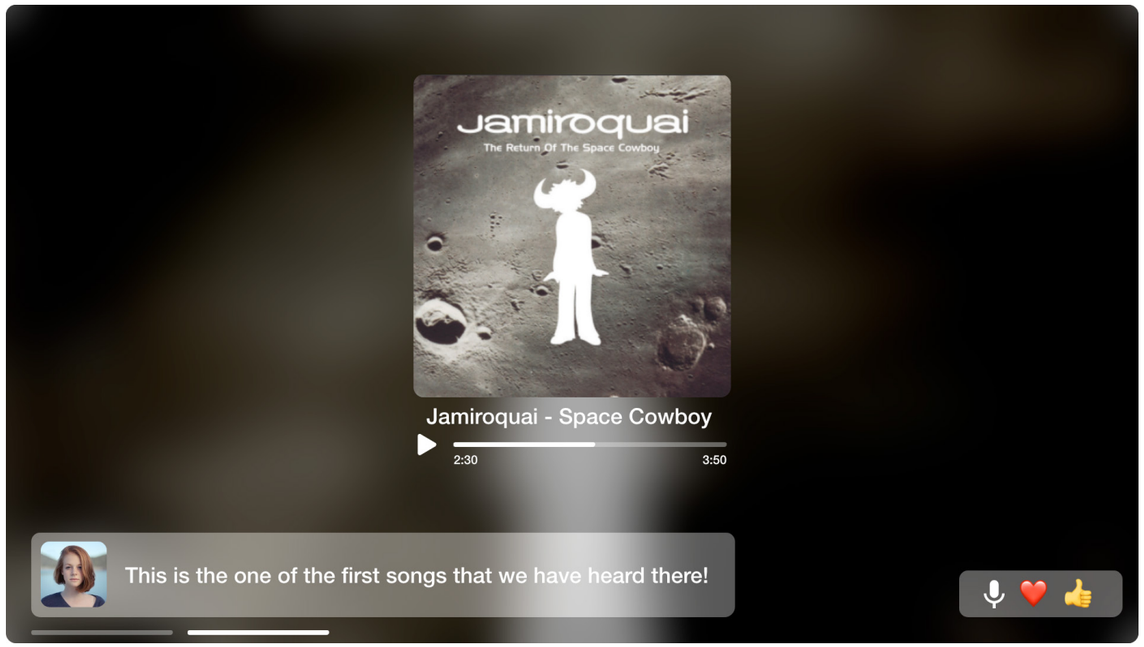
Kate
New moments

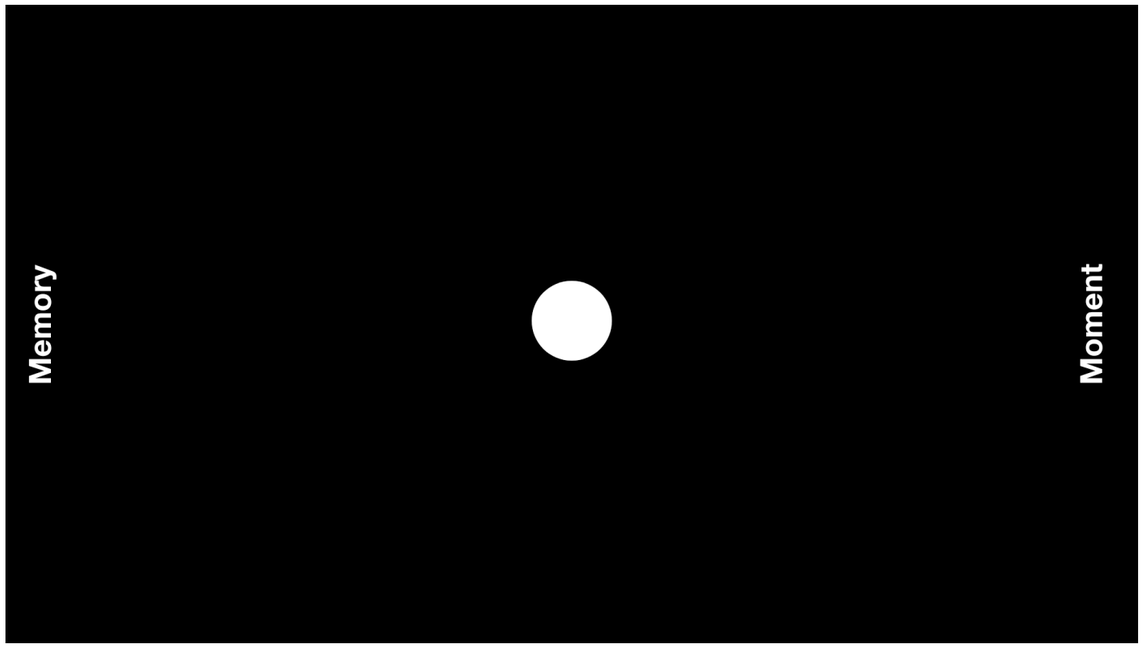

Active Mode
What others are doing?
Kate
New moments
Irene
Wants to connect
What would you like to do?

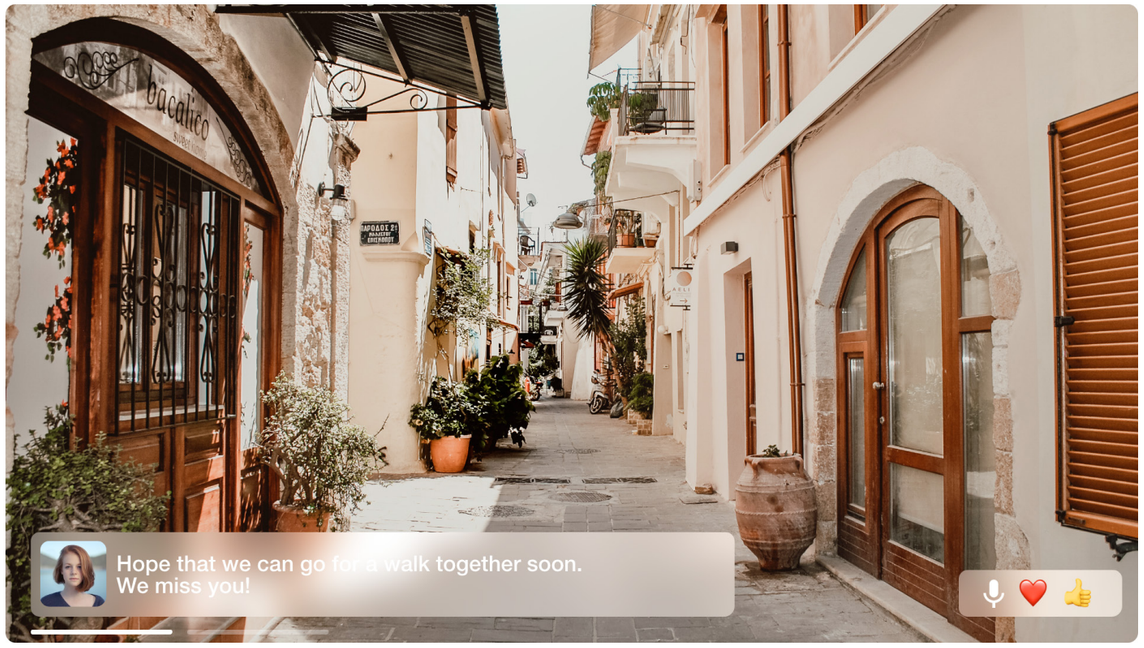

Hope that we can go for a walk together soon.
We miss you!

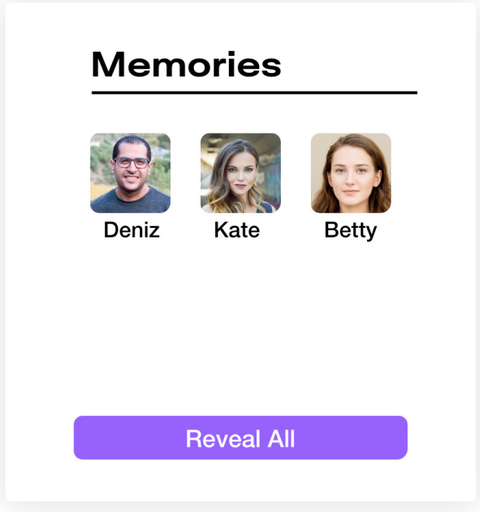

Kate

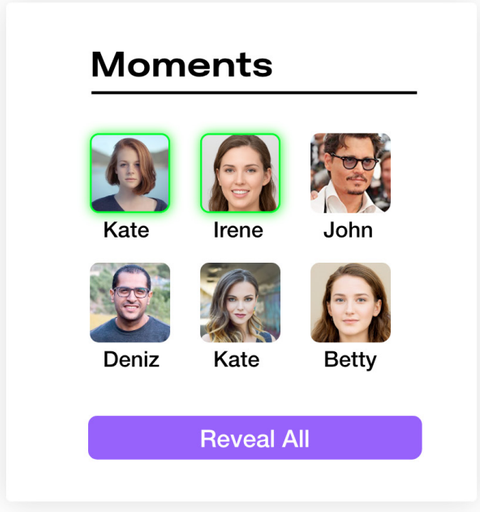

Kate
New Moments
Activity
Walking
Outside the house
10:40
At the Office
Outside the house
9:05
Back

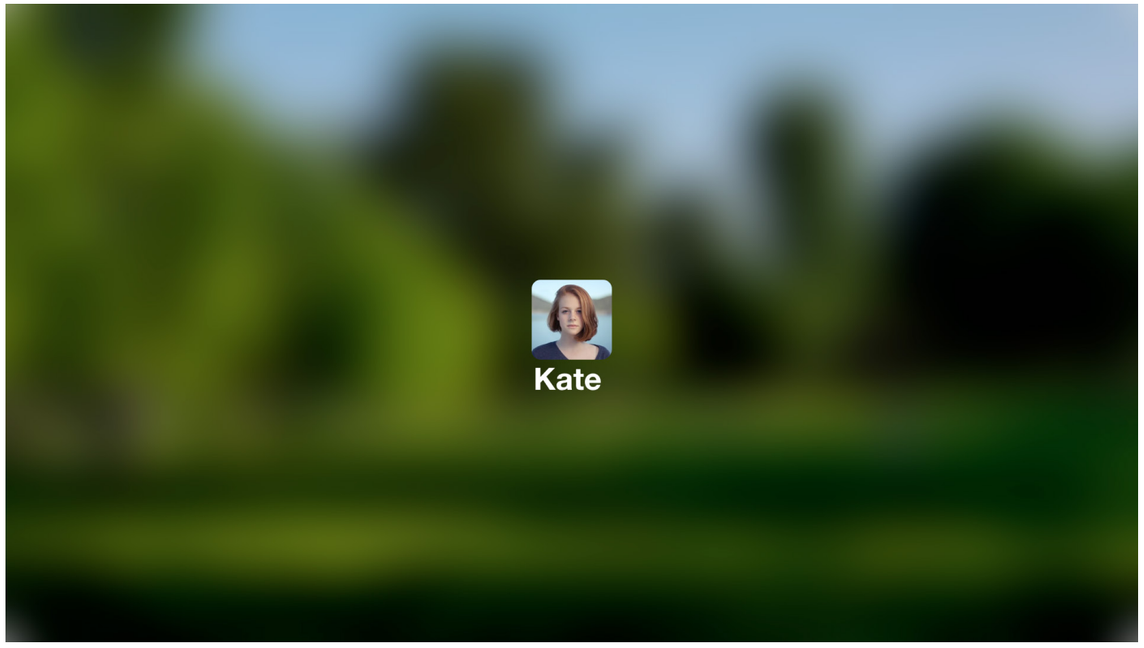

Jamiroquai
The Return Of The Space Cowboy
Jamiroquai - Space Cowboy
2:30
3:50
This is the one of the first songs that we have heard there!

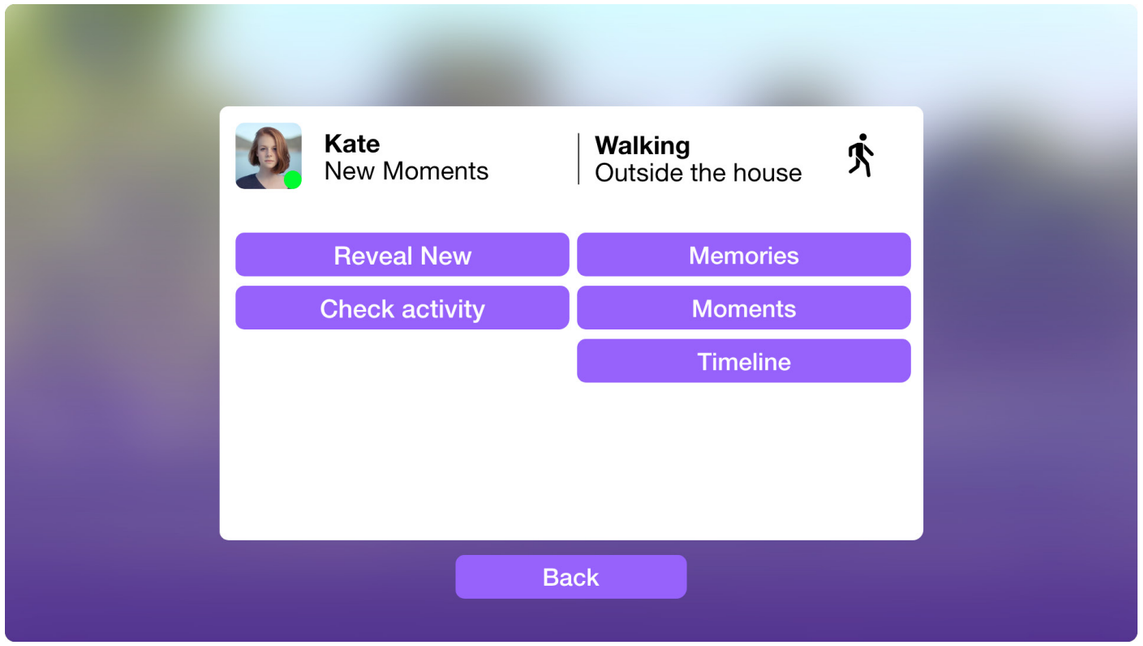

Memory
Moment

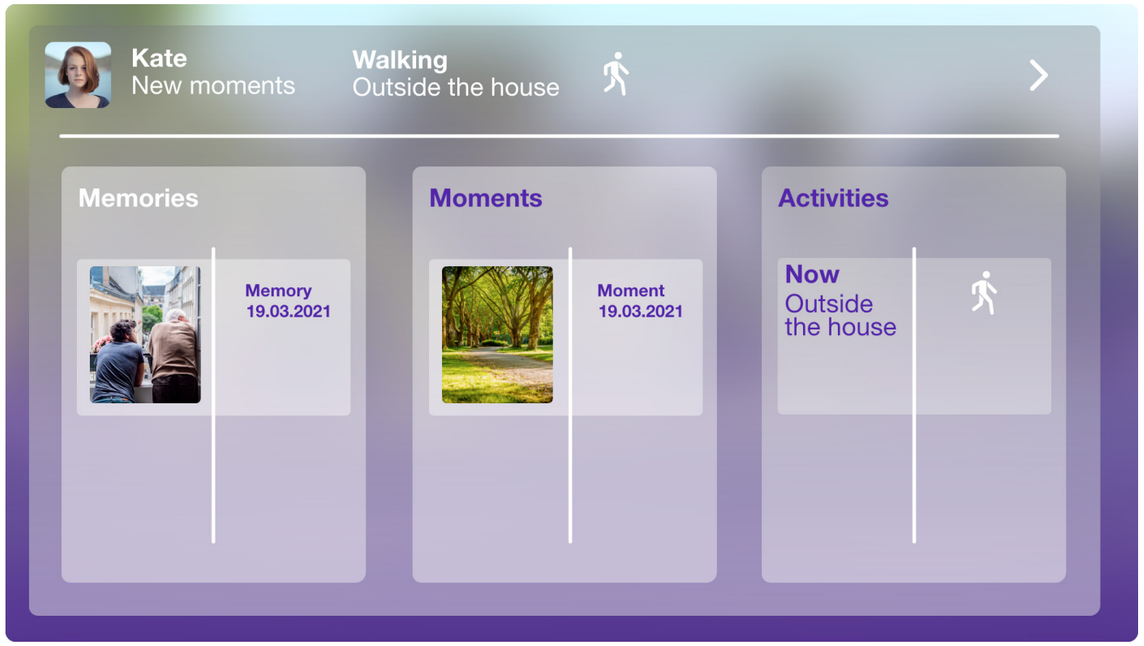

bacalico
Hope that we can go for a walk together soon.
We miss you!

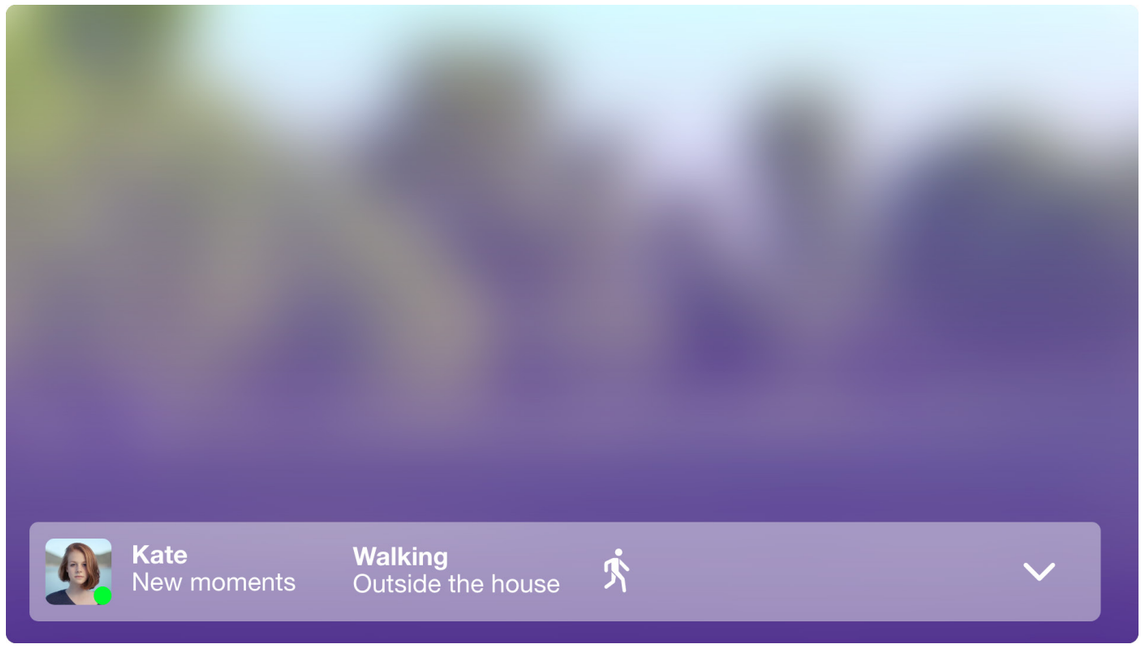

Memories
Deniz
Kate
Betty
Reveal All


Moments
Kate
Irene
John
Deniz
Kate
Betty
Reveal All


Kate


Kate
New Moments
Walking
Outside the house
Reveal New
Memories
Check activity
Moments
Timeline
Back


Kate
New moments
Walking
Outside the house
Memories
Memory
19.03.2021
Moments
Moment
19.03.2021
Activities
Now
Outside
the house


Kate
New moments
Walking
Outside the house

Appendix L

Evaluation Script

Hi, thank you for helping me to evaluate the design of the Close app. I'm firstly going to introduce you briefly to the main features, and will present the exemplary workflow of the app.

The close app had been created to unobtrusively evoke the feeling of closeness between the hospitalized patient and their family. Family here will create the content with a division on two categories Memories - to evoke positive emotions and Stories - to send a short updates from the family life. The patient side of the app consist of the feed of content that can be displayed on the TV. Patient can also reveal the memories manually from the app, check the timeline, invite more users and send back a short reaction.

Besides the mentioned functionalities app will also unobtrusively recreate a feeling of familiarity and closeness by the use of Ambience mode, showing your loved one's current location.

Let's start with the study.

For the app usage process imagine that you are the patient admitted to the hospital's general ward due to the mild covid symptoms.

I am your closest family member. I have just sent you the pictures from our last day of Sumer holidays.

Let's test now a second scenario which will be revealed by waking up your phone:
https://xd.adobe.com/view/84ddab5a-5a8f-4846-93fe-b5940238ef88-d18e/

You just discovered the unobtrusive mode. I will now ask you to open the App
https://xd.adobe.com/view/bdfa6a09-bdd8-491f-9dc6-4d9088d4cada-e8a9/?fullscreen

Inside the app you can reveal the received content by casting it to the TV or you can also see it on your smartphone.

1. Click the casting button
2. Pick the reaction

Now I will guide you through the use of app

1. Let's start from the timeline - here you can check all the content that you have received.

2. Loved ones
3. reactions
4. Mode and ambient mode

Questionnaire Patient

5. Initial Questions

1. What do you think about the App?
2. What were the positive and negative parts of the experience?
2. What are the benefits and difficulties of using this App as a communication tool with your loved ones?

6. Relatedness

1. Does the use of the App reduce the feeling of isolation?
2. Which component of the App: memories or moments, in your opinion, could bring you closer to your loved ones at home? Why?
3. What feelings does using this App evoke?
4. Do you think that the use of this App could result in negative emotions?
5. What interaction can evoke closeness between the isolated patient and their loved ones at a distance?
6. Do you think that this App could evoke the feeling of closeness between you and your loved ones? Why?
7. Do you think that the use of reactions can bring you closer to your loved ones?

7. Stimulation

1. In your opinion, Does the Close App is unobtrusive?
2. What element might help you to be distracted?
3. Do you think that the Close App can serve as a positive distraction?
4. Is the App overstimulating for you?
5. Do you think that there are some unnecessary components?

8. Security

1. Regarding the Ambience mode, what emotion can this evoke?
2. Do you believe that knowing where your loved ones are is useful?
3. Can the familiar pictures evoke the closeness and feeling of security?
4. **Moments explain !!** Does the function of moments help you to feel more secure? Knowing what others are doing?

9. Improvements

1. Do you have any improvements, recommendations, or changes to the App, experience, or process?

Questionnaire Family

1. **Initial Questions**
    1. What do you think about the App?
    2. What were the positive and negative parts of the experience?
    2. What are the benefits and difficulties of using this App as a communication tool with your loved ones?

2. **Relatedness**
    1. Does the use of the App help you to feel closer to your loved one?
    2. Which component of the App: memories or moments, in your opinion, have a more value?
    3. What feelings does using this App evoke?
    4. Do you think that the use of this App could result in negative emotions?

3. **Competence**
    1. Do you think that the use of reactions can bring you closer to your loved ones?
    2. What do you think about knowing that the patient is currently using the app?
    3. What element might help you to be more informed about the patient ?
    4. Do you think that the use of Close App could be a sufficient way of communication between you and the patient?
    5. What emotion could be evoked, knowing that your content was revealed by the patient?
    6. Do you think that there are some unnecessary components?

4. **Purpose**
    1. Would you feel more supportive while using the Close app towards the patient?
    2. What do you think about guided content creation?
    3. Would you share your location with the patient knowing that this can help him to feel closer?
    4. Does the app gives you the feeling purpose?

5. **Improvements**
    1. Do you have any improvements, recommendations, or changes to the App, experience, or process?

Questionnaire Healthcare Professionals

6. **Initial Questions**
    1. What do you think about the App?
    2. What were the positive and negative parts of the experience?
    2. What are the benefits and difficulties of using this App as a communication tool for patients and their loved ones?

7. **Relatedness**
    1. Would the use of the App help reduce the feeling of isolation for the patient? Why or why not?
    2. Which component of the App: memories or moments, in your opinion, would bring patients feeling closer to their loved ones at home? Why?
    3. What feelings does using this App evoke?
    4. Do you think that the use of this App could result in negative emotions for the patient or family?
    5. What interaction can evoke closeness between the isolated patient and their loved ones at a distance?
    6. Do you think that this App could evoke the feeling of closeness between the patient and their loved ones? Why or why not?
    7. Do you think that the use of reactions can bring them closer to their loved ones?

8. **Stimulation**
    1. In your opinion, is the Close App is unobtrusive?
    2. Do you think that the Close App can serve as a positive distraction?
    3. Is the App overstimulating for patients in general ward or ICU?

4. Do you think that there are some unnecessary components?

9. Security

1. Regarding the Ambience mode, what emotion can this evoke?
2. Do you believe that patient's knowing where their loved ones are would evoke a feeling of closeness with their family?
3. Can the familiar pictures evoke the closeness and feeling of security for patients?
4. **Moments explain !!** Does the function of moments help you to feel more secure? Knowing what others are doing?

10. Improvements

1. Would the use of this app interfere with the work healthcare providers need to do?
2. Do you think the use of this app could aid healthcare providers in providing good care for their patients?
3. Do you have any improvements, recommendations, or changes to the App, experience, or process?

Polish Ankieta Pacjent

1. Pytania wstępne

1. Co myślisz o aplikacji?
2. Jakie były pozytywne i negatywne strony doświadczenia?
3. Jakie są korzyści i trudności związane z używaniem tej aplikacji jako narzędzia komunikacji z najbliższymi?

2. Pokrewieństwo

1. Czy korzystanie z aplikacji zmniejsza poczucie izolacji?
2. Który element aplikacji: wspomnienia lub chwile, Twoim zdaniem, mogą zbliżyć Cię do ukochanych osób w domu? Dlaczego?
3. Jakie uczucia wywołuje ta aplikacja?
4. Czy uważasz, że korzystanie z tej aplikacji może wywołać negatywne emocje?
5. Czy uważasz, że ta aplikacja może wywołać uczucie bliskości między Tobą a Twoimi bliskimi? Dlaczego?
6. Czy uważasz, że wykorzystanie reakcji może zbliżyć Cię do bliskich?

3. Stymulacja

1. Czy Twoim zdaniem aplikacja dostarcza wiadomości w tle (dyskretnie)?
2. Jaki element może pomóc Ci w odwróceniu Twojej uwagi?
3. Czy uważasz, że aplikacja Close może pozytywnie odwracać uwagę od Twojego stanu w pozytywny sposób?
4. Czy uważasz ze aplikacja i jej działanie może wpłynąć negatywnie na Ciebie (nadmierna stymulacja)?
5. Czy uważasz, że aplikacja posiada jakieś niepotrzebne elementy?

4. Bezpieczeństwo

1. Jeśli chodzi o tryb Ambience, jakie emocje może to wywołać?
2. Czy wierzysz, że wiedza o tym, gdzie są twoi bliscy, jest przydatna?
3. Czy znajome Ci zdjęcia mogą wywołać bliskość i poczucie bezpieczeństwa?
4. Chwile wyjaśnij !! Czy funkcja chwil pomaga czuć się bezpieczniej? Wiedząc, co robią inni?

5. Improvements

1. Czy masz jakieś ulepszenia, zalecenia lub zmiany w aplikacji, doświadczeniu lub procesie?

Evaluation with expert

Method

A usability workflow session had been conducted with professional UI/UX designer. The The

In the future evaluations the further explotration of the subject you can observe the other two

Results

Main quotes

Results

Patient 1
The patient stayed only four days at the hospital had been hospitalized due to a non-covid related illness.

Not sure about the division between the memories and moments.

Emotions evoked will differentiate on the content shared by the family member. It is better to share the memory with someone close - someone associated with the memory created with - it will not feel lonely.

As a patient, you do not have visitors at the hospital moments to help you stay in the loop.

You know what is happening with your loved ones. You stay in the loop.

Moments would have more value for me. They would help me to stay in the loop.

The app seems a bit not clear, especially that it was shown with sample images.

App also looks like it more than it is. Maybe the landing page is too complicated.

The onboarding and the introduction to the functionality and features should be given.

The need for the app

Patient 2
General Questions
Elderly people
Nice organized things
If you are familiar with the phone, you should be familiar with how to use this app.

Relatedness

Moments and ambiance personally have a higher impact. Significantly older pictures could help me to bring back memories. Some people can feel sad looking at the memories - every person has a different feeling.

I would feel less lonely being connected to people - It is essential.

Stimulation
Ambiance - I Could see the current information what she is doing to keep me informed. Now we are used to following our loved ones.

Friendly and easy - even the elderly could use it mostly they are isolated, and this app could help them stay updated with the closest ones.
6. Happiness less lonely

Stimulation
Usually, during the hospital stay, people watch TV, now by watching a TV, they could be distracted and informed about their families.

None of the participants indicated that the application consists of unnecessary components.

Moments can keep me updated about my family life, and it makes me feel more secure.

Recommendations - indicated by the participants
One of the participants indicated that besides seeing the location of our close ones, it would be a more immersive experience to be able also to listen to the ambient sound.

Patient 3
The patient is in Poland, stays, on average, ten days at the hospital.

With the discreet application, you do not need to look at the phone.
My mother woke me up all the time. She wanted to ask if everything was ok.
Participants from the outside of the Netherlands could not have visitors.

Patients can't see the negative sides of the application.

My husband sent me a picture from our summer holiday. It was a strong positive feeling that motivated me to plan the following holidays with my family after the hospitalization.

An application was created for patients who are tired of the disease.
During my illness, I became very impatient. I was unable to concentrate. Talking too long or FaceTime made me angry.

I felt lonely after just a couple of hours spent in the hospital.

The application is easy to use. You can be close with your loved ones whenever you want to be.

The fewer steps to see something, the better.

This app trigger thinking about me by my loved ones it shows their support

Relatedness
Memories would work better.

This app evokes the positive feelings triggered by the memories that could also distract me slightly from the hospital.

In my opinion, the app can't evoke negative feelings. It can evoke only sadness but still show you that you are not alone and that you can be with your close ones.

The app is unobtrusive - I can also imagine the scenario when I sleep during the day and when I cannot fall asleep. I could reveal the content made by them, which would make me calmer and help to fall asleep with ease.

Stimulation
You can be distracted, but of course, you cannot forget about the fact that you are hospitalized. You don't sleep on your bed. Nurses make you many diagnostics, taking a sample of your blood, etc.

Security

In my case, my son and husband also got sick at the same time. Only I was hospitalized. I wanted to know how they are doing and what they are doing. This app would be very useful to just know how they are.

If it is easier, then it is better. I am personally using a smartphone as a work tool. I am not using Facebook. I do not like unnecessary features or apps, but I would definitely use them.

Recommendation
Maybe instead of having every user send you a single memory, you could also create groups to send more content at once.

Nurse 1
Healthcare professional. ICU nurse specialized in Research line "Improving (long-term) health outcomes of patients and relatives in a person-centered intensive care unit and promoting the well-being of professionals."

Concerns
Data storage
Already existing infrastructure Infrastructure - Patients have a special wifi network.
Safety and privacy are critical.
Rethink who can send the memory. Sometimes there can be inappropriate content.
It is very important during the development of such a solution to remembering that it should not involve any workload from the healthcare professionals.
Privacy data storage
How to finance this project?
Who is going to pay for it?
Who is going to manage it?

Ambiance - It is nice to see the familiar picture - something nice to look at.

Some of the patients are cognitively impaired, and they cannot check on their phones.

The app can evoke positive emotions - hope reassurance.

Immediate reactions - feeling that you are close, preventing loneliness at home
Message from loved ones are at the hospital displayed on the TV.

Ambiance - meaningful connectedness

Memories from the past can cause negative reactions.

Recommendation
The calendar would be nice to see the schedule of visits (COVID patients in the Netherlands can have up to 2 visitors for one hour, visiting almost every day.

People do not react as strongly when they see me, but they squeeze their hands when there is one of their loved ones.

Family 1
The participant was diagnosed with COVID 19. Throughout the illness, the subject was not hospitalized. However, the participant's father was diagnosed with COVID 19 severe symptoms and hospitalized for a prolonged stay. Here the question we are asked in the form of testimony of the patient's closest family.

The concept shows the importance of the psychological well-being of the patient and family.

It is unobtrusive

People do not have enough energy to take their phone to contact the family.

Transparent content intuitive design

I love to be close with my family - Major improvement is that you do not have to talk to communicate with your loved ones.

The patient does not have the energy to talk, and this app could give them hope.

My father did not want to speak with us. He was coughing almost all the time.

Reactions would make me and the rest of our family calmer—also the possibility to see if the patient is active or not.

Relatedness
The use of the Close app could bring me closer to my family. The patient cannot and doesn't want to talk. He is exhausted. Also, it gives information to the family about what the patent is currently doing, and I can imagine that knowing more family is calmer.

Memories and moments are significant, Memories would give hope and strength, and later moments could help update the patient about his family, but maybe when a patient feels a bit better.

App for the patient can appease, give happiness, give the strength to fight.
For family, when my dad was almost dying, knowledge and ease, especially in Polish hospitals - it is hard to get any information.
The app can bring me closer, primarily through a broad spectrum of reactions, especially by recording the voice messages.

We could always call my dad, but this app shows a different way of communication. It gives you a purpose and drags your attention into creating mindful stories based on the moment or memories; it also helps to look at them from a different perspective.

Knowing that the patient revealed my content would make me calm and satisfied.

Every component is necessary; I cannot see any improvements or overstimulation features here.

Everyone in our family is sharing a location.

Recommendations
Memories could be made in the way that you can simultaneously prepare one that more. You could make drafts, and then later, you could send a bunch of them.

I would feel worried if I would not get the reactions after sending the content to my father. It would mean only negative things for me.

The subject also recommended the function that could ping the patient to remind that family is worried.

Still, I would like to see my father's face to recognize what is currently happening.