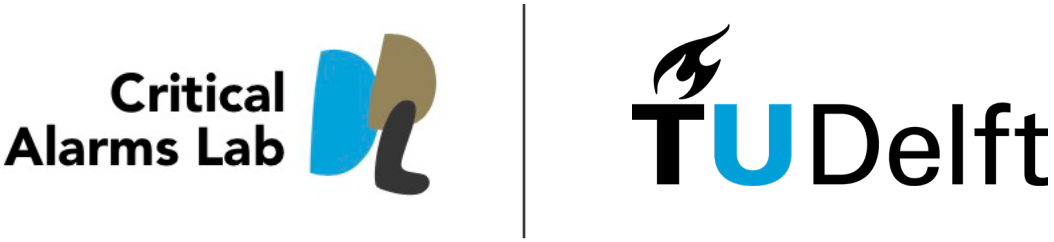
takeUthere

Sound-driven relaxation APP design for nurse

Master Graduation Thesis

Tianren Zhang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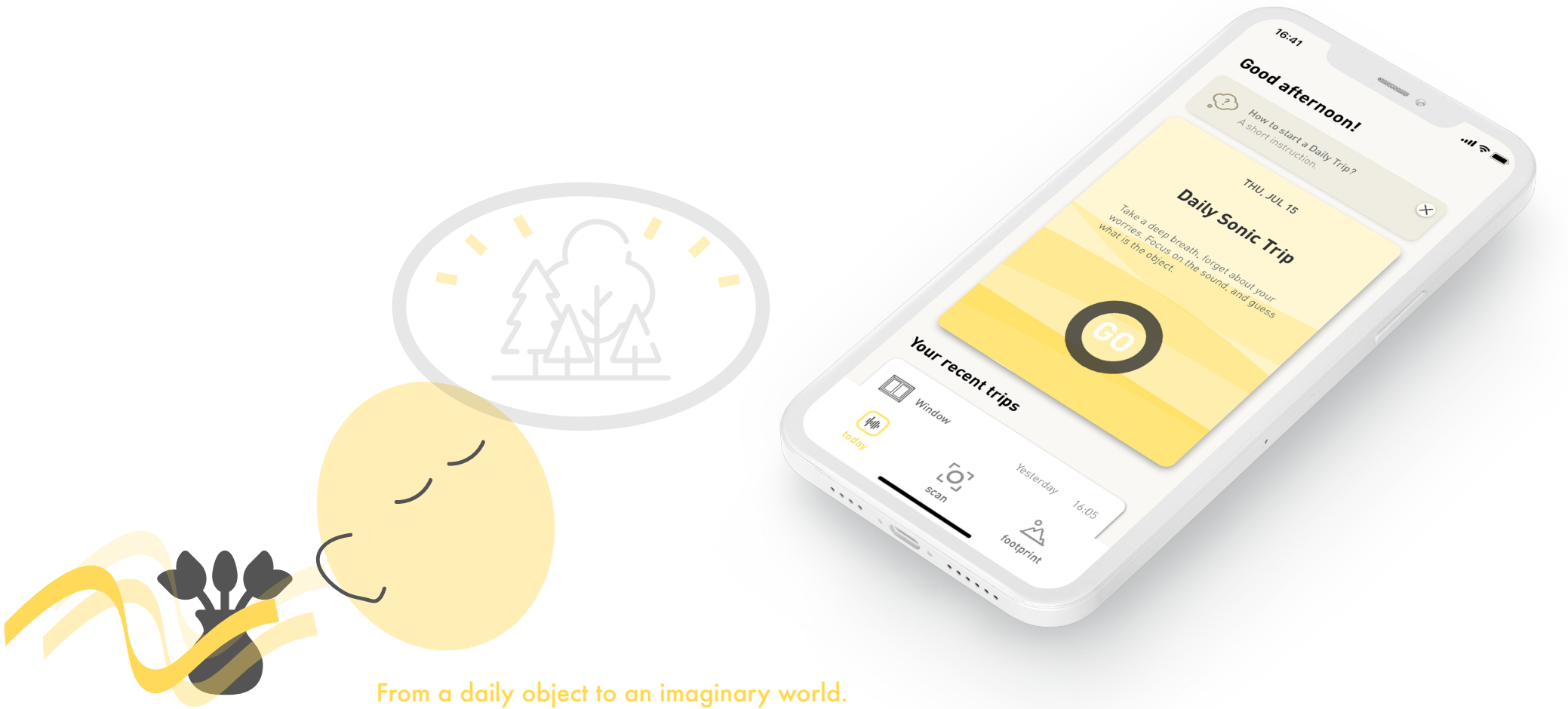
Executive Summary

takeUthere is a digital product design for nurses in the hospital to reduce working stress during work break time. As the professions that help people solve health problems, the hospital staff pay attention to the patient's physical condition all the time, including nurses, they face complex and difficult tasks every day. During the work, they need to follow orders from the head nurse and physicians, regulate mood for patients and their families, monitor the medical equipment, track the data and write reports for information sharing with colleagues, etc. This type of work challenges a nurse's professional skills, psychological enduring capacity, sense organ enduring capacity. Metally overwhelming becomes normal status in nurses' daily working time. Therefore, providing a balance between sensory and mental during the work break by regulating their mood has its value to be explored.

This graduation project aims to solve this problem by introducing a product/service solution. It cooperates with TU Delft Critical Alarms Lab, which focuses on sound-related research and design, in the area of healthcare, academic hospitals, etc. The main goal is to reduce the daily working pressure of nurses through sound and music, therefore creating a positive mood to face their work.

The outcome of the project - takeUthere digital product introduced a sound-driven experience in which nurses can enjoy short-term relaxation. It provides detailed sound from a daily office object. The user needs to find it and scan it on the APP. Then it delivers a fantastic charming scenario with 360-degree panorama visuals cooperating with relaxing scenario music. The final design includes APP user experience design, panorama visual design, and scenario sound editing. Moreover, it successfully convinced 8 participants with its unique fun experience. It shows the values for further development possibilities and improvement ideas. It also concluded new implementation opportunities areas followed by future recommendations.

takeUthere, let the sound bring you to a scenario that you ever dreamt of.



From a daily object to an imaginary world.

Contents

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1. Project Introduction

In this chapter, you will see a background introduction, the problem definition, project context, and the design approach in the project.

1.1 Introduction

"In the hospital, all the attention falls on the patients."

This patient-centered environment requires doctors and nurses to face complex and difficult tasks every day. New diseases and cases force them to focus the mind on patients and medical equipment. After the doctor completed the diagnosis, except for the operation, the nursing and care of the later period fell to the nurses. This makes nurses experience a lot of pressure when facing daily work, which will undoubtedly cause negative emotions, make it more difficult to empathize with the patients under care, and even affect their follow-up work and their normal lives. (Jill Suttie, 2017) The profession of a nurse requires a professional level of operation, empathy for patients, and a calm working attitude. All these require nurses to have strong self-regulation ability, to switch freely between complex tasks, and to maintain their calm emotions at all times to ensure work efficiency. However, this is an ideal working environment, but in fact, there are many factors that affect the psychological pressure of nurses.

Normally, in the hospital environment, people usually feel a sense of seriousness and coldness. Patients usually face the diagnosis and treatment with a calm, nervous, or even an extreme attitude. In order not to affect the judgment or treatment of doctors and nurses, the hospital is usually very quiet, but accompanied by warning sounds from medical equipment. This will greatly affect the mental health of people who have been working in this environment for a long time. As mental health is an essential issue for everyone to pay attention to these days, the increasing working pressure will cause a lot of people to find it hard to balance their life and work and therefore experience uncertainty, effortlessness, or even depression. (Susan Klitzman, James S. House, 1989)

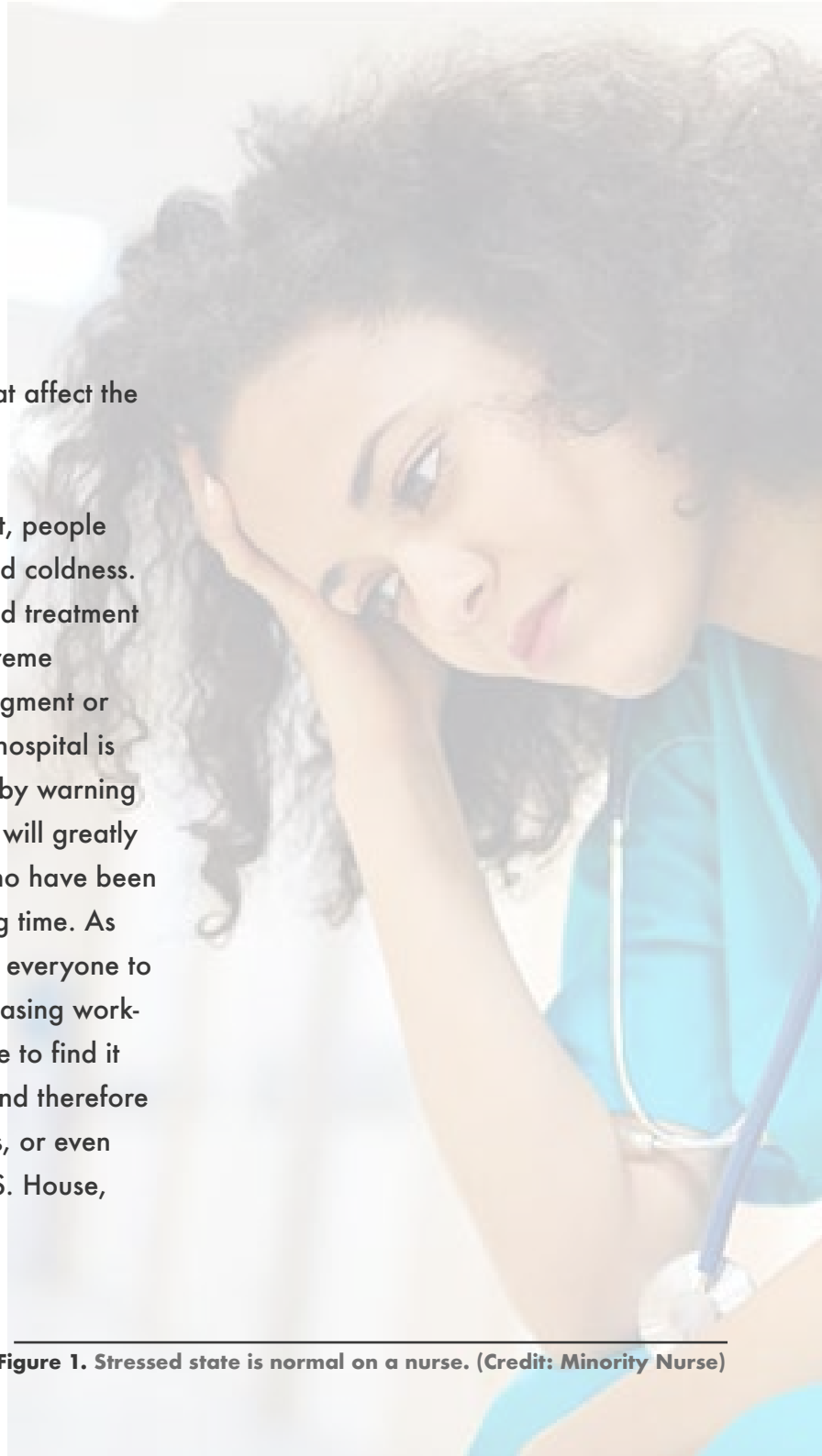

Figure 1. Stressed state is normal on a nurse. (Credit: Minority Nurse)

They need to have appropriate relaxation or recovery of their senses during the working hours for example, visual and auditory.

In terms of sense recovery, it often uses sound/music as a medium, with the environmental elements, for example, lighting and other visuals, received by the user, therefore, changing the brainwaves and nerves to create dopamine and regulate the user's mood. Study shows that introducing positive music and sound can bring relaxation and alleviate the stress response. (Elliott Salamon, Minsun Kim, 2002) The potential to implement sound and music into nurses' daily working brings it unique values.

Overall, the graduation project will focus on helping nurses in the hospital decrease the rate of pressure from daily work and design a product/service system that they can use during working hours without paying too much attention but can increase the working efficiency and refresh their minds to some extent.

In this report, you will follow the whole design process driven by reducing pressure and the possibilities of using music. The project started in spring 2021, new waves of COVID-19 outbreaks challenge the project research. New design methods were conducted to understand the user perspective. Therefore, the project also brings especially relevance to the busy, hard-working hospital workers.

1.2 Problem Definition

THE PROBLEM

Nurses in the hospital always experience sensory overload during working hours. Personal mental health cannot be secured means more chances to make mistakes in normal work. However, the lack of awareness and appropriate methods to recover their senses increase the high-pressure conditions. The challenge will be to create an interactive experience through sound and music for them. So within the assignment, I (the author, the researcher, the designer) aim to explore how to use sound/music as a medium to deliver positive interaction, therefore bringing positive attitudes towards daily missions and releasing working pressure for nurses.

THE ASSIGNMENT

Within the scope of the project, it is expected to result in a product/service system that introduces sound/music to nurses during daily work but without adding any burden to follow or receive, comparing with their current routines, and create a feeling of mind-recovering. The outcome involves user experience design, sound/music design.

1.3 Project Goal and Scope

PROJECT GOAL

Deliver a product/service solution for nurses to reduce daily working stress by using sound and music interaction, therefore regulating their moods.

PROJECT SCOPE

To make the whole project structure clearer, the researcher defined 3 fundamental needs from Pieter Desmet's 13 Fundamental Psychological Needs. Beauty is one of the human needs that experience the elegance, coherence, and harmony side of the world. However, in the design context, a nurse's daily working environment has a lot of disharmonious alarm sounds from medical equipment, the unappealing patient's talking, etc. In the design solution, I'm going to bring music interaction to create Unity and Order for them to regulate the balance of the personal mood. Then, with a positive mood and attitude, further reduce working stress in the hospital by having a feeling of Comfort. It requires to offer Peace of Mind - having a mental state of calmness. Overall, the design is going to help nurses to have good health from a mental perspective, and also to raise the awareness that hospital workers should also pay enough attention to themselves to recover their senses.

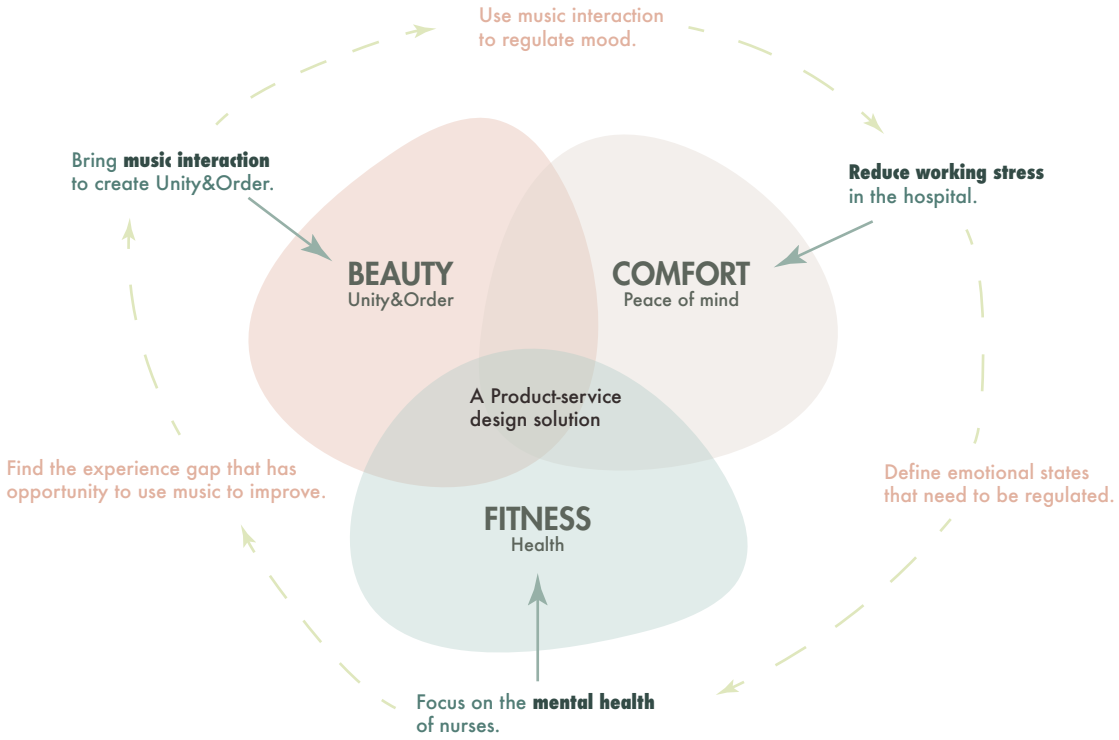

Figure 2. Project Scope - 3 Fundamental Needs in the project

1.4 Design Approaches

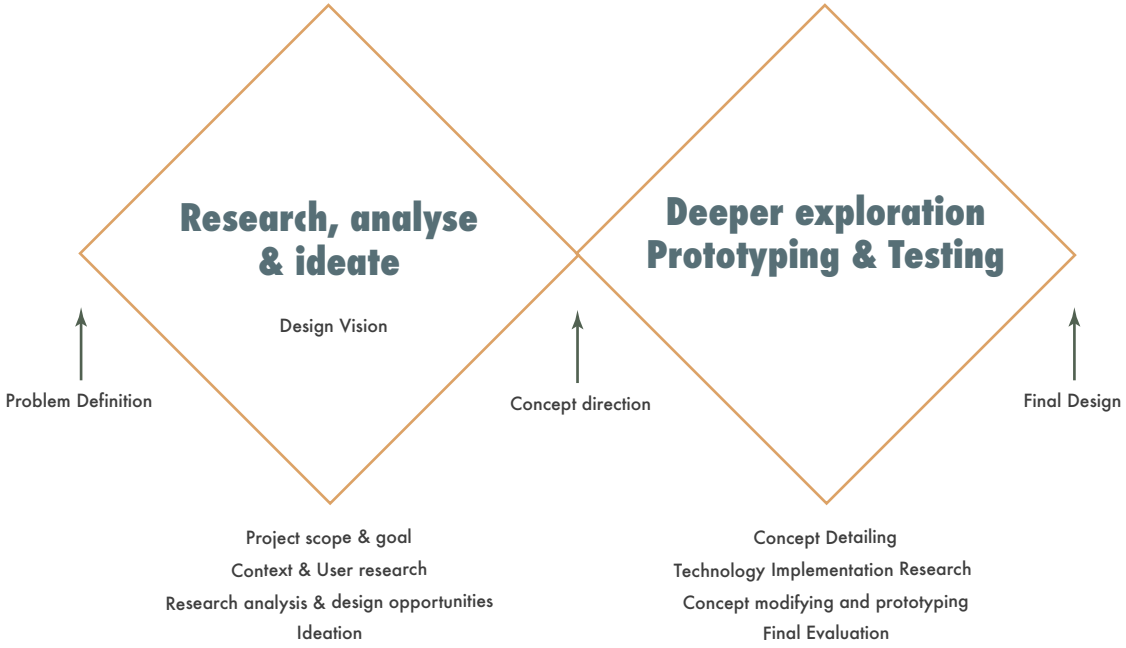

Figure 3. Design Approaches in Double Diamond design model

ⓐ

Determine the project scope

Desktop research about the background,
Define research scope and questions.

- Basic design background study
- Exploratory research to define scope and research questions

ⓑ

Context & User & Knowledge research

Context and User research to get a better understanding of a nurse's working environment and working structure. At the same time to learn related knowledge about pressure, emotion, and music.

- Context & User study by literature research and co-creation workshop with hospital workers
- Literature review on pressure, emotion, and music/sound.

c

Analysis & Opportunities

Gather all the research results and find out the design opportunities, determine the design vision. Start doing ideation according to the vision.

- Organizing all the design insights into design goals and design vision. And prepare the next steps to ideate possible design solutions.

d

Concept Development & Final Design Direction

Design conceptualization. Define concepts and make the selection. Find out the way music and sound can take part in the design ideas.

- Concept generation and explanation
- Concept synthesis and final direction

e

Technology Research and Concept Detailing

Find out technical requirements in the final design by conducting Technology Research. To realize the ideal effect, select the appropriate music/sound composition and iterate for the design concept.

- Technology research to find design requirements of implementing the specific technology
- Visual & Music demo in the final design.
- Concept prototyping

f

Final Evaluation, Reflecting and Concluding

Conduct final user testing to verify the function, qualitative research, and reflect on all the design processes and researches. Find out the limitations, benefits, possible future improvements, applications from different perspectives, in order to introduce a complete, viable, feasible, desirable solution.

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2. Context Analysis

This chapter focuses on the research about nurses' daily working environment and structure of work, as well as the relationship between sound/music and pressure/mood. The goal of the whole research is to understand nurses' needs, possible application domains, and design opportunities.

Research Direction & Method

Understand the Nurses' work in the Dutch medical system

As the project aims to give solutions to reduce stress for nurses in the Dutch hospitals, the basic knowledge about the structure of a Dutch hospital, working principles, working environments, etc. needs to be researched. This research will help the researcher to understand the context, in order to have a clear overview in the mind. The desktop research was used in this section.

The working journey of nurses

Nurses are the target group in this project. The understanding of the daily working journey and job content are essential to be learned. The research content will help the reseacher to find pain points and design opportunities to introduce the final design. Literature research and user research (workshop) were used in this section.

Pressure & mood

The main topic for the project is to use music and sound to regulate nurses' moods. As the issue is how to reduce stress (working pressure), research about the stress sources, nurses' working stakeholders are needed. The insights were discovered through co-creation workshop discussion and observation, referred to literature research results at the same time.

Music and Emotion

As a type of information input, solving the problem by using music and sound requires knowing why, how, what music, and regulating emotions. Defining the emotional states that need to be changed by using music is needed.

LITERATURE REVIEW QUESTIONS

- What is the current Dutch medical system like?
- What are the requirements of becoming a nurse? What type of skills and mindset are required as a normal nurse?
- What types of benefits will the nurses and other stakeholders have if the working stress is released?
- How does sound/music affect people's moods and pressure?
- What types of music can change people's emotions? Why can it change people's emotions?

USER RESEARCH QUESTIONS

- Awareness on sounds around you. How do you feel about those sounds?
- Do you listen to music during the daytime? What do you do when you listen to music? Can you match your behaviors with the music? Match music genre with activities.
- Do you feel stressed when doing your daily tasks? What is your personal way to reduce stress for a while and focus on work quickly?
- How do you maintain a good mood when facing on work?
- What typical sounds can you find in your daily working environment?
- What type of sounds is joyful for you?

2.1 Background Review

2.1.1 Nurse's work in a Dutch Hospital

From GP to Hospital

In the Netherlands, the GP holds a central role when it comes to healthcare. If a person has any questions regarding physical and mental health, the personal GP is the first one to ask. As well as answering any health questions the person may have, a GP in the Netherlands can also perform minor surgical procedures and carry out pediatric and gynecological examinations. Generally, a GP does not provide dental treatments.

After consulting the GP, the person can make an appointment with a specific department in the general Dutch hospital. Through this medical system means specialists and nurses can have more focused work on patients that really need help. On the other hand, it requires more solid professional skills and mindset to face the everyday complex work. [1]

Figure 4. Nurses' soft skills [1][2]

The working journey of nurses

Research from Lotte Maja Salome in Erasmus MC, Rotterdam [3] results on a nurse's workflow journey map. There are 4 major high-pressure feelings during a nurse's daily work:

- When in the morning Doctor Visit section, treatment methods may have some changes, which are sometimes disagreed by nurses but have to be accepted. As nurses always do face-to-face treatment for patients, they may get more insights from details than doctors. This gap increases the working pressure.

- The check-up process. Nurses need to get patient's data regularly to stay updated, and administer medication, also implement treatment plans.

- The administration. Nurses need to record and report information about the patients to colleagues and keep them up to date. The summary of changes is complex and needs quite a long time.

- The transport (especially ICU). Sometimes the patients need to do X-rays at another place. The nurses need to help out, especially all the machinery's disconnection, etc.

Needs:

A short-term escape from reality for sense recovery

For a normal nurse in the hospital, the personal moment only occurs at coffee break in the morning, lunch break, and work shift during the day. In most cases, they don't have enough time to finish a time-consuming activity to distract them. But short escapism especially from the noisy medical environment is necessary.

Feel involved in the discussion and treatment decisions with colleagues

The information asymmetry between nurses and colleagues will cause a lot of misunderstandings, mistakes, and psychological unpleasantness. The sense of being in a group is needed during the work.

Some of them may need to increase the communication between colleagues.

As nurses' work needs teamwork a lot, they need a feeling of belonging in the team and following it.

"When we routinely collaborate, the clinical climate within our work environment rises, workplace satisfaction improves, and staffing retention soars. All team members want to feel that their ideas and skills are valued. And increasing nursing workplace satisfaction is linked to positive patient care experiences."[4]

Communication between nurses not only should be increased during the work, but appropriate team-building activities during spear time also bring benefits to some extent.[5]

Conclusions:

- A well-structured Dutch medical system offers a focused working environment, yet needs more solid personal soft skills. Nurses' work directly influences the patient's health and recovery. Designing for nurses has its unique value, maintaining a better working attitude, so as to better help patients.

- The four major high-pressure and negative emotions from nurses' working journey occur mainly due to the complexity of the tasks. The nurses should take their responsibilities to the administrations. Therefore, they experience personal mental health challenges at that moment.

- There are some touchpoints that they can have some rest during work, for example after the medication, lunch break, daily summary period, etc. The characteristics of these potential touchpoints are short periods of time, quickly switchable, from complexity to simplicity.

- The high-pressure feeling sometimes comes from the communication gaps between colleagues. There are opportunities to design for nurse's communication, but it will be affected due to nurse's personal willingness and personalities, etc.

2.1.2 Music/Sound, and Relaxation

The Importance of Maintaining a Positive Mood

A study by Erber & Markunas shows that a positive mood indicates that the environment is comfortable and familiar, and not dangerous. Therefore, people can safely help others. A good mood drives an attitude that people are willing to accept people and give their own support. Finally, the most important thing is the possibility that helping makes us feel good about ourselves, thereby maintaining our positive mood. In fact, people who are in good moods are particularly likely to help when the help that they are going to give seems likely to maintain their positive mood. But if they think that the helping is going to spoil their good mood, even people in good moods are likely to refuse to help.

However, a negative mood causes guilt, which sometimes also makes people helpful. But as for nurses, they help patients on a daily basis, and it is also their duty to work. The negative mood will only cause more mistakes at work. So regulating nurses' mood to a positive state not only benefits their mental health but also has value to keep on their nursing working. [6]

How Does music Help Reducing Stress

Sound waves affect hearing, the sense linked to many of the body's physiological reactions. Therefore, as a form of mixed source sound wave, music affects the body like any other sound. Rhythms, beats, and audio samples often imitate nature, and the power of voice carries through both analog and digital means. The ears signal the brain to produce dopamine. [7]

Journal of Music Therapy by Oxford Academic keeps updating research and information about using music to help people with Dementia, Traumatic Brain Injury, Autistic Children, Anxiety, etc. [8] Suzanne Hanser defined anxiety, also referred to as stress and tension, and conducted research in music therapy with analysis using brainwave measurement and behavioral observations of reduced stress. [9] Martina de Witte et al researched the positive effects of music on both physiological arousals and psychological stress experiences. The conclusion shows that music mostly affects heart rate and hormone levels. [10]

In general, music has a lot of different genres, which may have different effects on people's feelings and moods. Also, people tend to choose a diverse type of music to match their behaviors. Therefore, according to scientific evidence, depending on the track, music can impact hormone levels, heart rate, blood pressure, the psychobiological stress system, mood, post-task mental and physical revitalization, alertness and energy levels, etc. [11]

Brain Waves and Music

There are 4 types of Delta waves, but Alpha waves have the function of strengthening absorption, sorting, and remembering information. When people feel bored or feared, they will be in a state of tension. When people feel anxious or restless, the brain will be in a state of β waves.

Alpha wave music normally has 60-70bmp, soft music. The slower a song, the more likely the person is to experience deeper breathing, lower blood pressure, and a lower heart rate. Faster music has the opposite effect—pumping up the vitals and propelling the person to move.[12]

Nature Sounds and Relaxation

"Nature sounds physically alter the connections in our brains, reducing our body's natural fight-or-flight instinct. " [13]

The research shows results comparing with naturalistic sounds and artificial sounds: people's minds focus outward-direction on the environment when listening to nature sounds, and focus inward-direction on themselves, which is similar to the states observed in anxiety, post-traumatic stress disorder, and depression.

"Natural sounds improve health, increase positive affect, and lower stress and annoyance. " [14]

The study quantifies the soundscape in national parks in the United States. The results show that prominent, persistent natural sounds may confer additional health benefits by masking noise. Nature sounds like water sounds and bird sounds have the biggest influence on regulating moods.

How Do We Relax - Activities and Behaviors

Graduation research from M. Berket [15] studied the sleeping experience and the relationship between stress and sleep. In the research conclusion part, he introduced a concluded chart about How Do We Relax. The author classified the way of relaxation into five parts: Disconnect from reality, Sensory soothing, Embrace the mind, Emotional belonging, and Personal development.

Disconnecting from reality means activities that don't require brain power but keep the mind entertained, for example watching TV, reading, painting, etc. Sensory soothing means activities that provide sensory stimulation, which can enrich the experience of the world. Embracing the mind means activities that help the personal mind to open and spread, like doing meditation or yoga, etc. Emotional belonging allows the person to be surrounded by people who care about them with or without physical activities. Finally, personal development means activities where the person can do it alone but feel comfortable and joyful.

Conclusions:

- For nurses, helping them regulate mood to a positive state can keep certain effectiveness of helping patients and execute nursing tasks. This humanistic care undoubtedly would benefit multiple stakeholders in the design.

- Music and sound as tools to reduce stress is not an innovative invention. Scientists have proved the positive effects of using it to help various types of people.

- Soft, slow tempo music and nature sounds will affect the person's Alpha Brain Wave and reduce stress by regulating physiological and psychological index.

- Activities about actively seeking to reduce the stress of the person always show a modest, soothing, or even microstate of physical interaction. The interaction is more closed to the information offering-receiving perspective.

2.2 User Research

The user research has two parts, user interview, and co-creation workshop observations and homework tasks.

The user interview is a basic understanding from general working people about music and sound, work, and relaxation. The purpose of the interview is for defining the emotional status that people maintain for normal work and understanding how music affects people by passively interacting with it daily.

The co-creation workshop is under the topic research from the project Mentor, Dr. Stefano Delle Monache about better sleep for patients in a ward environment with Reinier de Graff Gasthuis in Delft, the Netherlands. The workshop is cooperating with physicians, nurses, and hospital supervisors, from daily sonic awareness in the hospital to better sleep solutions for patients.

As COVID-19 lockdown affects the whole design process. It was a fortune to have this opportunity to contact real users and discuss, research, and learn from them. The researcher hold small activities for them to research nurses' stressors, sonic environment, and the real context in the hospital.

2.2.1 User Interview:

The user interview was conducted in 2 days with 5 people age 21-27. As the purpose of the short interview is to discover the basics of sonic awareness in order to prepare the further workshop research, the participants are only peer students and normal office workers. The interviews were finished via the online platform, Zoom, and face-to-face interviews. The face-to-face research all followed the COVID-19 regulations.

Questions

- Do you notice sounds around you often? Like nature sounds, machine sounds, unintentional moving sounds, etc. How do you feel about those sounds?
- Do you listen to music during the daytime? What do you do when you listen to music? Can you match your behaviors with the music? Match music genre with activities.
- Do you feel stressed when doing your daily tasks? What is your personal way to reduce stress for a while and focus on work quickly?

Results

– *People DO notice sounds around them daily, but try not to be distracted by them.*

4 people described that when they engage in the everyday tasks, they won't notice the sounds around them. But from getting the task to engaging in, this status always got distracted by the sounds (or defining those are NOISES for them at that status), for example, other people's talking, moving chairs, the sound of the wind blowing on paper, the car went by, etc. By deeper asking and analysis, the unpleasant sounds are all sounds that are not controlled by themselves. (passively received)

– *Music is a common habit of people. Different activities affect choosing the music genre.*

All the participants listen to music pretty regularly. For example, one described that he listens to soft-pop in the morning with coffee and breakfast. Jazz music to chill out in the afternoon. EDM for the party. Playlists are essential for

them to use by genre and activities. But in general, when people trying to relax or focus on work, soft music is mostly chosen, which also matches the previous literature review results.

– *The emotional status of facing tasks is common: Clam and neutral mood are important.*

People said that when facing stress during the day, they tend to find ways to calm down and try to keep a neutral mood to continue working. One uses the decompression toy - a finger spinner. He said, "*Having a thing that you can control is nice, even just watching it spinning is a relaxing moment for me.*" One fact is that the finger spinner creates a slight sound when it starts to spin. The sound is similar to machine operating noise, but the participant didn't feel bothered.

Figure 5. Participant with a finger spineer

User Interview Conclusions:

- Passively received sounds/music may have negative effects on people. Active control and creation are potential.

- Due to the context in the hospital, creating a calming experience for the senses is more valuable than changing the emotion, as nurses only have a limited period of time to have an interactive solution during working hours.

- For working people, trying to keep a balance between a calming experience and a sleepy experience is extremely important. Too relaxing will bring a dull status to face at work. Maintaining a certain rate of engagement and joy is the potential to avoid boredom yet relaxing.

2.2.2 Context Mapping from Co-creation Workshop:

The workshop Better Sleep with RdGG hospital in Delft, the Netherlands was held online and had 2 sections. The first section is helping hospital workers to become more aware of the soundscape around them, both in the working environment and in their personal lives, in order to gradually become sensitive about the sleeping environment for themselves, also for patients in the ward. Then the second section is thinking about solutions for the hospital to increase the sleeping experience in the ward.

The researcher's role in the workshop was mainly for the first section, sonic awareness, by introducing tasks for participants to finish for the coming weeks after the workshop - Sound Hunter. The 6-days activity focuses on stressful, relaxing, and playful sound awareness and hospital worker's individual behaviors. It is an online activity via the WhatsApp platform with support from the Critical Alarm Lab team.

SOUND HUNTER
via WhatsApp

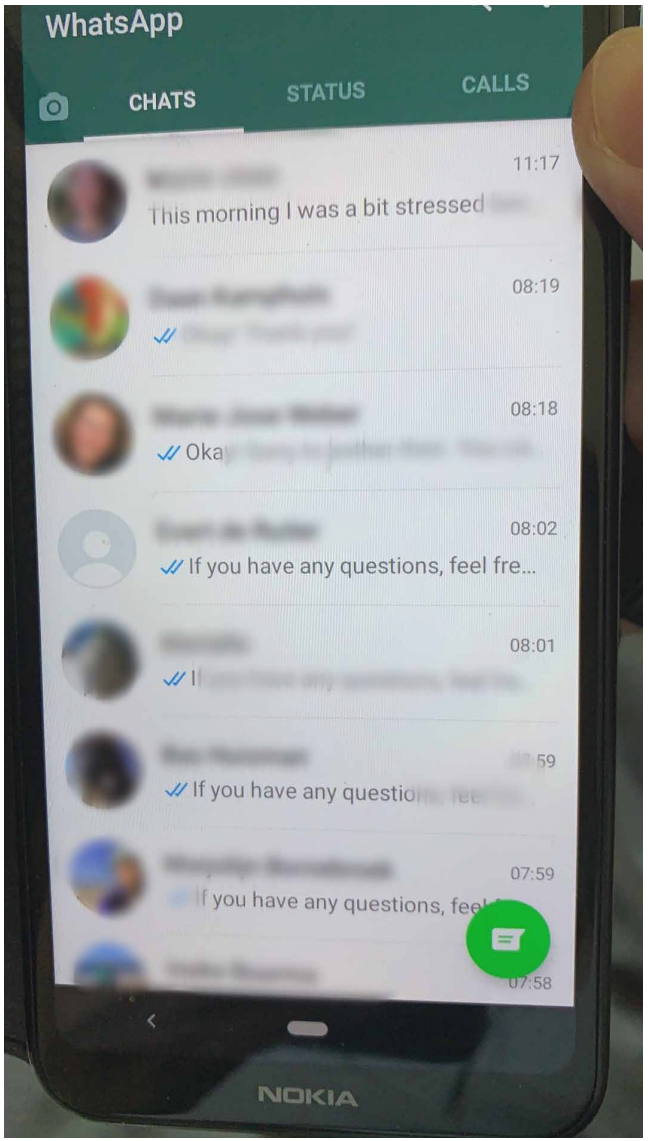


Figure 6. Sound Hunter Whatsapp activity and phone contact with participants.

The Content of Sound Hunter Activity

The Sound Hunter aims to let the user find sounds around in the hospital and outside of the hospital. The main themes of "hunting" are stressful, relaxing, and playful/joyful. Each theme will last for 2 days when the participants need to start from sound and describe it the first day and focus on behaviors on day 2.

The first 2 days' topic is stressful. On the first day, the task asks the participant to find stressful sounds for them during the work, and then record it through audio or video on WhatsApp and send it with explanations to the official WhatsApp account from Critical Alarms Lab. The second day focused on the stressful moment during the day. Participants need to find what the stressful behavior he/she experienced and describe the situation, scenario, and sound they heard. Then, same as the mission on days 1&2, the topic of days 3 and day 4 is relaxing, and the topic of days 5 and 6 is playful/joyful. Again, hunt sounds first, then the other day is for behaviors. The difference is that the participant can hunt playful/joyful sounds and behaviors both during work and after work.

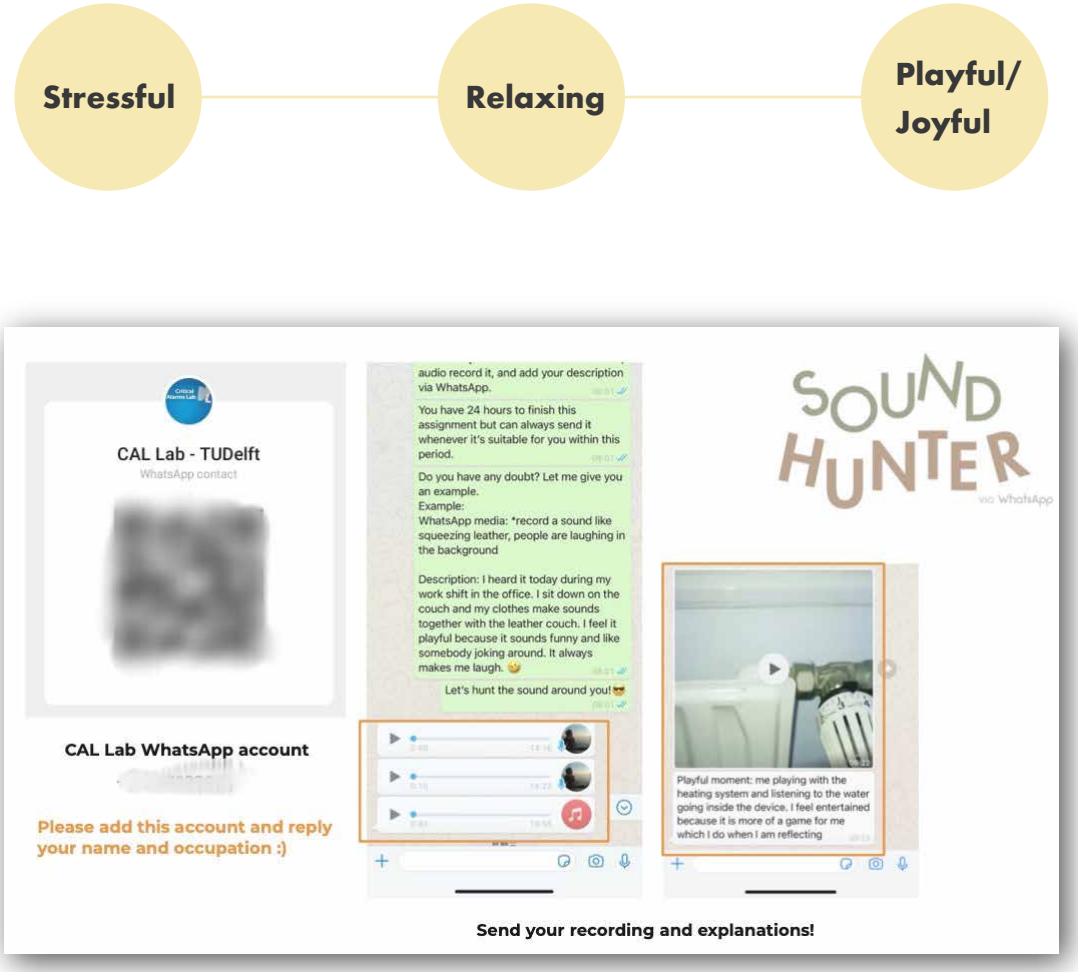


Figure 7. Some instructions for participants, more can be seen in Appendix

Main Results

In total, we had 11 participants. The research results were acceptable yet not fully complete. Some people misunderstood the assignment the first day, but after the explanations, they successfully finished the assignment. In the coming days after, sometimes they do the assignments, sometimes don't. This was mainly due to the Dutch public holidays experienced during the event, and the participants did not give details of the specific time when they could participate in the event. This cannot be perfectly controlled by the researcher, which leads to incomplete research data in the end. Above all, the data collection results can be found in the Appendix. Although the online data gathering process has a lot of limitations, it still shows a lot of interesting conclusions for the further design inspirations.

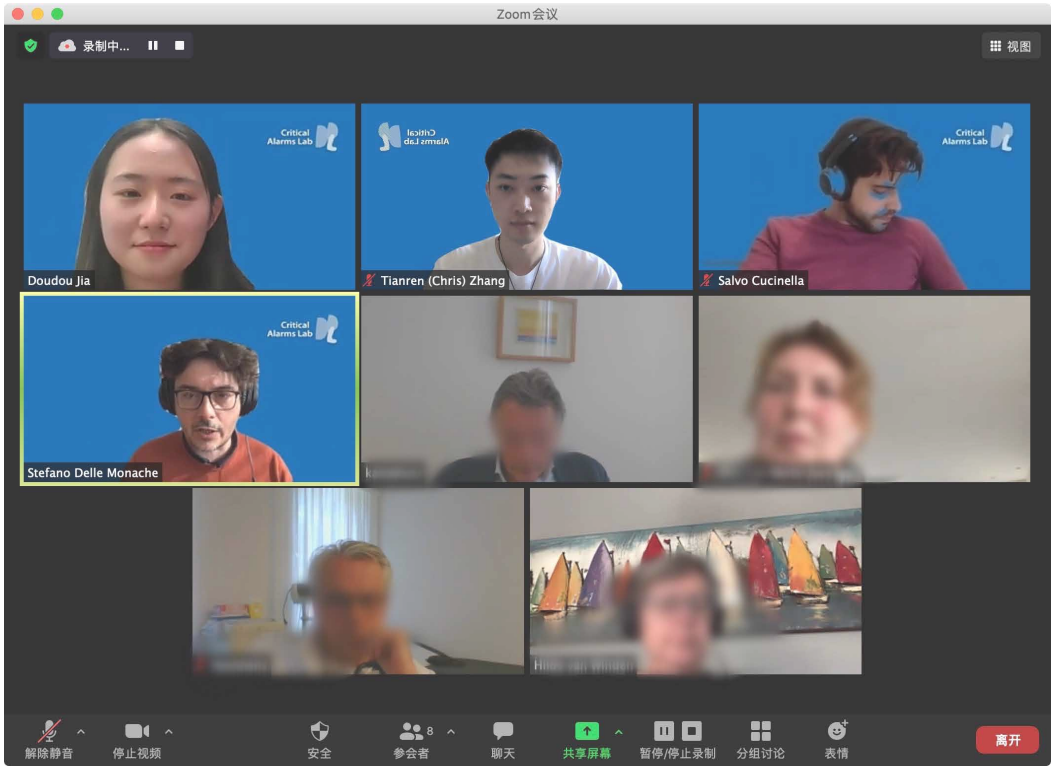


Figure 8. Zoom workshop, CAL team and RdGG hopital workers.

Context Mapping Conclusions:

– *Stressful feelings are always related to personal experiences but have an overwhelming mood in common.*

The hospital workers do have a lot of tasks to finish daily, especially nurses. They follow the schedule extremly strictly and easily get the overwhelming mood. This affects their mental, auditory, visual, etc.

– *Nurses do feel stressed during work, but they've already got used to it.*

During the discussion and sharing section in the workshop, nurses introduced that the wards are always busy in the morning and cause a lot of noise. Meanwhile, they do experience stresses in the morning. But they believe that they've already got used to the high-pressure environment and workload. Therefore, one possibility might be to raise awareness of personal mental well-being.

– *Sound is not always for one group of people, it will affect other people.*

Although the aim of the whole project is to help nurses to reduce stress and regulate a positive working attitude, the effect on patients cannot be ignored. One person stated that alarms in the ward for patients are annoying, but sometimes listening to nurses talking is relaxing, even not paying attention to details. The emotions that are conveyed through the nurse's talking will affect the patient's mood too. So considering the relationship between nurses and other stakeholders, the context of using the final solution is crucial in the analysis.

– *Nurses don't want to hear sounds similar to the working environment.*

Due to the familiarity of the everyday working context, the nurses can easily recognize the ward sounds and nearby. Sounds evoke people's memories in the specific scenario. In their spare time, people are unquestionably unwilling to hear sounds similar to the sounds in their stressful working environment.

– *Uncontrollable and unpredictable sounds increase the feeling of stress.*

Random sounds made the soundscape of normal work lose order and structure. Disorder uncontrollable sounds affect regular work and make people feel restless.

– *Relaxing sound means silence with a slight background white noise for them.*

Due to the overload from hospital work, relaxing sounds for them are slight background white noise, for instance talking, wind, and bird sounds. But the overall feeling of the soundscape should be silent.

– *People tend to do tasks that are simple/easy to handle for relaxation.*

The job in the hospital has a certain degree of difficulty, and medical staff need to use their professional skills to challenge one task after another. Therefore, in leisure time, the method used for leisure needs to be simple enough to utilize.

– *The difference between relaxation and joy is that joyful feeling often evokes related memories through behavior and interaction.*

From the research results, relaxing moments or behaviors for them were basically things that they don't see, use or hear during work. But in a higher emotional state - joy - they can tell a whole scenario or story from it.

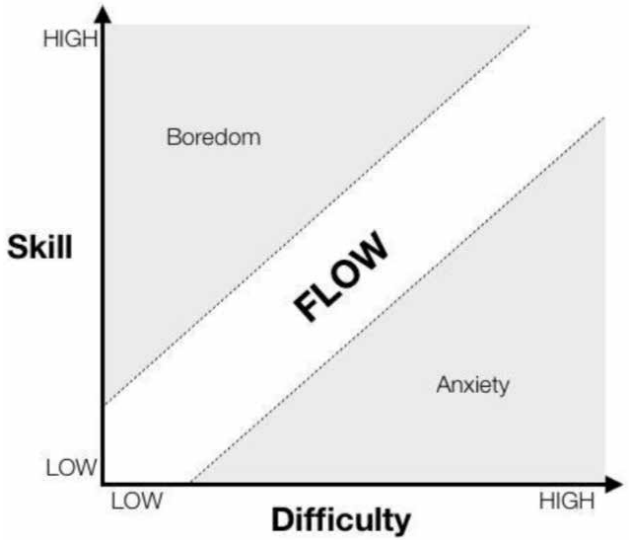


Figure 9. **Flow state theory[16]. Balance difficulty and simplicity of the task.**

2.3 Conclusions of this Chapter

In this chapter, literature research and user research were conducted to understand the basic background knowledge about reducing pressure, music and sound for relaxation, and user perspective about sonic awareness, soundscape situation in the hospital, etc. To conclude all the research insights, here the researcher uses several charts and figures to recap.

Stressors from Nurse

The stressors that nurses need to balance daily in the hospital can be classified into 3 perspectives, Personal issue, Responsibility from Work, and Working Structure. The personal issue contains the nurse's personality and personal experiences. Sometimes personal health, preferences and inadequate preparation will also affect the attitude towards daily work. From the Responsibility from Work perspective, as nurses always need to follow the treatment instruction from the head nurse and physicians, sometimes they may feel uncertain about the order. Facing different types of patients and treatments, the workload will obviously increase the working stress of nurses. However, during the treatment or walkaround inspection in the ward, the patient's emotional and physical reaction will indirectly change the nurse's mood. Ethical consideration plays an important role in both the Personal Issue and Responsibility from Work perspectives. Working Structure is more external factors, such as unequal information sharing between other colleagues, lack of support, or other issues.

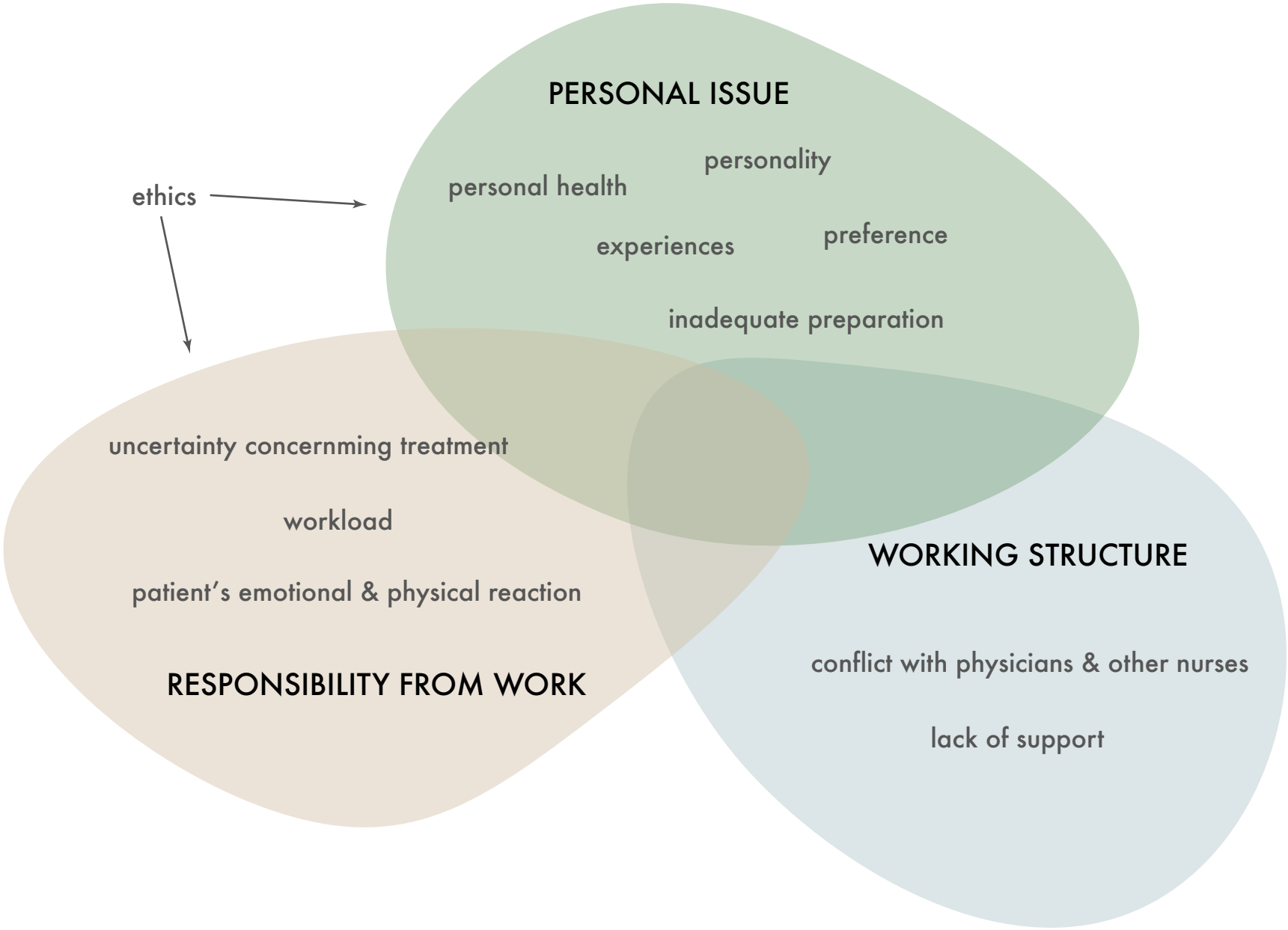
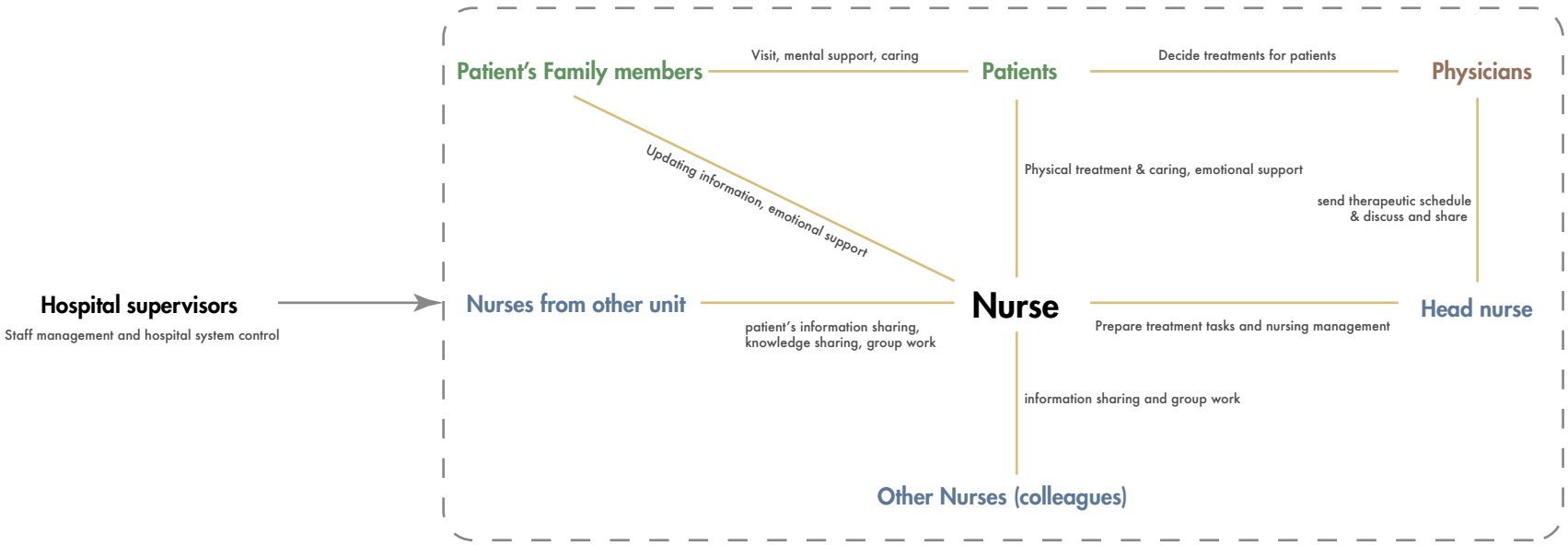


Figure 10. Research Analysis - Stressors from Nurse



Stakeholder Map

In the Stakeholders Map, nurses play a central role in dealing with everyday treatment work. They need to prepare treatment tasks and nursing management from the head nurses after getting the therapeutic schedule from physicians. Then, they need to share information about the patient's physical changes to their colleagues, therefore, continuing the teamwork. Moreover, nurses need to keep in touch with nurses from other units and share essential data with them and solve problems together quite often. As for patients' perspectives, nurses provide physical treatment, caring, and emotional support. At the same time, they need to give patient's family members appropriate information and therefore regulate their moods.

Figure 11. Research Analysis - Stakeholders Map

Nurse's problem definition -
Charteristics of Nurses in the design context

Main Pain-points:

- Concentrate on the patient, treatment plan, data monitoring, teamwork, etc., feeling tired but unable to change.
- Nurses have a tight schedule, only have limited time to take a break.
- Too sensitive to the soundscape of the hospital environment.
- Don't want to hear sounds similar to the working environment when having a rest.
- The stressful reality for them is from personal issues, working structure, and the responsibility from work 3 perspectives.
- Already receive too much information from the auditory sense in the ward.

Main Needs:

- A temporary opportunity to "escape" from reality.
- Relaxation for both physically & mentally.
- Experience something new, interesting rather than things similar to the environment in the hospital.
- Emotional support during the work, rather than only following, obeying, executing.

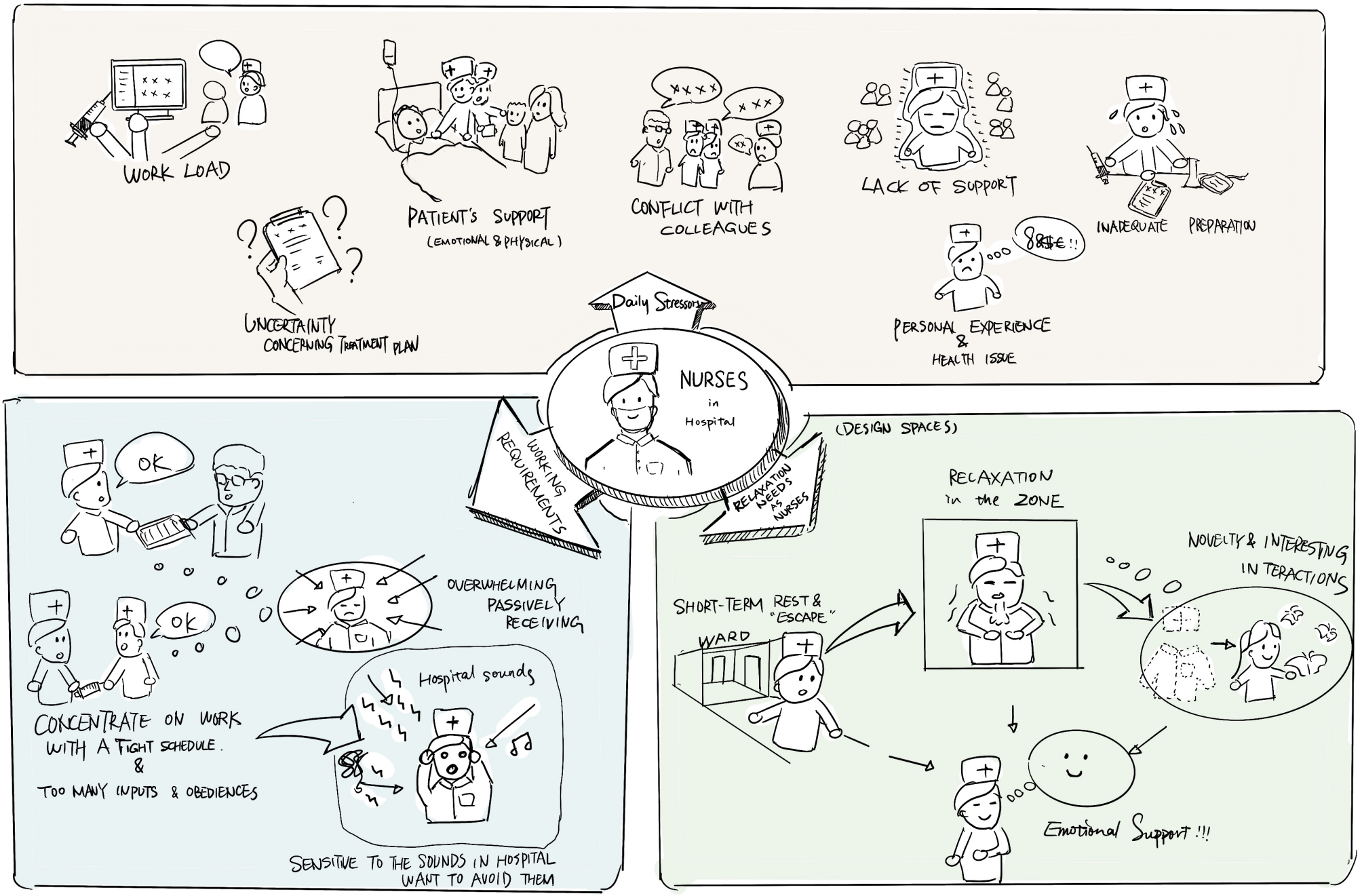


Figure 12. Research Analysis - Charteristics of Nurses in the design context

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3. Concept Development

In this chapter, a design vision and design goals are concluded through the research phase of the design process. Following with ideation, the researcher introduced 3 different design solutions. Then with the considerations on previous design definitions, the researchr synthesized the concepts and introduced a final design direction.

3.1 Design Vision & Goals

Design Vision:

Introduce a joyful product experience in which nurses can actively interact/create sonic stories, in order to give them a short-term engaging relaxation moment.

Figure 13. Joyful relaxation experience. Credits: woman's day WESTEND61

Design Goals:

Fun Experience

The overall experience is full of fun and interesting elements.

Sonic Stories

Create sonic stories that show the bright side of the world in order to arouse curiosity, therefore mentally away from the stress.

Actively interact/create:

Nurses can use the elements and mix in a settled system but can feel the freedom of control and interaction.

Short-term relaxation

Using the product-service solution can help them go inside of the world that relaxes both mentally and physically within a short period of time and won't affect their normal work.

3.2 Ideation

At the beginning of this phase, the researcher introduced the design vision and goals in the design solution. The ideation process was starting from these goals and some important research insights. Here I used methods for brainstorming, visual mind-map, and How-tos (How Might We). Then clustered ideas and used WWWH to make them into preliminary design concepts.

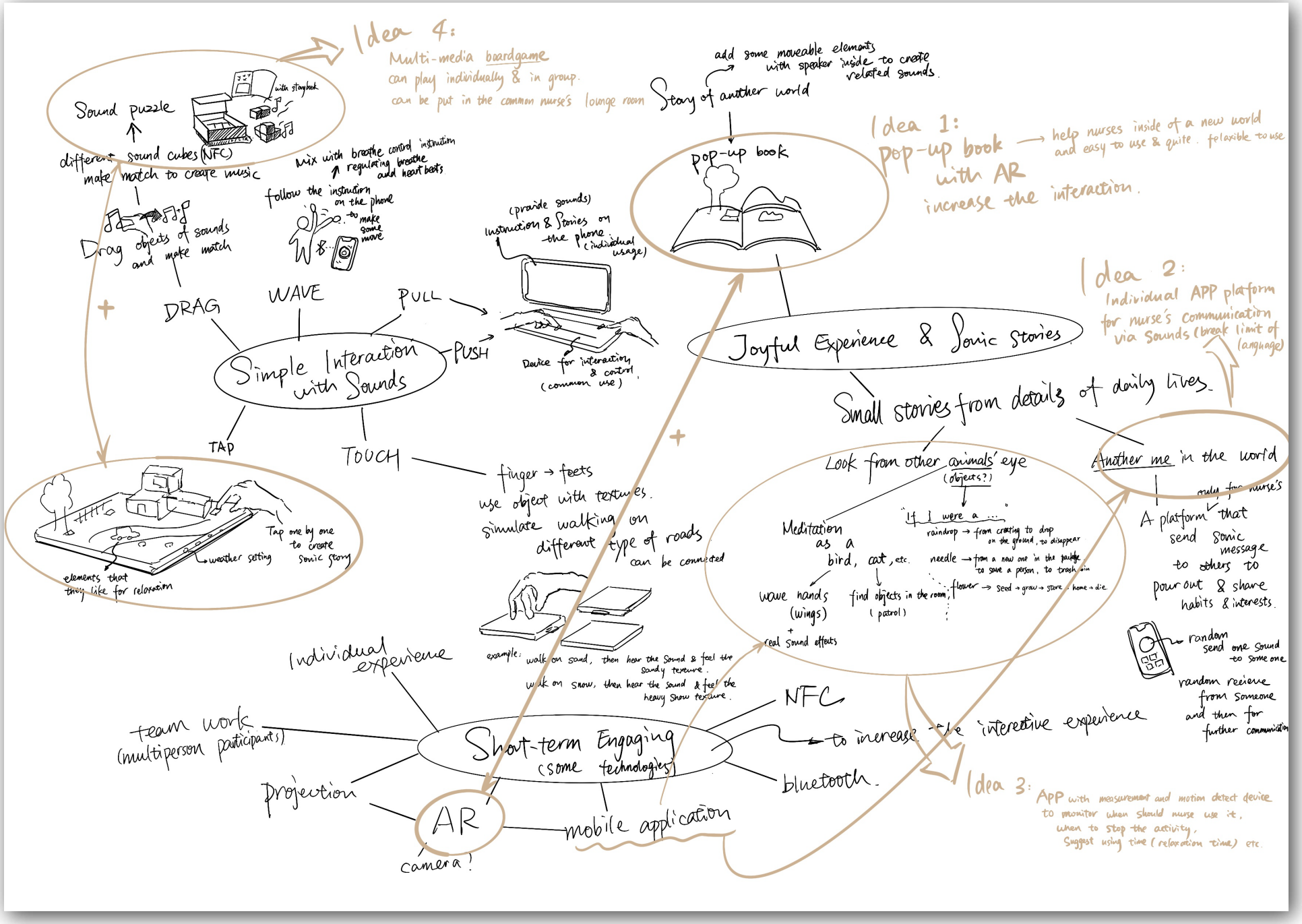


Figure 14. Brainstorming - Visual Mind-Map

3.1 Brainstorming

The three main starting points of the brainstorming are interactions, short-term engaging technologies, joyful experience and sonic stories. By listing solutions layer by layer, and keep asking questions about:

- How to (might we) blend music interaction in a design solution naturally?
- How to (might we) provide Unity & Order in the design?
- How to (might we) provide short-term relaxation?
- How to (might we) provide a joyful experience?
- How to (might we) reduce complexity in the design solution?
- How to (might we) make the design suit the needs of nurses?

Small sketches in the brainstorming visual mind-map are some preliminary ideas. Then with further thinking, ideas are presented with golden circles and text explanations.

3.2 Concept Development

By comparing and combining ideas, in this concept development section, the researcher introduced 3 different design concepts. Each concept is presented by visuals and detailed explanation by method WWWH (What, When, Where, How) with sound/music in the concept, concept benefits, and concept challenges.

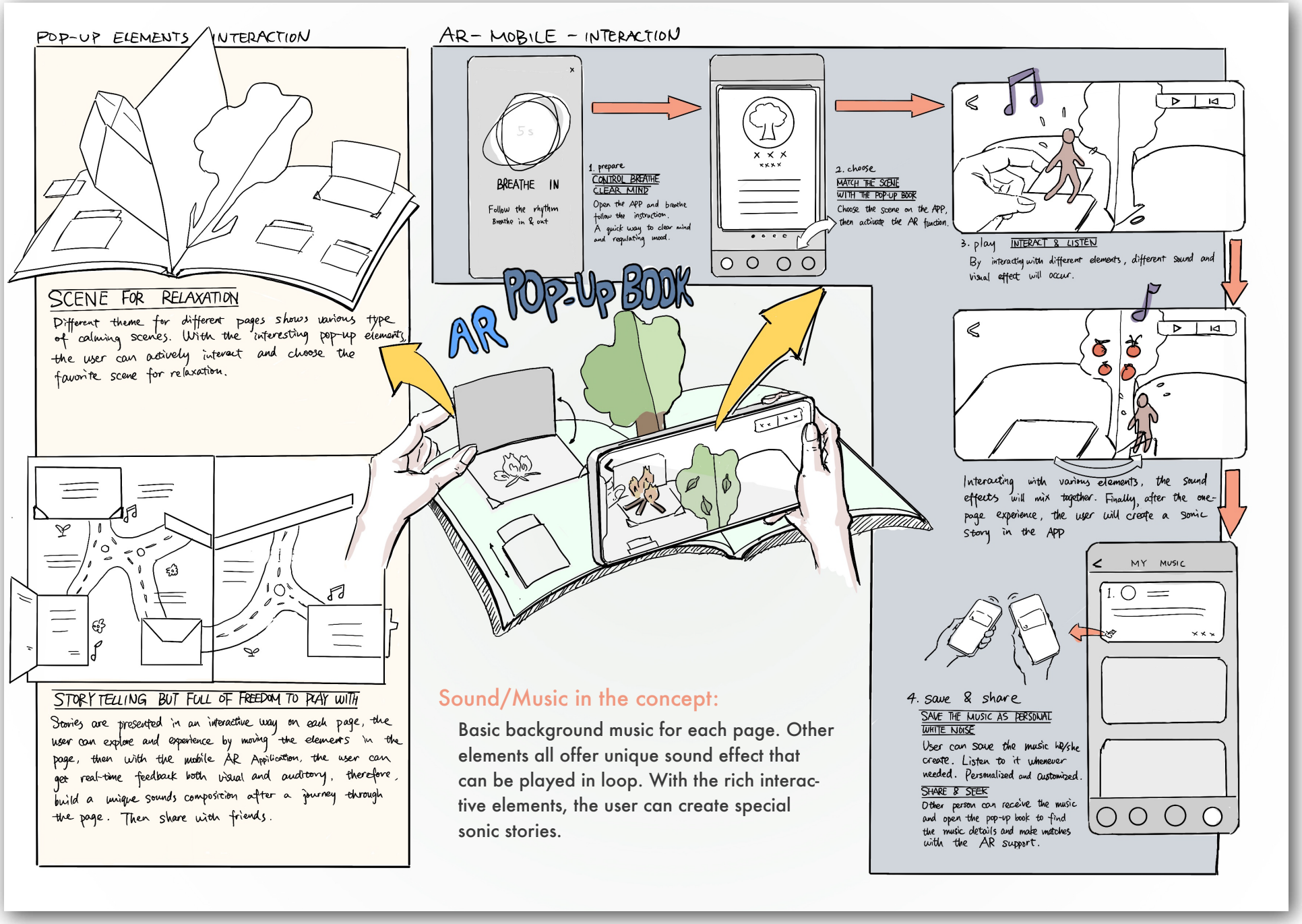


Figure 15. Preliminary design concept 1

3.2.1 Preliminary Design Concept 1

What?

A Pop-up book with interactive elements on each page. Cooperate with a mobile software AR function to realize an increased experience of reality, and provide engaging sonic interaction.

When?

Although nurses need group work at most of the working time, they are not available for a rest at the same time. So the concept introduces a method that they can both play with individually or multiple people.
Whenever they want to have a rest during the working hours or after the preparation of the work shift, they can use the product service to release the working pressure and regulate the stressful mood.

Benefits?

1. Feasible for hospitals and users to use. Don't need a big investment, but benefit for all hospital workers.
2. AR technology increases the experience of the short-term engagement with sound and music.
3. Sound and music play a role of clue in the product service, users can both enjoy creating sonic stories or solve other people's sonic puzzles.

Challenges

1. Theme decision, and pop-up elements design.
2. Music and sound selection.
3. AR technology implementation in the concept.

Where?

The pop-up book will be put in the common room for nurses to have rest. (Lounge room/office) The mobile APP will be installed individually on each nurses' smartphone.

How?

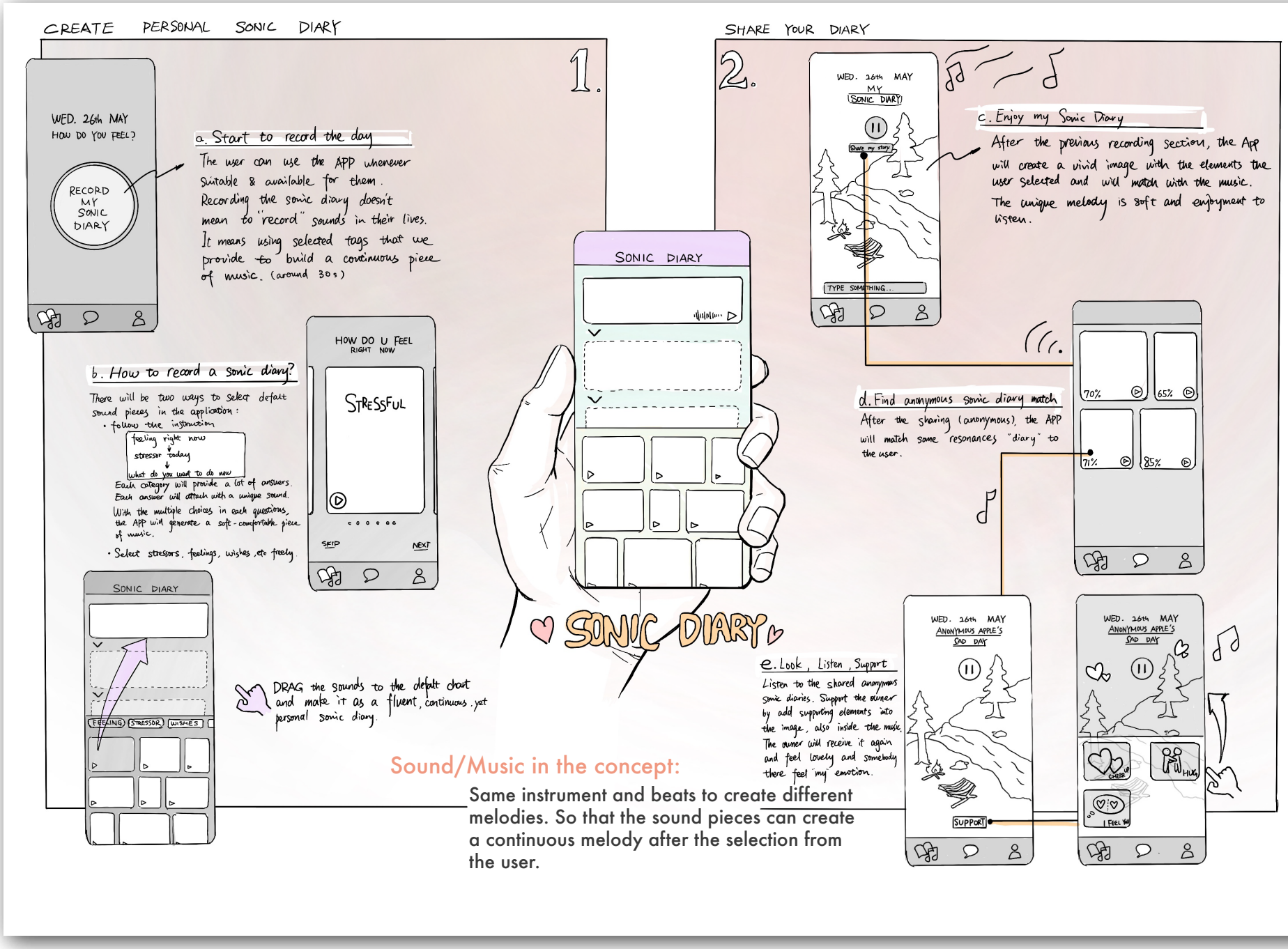
The product service has two parts, a pop-up book, and a mobile application. For nurse's leisure time during the day, they can quickly leaf through the pop-up book pages in the common room, also can enjoy a more engaging sonic experience and social game through the APP.

Pop-up book:
Each page will offer a theme, for instance, flower hunting in spring, summer beach vacation, hiking in autumn, snowy winter town, etc. For the different scenes which provide a feeling of good memories in seasons, the nurse can leaf the page he/she like and interact with the pop-up elements, including the action of folding, pulling, rotating, moving, opening, etc.

Mobile AR APP:
AR-Play with the pop-up book: Open the APP and choose the same theme that provides in the pop-up book, then the user can hold the phone and watch the pop-up book in an AR environment. By interacting with different props, it will provide different curative and peaceful sounds to match.

Music that I create:
After around 3 minutes journey in the pop-up book page and the APP, they will create a sonic story and save it on the phone. The user can replay the music anytime as normal meditation music, as well as share it with colleagues.

AR-Seek the sound:
With the music that other colleagues shared, the user can use the music as a base to seek the pop-up elements in the book to solve this as a sonic puzzle.



Sound/Music in the concept:

Same instrument and beats to create different melodies. So that the sound pieces can create a continuous melody after the selection from the user.

Figure 16. Preliminary design concept 2

3.2.2 Preliminary Design Concept 2

What?

A mobile phone application that help user to record the day with simple characters, and create a sonic diary as a way to save or share anonymously. Through the pour out with sounds and anonymous support to regulating nurse's mood and pressure.

When?

Every after some unpleasant events, the mood will have some changes. Pouring out to someone will be a good way to release the pressure. But due to the specification character of nurse's work, pouring out to someone requests more factors. Then using this mobile application will help them to record and share in private. It's also able to be used after work just as a normal documenting diary APP.

Benefits?

1. More suitable as a concept for real-life situations and potential in the market.
2. Simple and easy to accept and use.
3. Meeting the needs of nurses to release pressure in a private zone, but can also get emotional support with anonymous sonic message.
4. Guarantee the privacy issue. Anonymous sharing only sounds, and get message back only sounds.
5. Can be implement globally with hospitals. Create a community of hospital workers platform.

Challenges

1. Music and sound in the concept
2. Some researches about the function of anonymous (privacy issue), random matching solution (AI) and implementing risks.

Where?

The APP will be installed individually on nurses' smartphones.

How?

This digital product service has 3 major functions: Record my diary, Check the match, Review my sonic diaries.

Record my diary:
There are two ways to record the diary: following the instructions step by step, and free documenting. The step-by-step choice will be from the feeling of the day, my stressors to what I wish for now, etc. Each category will allow the user to choose several words, which link to some default melodies. Therefore, after around 2 minutes of documenting, the user will get around 30 seconds of music as a sonic diary, with an image matched with some element user selected. Users can choose to share the diary anonymously or save it privately and add more text to explain the day/event.

Check the match:
The step-by-step documented process is like a questionnaire test. After the 'test', the user can get matches that other users choose to publish anonymously. The user can listen to the sonic diary and send him/her support. The support will polish the music to a more joyful version. The other people can receive it again. This creates a feeling of companion and peace of mind.

Review my sonic diaries:
Since every sonic diary is unique and introduces a different daily story and mood, the user can check the history diaries anytime and listen. Users can see anonymous people's support and compare what has changed before and after. The music itself is good for meditation with soft and enjoyable effects.

Main feature 1: Play the sonic puzzle with default music

APP provide a complex daily soundscape – — – The daily scenario soundscape is like a song.

Use NFC card to find each elements in the soundscape – — – NFC cards are like each instrument.

Main feature 2: Play the sonic puzzle with other people's personalized music

Use all the NFC cards to generate a sonic scenario

Let other user to solve the sonic puzzle.

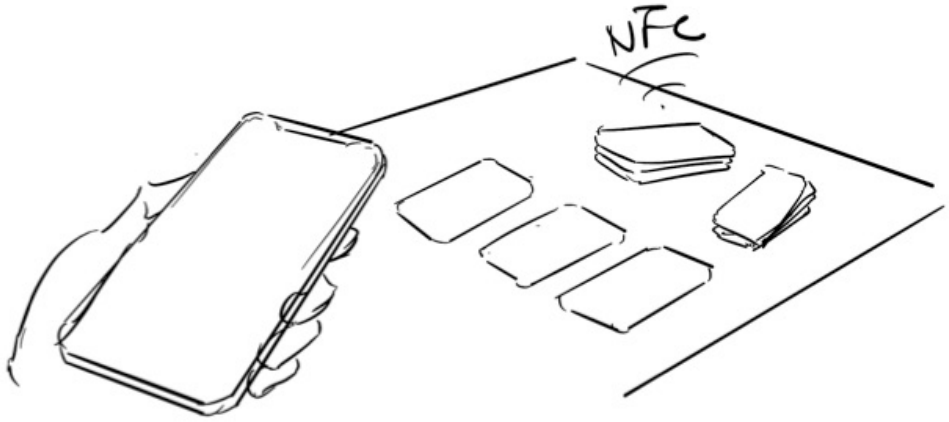


Figure 17. Preliminary design concept 3

3.2.3 Preliminary Design Concept 3

What?

Mobile phone application with physical NFC cards. The NFC cards present different detailed sounds from everyday life. The gamified experience allows nurses to mix sounds by selecting cards and send another nurse to guess during their personal work break. Leave a clue, and guess.

When?

This product experience can be played during the nurse's working break in the office. The nurse can find other people's sound and guess the element by scanning NFC cards on the phone to make matches, but also can mix a sound with the NFC cards and leave it to let colleagues guess.

Benefits?

1. Product cooperate with digital service. Rich interactive experi-ence.
2. Raise the awareness of soundscape.
3. Increase the communication between colleagues, but still have personal time to play.
4. NFC cards are easy to handle and accept, won't add burden to a hospital lounge room scenario.

Challenges

1. Music and sound for each NFC cards
2. Coding for NFC cards and programming for the music mix, and NFC implementation.

Where?

The APP will be installed individually on nurses' smartphones. The NFC cards can be put in the common office.

How?

This NFC-smartphone application product has 2 major functions: Daily sonic puzzle, Puzzling with colleagues.

Daily sonic puzzle:
In the app, there will be a given library with a lot of completed soundscapes made by NFC card sound effects. During a work break, the nurse can open the APP and check the daily sonic puzzle, listen carefully, then guess the elements inside. The soundscapes will be calming, relaxing theme music mix. By listening to these types of sound mix carefully, or ever multiple times, the nurse's mood can be automatically affected. Then browsing NFC cards to make sound detail matches.

Puzzling with colleagues:
Since the NFC cards will be put in the common office room for all nurses, but the nurse's working break might differ due to different types of patients and tasks, it will still connect them via sound and cards. Nurse A can create a music mix by selecting cards and scan them on the phone during the break, then shuffle the cards, and send the mix to the colleagues. Nurse B gets the music mix from A, then opens it during his/her personal work break, and solves the puzzle as a leisure activity.

3.3 Synthesis of Ideation - Final Design Direction

The divergence and convergence of the above design ideation produced three distinct designs solutions, including physical products and digital mobile software. Before starting the concept selection process, the designer had a meeting with the project supervisory team to discuss the pros and cons of my solution proposal. Analyzed each concept from the perspective of the design interactive, music-driven experience, and estimated user usage scenario.

In the first solution, the interaction of the pop-up book itself can bring an immersive story experience, and the audio interaction provided on the mobile phone has the opportunity to greatly enhance the user experience. The interactive elements in the pop-up book and audio on the phone can be used as a way to control the user's using time. However, the physical interactive product of the pop-up book lacks its own long-term usability, the limited pages and limited interaction, this type of design is not suitable for the introduction of office equipment in hospitals.

In the second solution, a special musical instrument is introduced, using emotional keywords as rhythms. Users fill in their keywords by recalling their daily experiences, in other words, arrange rhythm to music and share with others anonymously to gain emotional support. This form can ensure the unity and order of the music itself, which also means that it can be comfortable and relaxing when the melody is first written, and avoid the chaotic of different melodies. The interactive form is also worthy of reference, tapping and dragging elements on the mobile phone. This also satisfies the nurse's short break without the need to introduce other equipment to assist in the office room, and it can be done simply with a personal smartphone. The biggest problem with this concept is it requires nurses to recall their day, which may evoke unpleasant experiences again. Especially if they went through a painful and exhausting day, recalling the stressors again is an inappropriate form of interaction.

As for the third concept, after the previous workshop's verification, users are interested in guessing the sound source or action. In the meeting, the team provide sounds that are common in daily life. Nurses and doctors are very curious and active to guess what scenes or objects are there. Even after a few rounds, they can begin to guess the material of the item. This similar search-verify audio interaction method makes it easier to interact with nurses. However, physical sound cards still pose challenges for long-term use.

Combining the advantages and disadvantages of the above analysis, also the design vision and goals, the project team finally determined a comprehensive design plan.

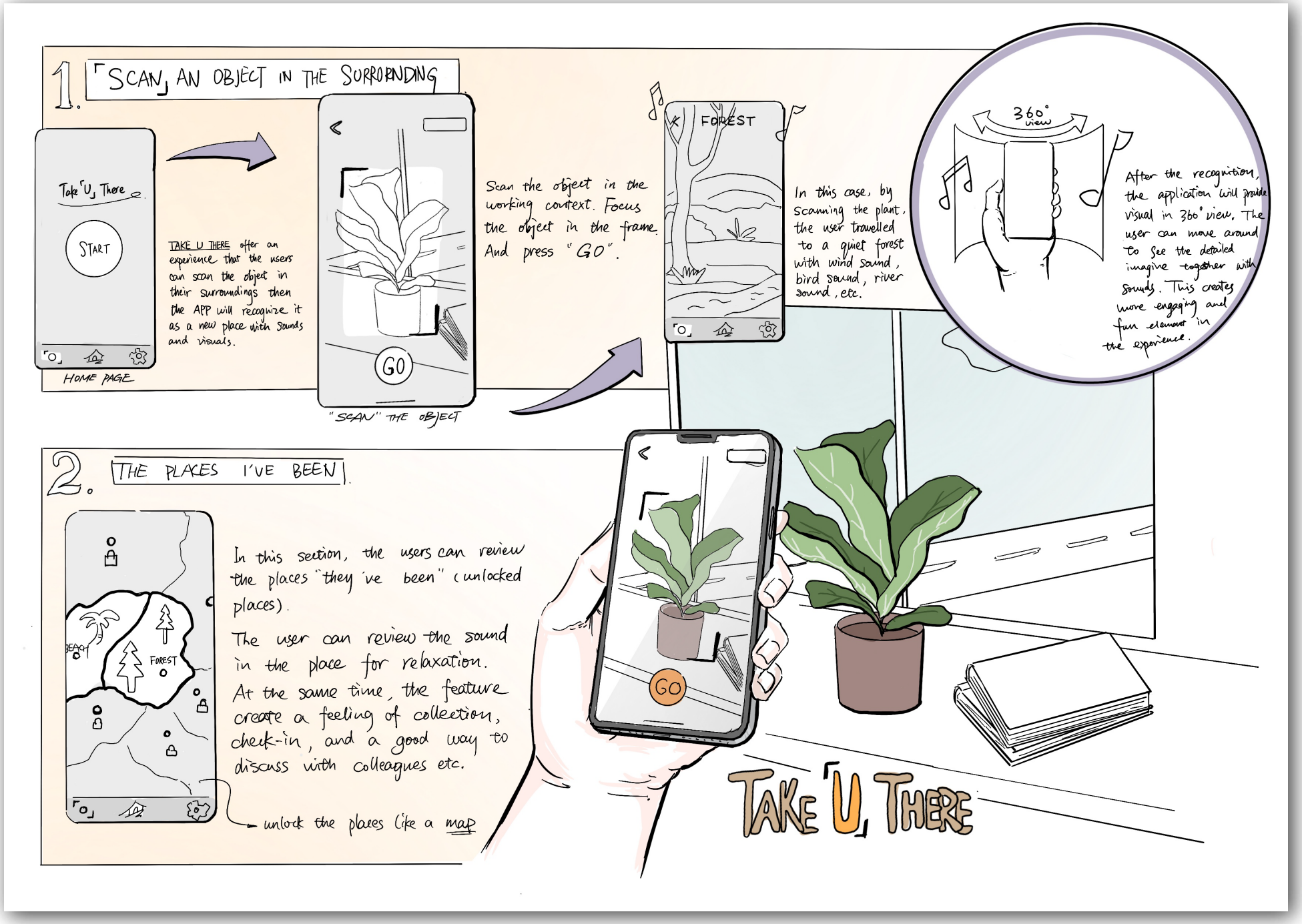


Figure 18. Final design direction

Final Design Direction:

The final concept can be seen in the figure 18. This is a mobile application that uses the camera to recognize the objects around the user, so that it can bring them into a new environment by using specific scenario sounds and visuals. Nurses can experience it during the working break in the office.

This digital product service has 2 major functions: "Take me there" and "My footprint".

"Take me there" - scan object in the surroundings:

The main feature of this digital product is scanning objects in the surroundings, the machine learning system will recognize it, then provide scenario sound and visuals, therefore creating a utopia-like feeling and away from the stressful reality for users. With the immersive various effects, the user can go inside of the new reality created by themselves and have a short-term mental recovery. After the scanning, the user can enjoy being in the new environment with the visuals and music. The visual will offer a 360-degree view, so that users can hold the phone and look around, really commit themselves to this fun sonic-visual experience.

"My footprint" - review the scenarios:

After the user scans objects around, they will collect the 'places where they've been to in the My footprint section in the application. Users can review the sound of the specific places anytime here as relaxation background music, and share the place collection with colleagues. The experience of unlocking new places and exploring will create a feeling of control and novelty.

Reflect the concept on the design vision

Reflecting on the design vision, the function of scanning then occurs visuals and sounds that actively interact and create sonic stories. The "footprint" function helps users to review the utopia-like place anytime for relaxation. For the fun experience, the user can enjoy the process of exploring stories behind objects and unlocking places in the imaginary world. The overall experience is quick and easy, which suits the needs of nurse's short-term relaxation. The engaging goal can be achieved through immersive sound with visuals and 360-degree interaction. The detailed elements will be designed further.

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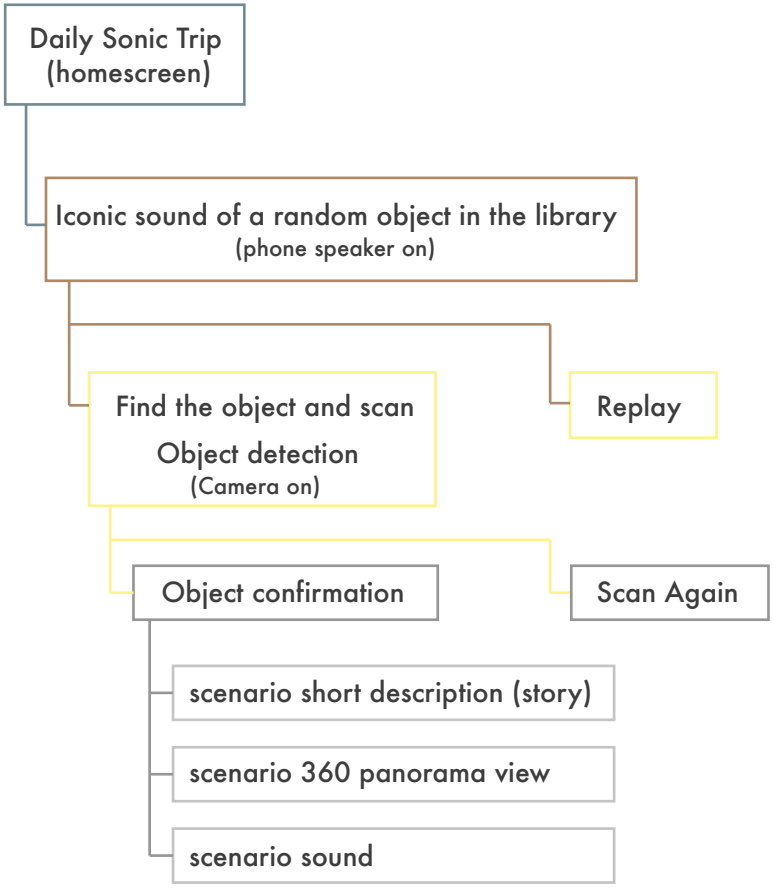
4. Technology Analysis

In this chapter, key technologies in the final concept are presented by introducing an information architecture. Followed with technical theory and requirements, small experiments are shown in the chapter.

4.1 Product System Logic



From the final concept, going deeper on the whole interactive experience, I illustrated the product system logic behind it and made it a software information architecture.

The Daily Sonic Trip will be the homepage for the whole APP. A big library will support the function here. Daily Sonic Trip will call data randomly in the library to show the user a detailed sound effect from an office object. The nurse will listen to it and match objects around in the office. With the camera on, the AI algorithm will recognize it and distinguish whether this is the right object to be scanned in the back-end. If the system can highly confirm what the object is, it will pop a scenario confirmation and directly show a 360-degree panorama view in a few seconds. The user can enjoy the immersive view and sound for short relaxation. However, sometimes due to a messy camera background or multiple objects situation, etc., there must be some unsuccessful recognition issues. Rather than showing “error” or “cannot recognize” or “scan again” information, the system will match a similar object in the back-end and show confirmation with a guessing tone in the front-end. This error state also gives the user some fun and surprising experience of using the APP.

Figure 19. **Information Architecture part 1 - Daily sonic trip**

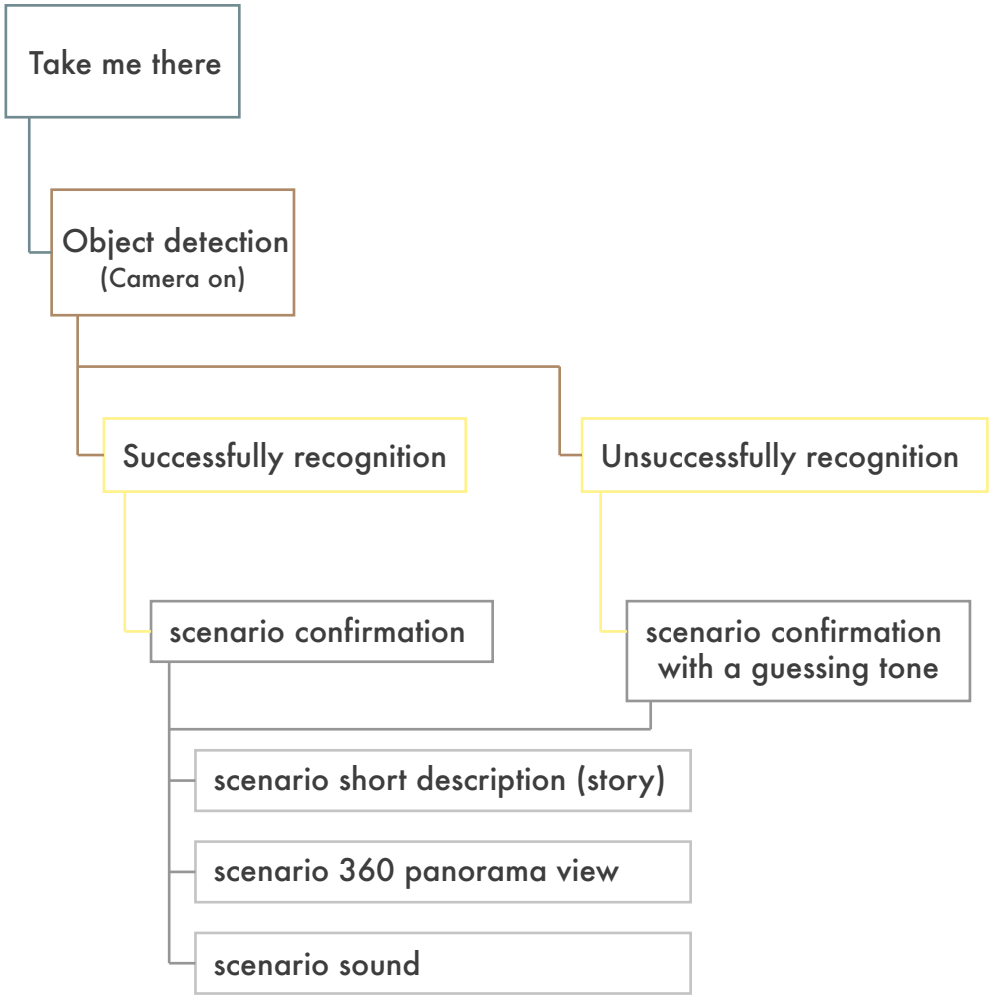
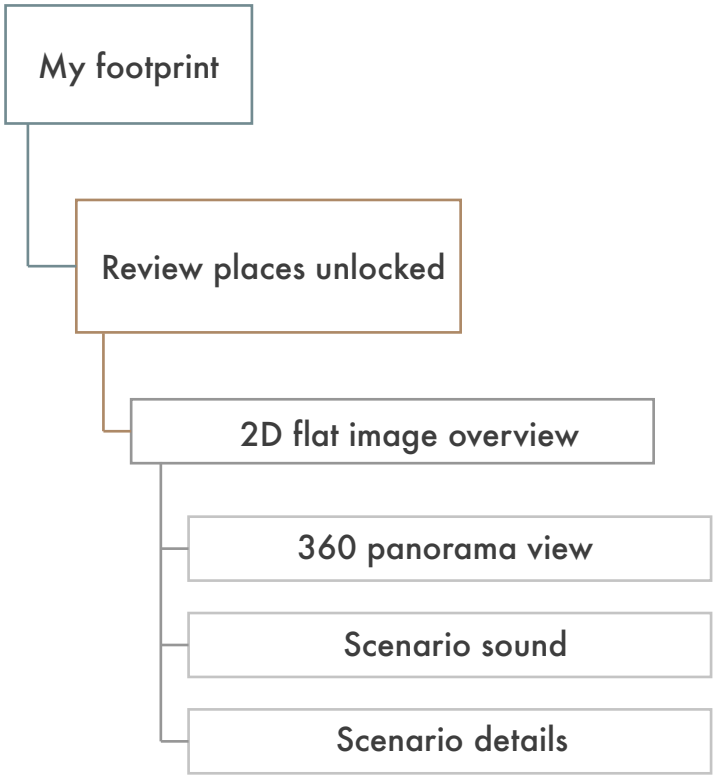


Figure 20. Information Architecture part 2 - Take Me There

On the Take Me There page, users can directly have access to the object detection part. Different from a daily mission controlled by the system in the Daily Sonic Trip section, the Take Me There section provides an experience of a user looking for a random object in the hospital office room and scanning it. They can have the freedom to 'go' places they want. It also requires object detection and shows panorama visuals with scenario background music to create relaxation.



On the My Footprint page, the user will see a map that shows places unlocked and hidden places. Places unlocked stand for objects that the user has already scanned. Users can see the 2D overview of the scenario, and the back-end shows again the visual and audio files to the user. The user can enjoy the panorama scene again with sounds. Hidden places are scenarios that the user didn't find yet, which means the user didn't scan the specific object in the office. Users can get some puzzling tips from it.

Figure 21. **Information Architecture part 3 - My footprint**

4.2 Key Technologies in the Design

Based on the final concept and key features, the main technologies are all computer and software engineering technologies, including Machine Learning - Object Detection, and Panorama View on mobile devices.

Machine Learning - Object recognition and detection

Technology Definition:

Machine learning (ML) is the study of computer algorithms that improve automatically through experience and by the use of data. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, speech recognition, and computer vision, etc. [17]

Object recognition and detection are two applications of it. It is related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class, such as cars, humans, animals, buildings, etc. This technology is widely used in a lot of daily scenarios, for example on traffic monitoring systems, football matches, and mobile internet business domains, like face, unlock, etc.

Object recognizing theory:

Every object has its own uniqueness of appearance, including size, length, shape, color. So there are different methods to achieve recognizing one object. Usually, achieving object detection mainly contains three steps: image classification, object localization, and object detection.

The software engineer will make the difference between objects in order to build a library of object classification, then by uploading images to “train” the model. This step is to predict the type or class of an object in an image and often use the image with a single object to train. Then locate the presence of objects in an image and indicate their location with a bounding box. Finally, locate the presence of objects with a bounding box and types or classes of the located objects in an image. The Mask Region-based Convolutional Neural Network, or Mask R-CNN, model is one of the state-of-the-art approaches for object recognition tasks. Other popular models are YOLO, MobileNet, SquezzeDet, SSD, etc. [18]

360° Panorama View

Technology Definition:

360° panorama picture is one of the applications of virtual reality. Normally, people believe VR is only available in specific high-tech devices, VR glasses. But a 360° panorama offers an opportunity to let users enjoy a virtual environment on any device, for example, smartphones, laptops, tablets. With the development of technology, there are 360° panorama videos to provide an immersive experience. Users can open the specific software and move the mobile device to explore the 360° details of the video and really engage in the virtual environment. Moreover, panorama pictures are in a similar way but providing static images. I assume that this helps in the final concept of short time commitment and play and exit stories at any time. Although this requires further user testing in the next phase.

Research (Anderson et al. 2013) [19] which used VR devices tested with participants proved that exposure to 360° natural environments can lower anxiety levels and thus induce relaxation in the participants. Other research also (Eleonora et al. 2020) [20] hints that the experimental evidence that a 360° real panorama VE(virtual environment) may be equally efficient to a computer-simulated environment in generating a sense of presence, anxiety reduction, and improving emotional states.

4.3 Technology Experiments

In order to better understand the 2 main technologies and structure the design requirements with them, the researcher conducted 2 small experiments. The testings are only for experience and design purposes from the function perspective. The overall experience testing will be conducted after the combination of visuals, sounds, and user interfaces.

As in the final concept, the experience is scanning objects and get results, real-time continuous detection is not necessary. So 2 sets of codes were prepared in the experiments, to simulate the camera on detection and static picture detection.

Materials:
Laptop front camera, P5 web editor with object recognition training model.

Purpose:
Test the basic feasibility of the function, and find out what detailed elements should be applied in the final concept as technical requirements.

Testing code & programming setting:

p5-webcam object recognition:
https://editor.p5js.org/TianrenZhang/sketches/WUlkp-ioT

p5-image recognition:
https://editor.p5js.org/TianrenZhang/sketches/ckYJs5Q-p

The coding requires a pre-trained model which has a big database of different objects as the starting point. Here I chose ml5js model [18] to continue.

Testing code & programming setting:

1. Find 5-10 office objects and run the programme on P5js.

2. Place the object in front of the camera (or upload an image with a single object) and check whether the results are right.

3. Place multiple objects in front of the camera (or upload images with multiple objects overlapping) and check the recognition results.

The final concept requires one-object detection, which means no matter how many objects in the picture(in front of the camera), the system will only recognize one major object. The experiement also simulate this experience using laptop webcam.

Results:

In the testing, the researcher selected 6 normal daily objects as the recognition target objects, small plants, bottled water, cup, cash, phone, glasses. The main thing that the researcher needs to verify is whether the ml5js, as the most popular object detection database, is suitable for this design context by checking the testing results.

After placing a different object in front of the camera, also with multiple objects situation, it's certainly conspicuous that the recognition is extremely accurate, and presents the detection results by framing the object and name it on the top-left corner. When placing plant in front of the camera, it shows the name as 'potted plant' rather than just plant or small plant. When placing glasses in front of the camera, it shows the name 'sun glasses'. The name results are coherent in the context of only recognize it in the system. As in the final design, recognition is only the first process, one factor that cannot be ignored is that a different name may link to a diverse type of music and scenario visual.

Put a single object wherever the location in front of the camera can be easily detected properly. But with multiple objects with angle differences, the accuracy is not greatly acceptable. The static image situation is the same.

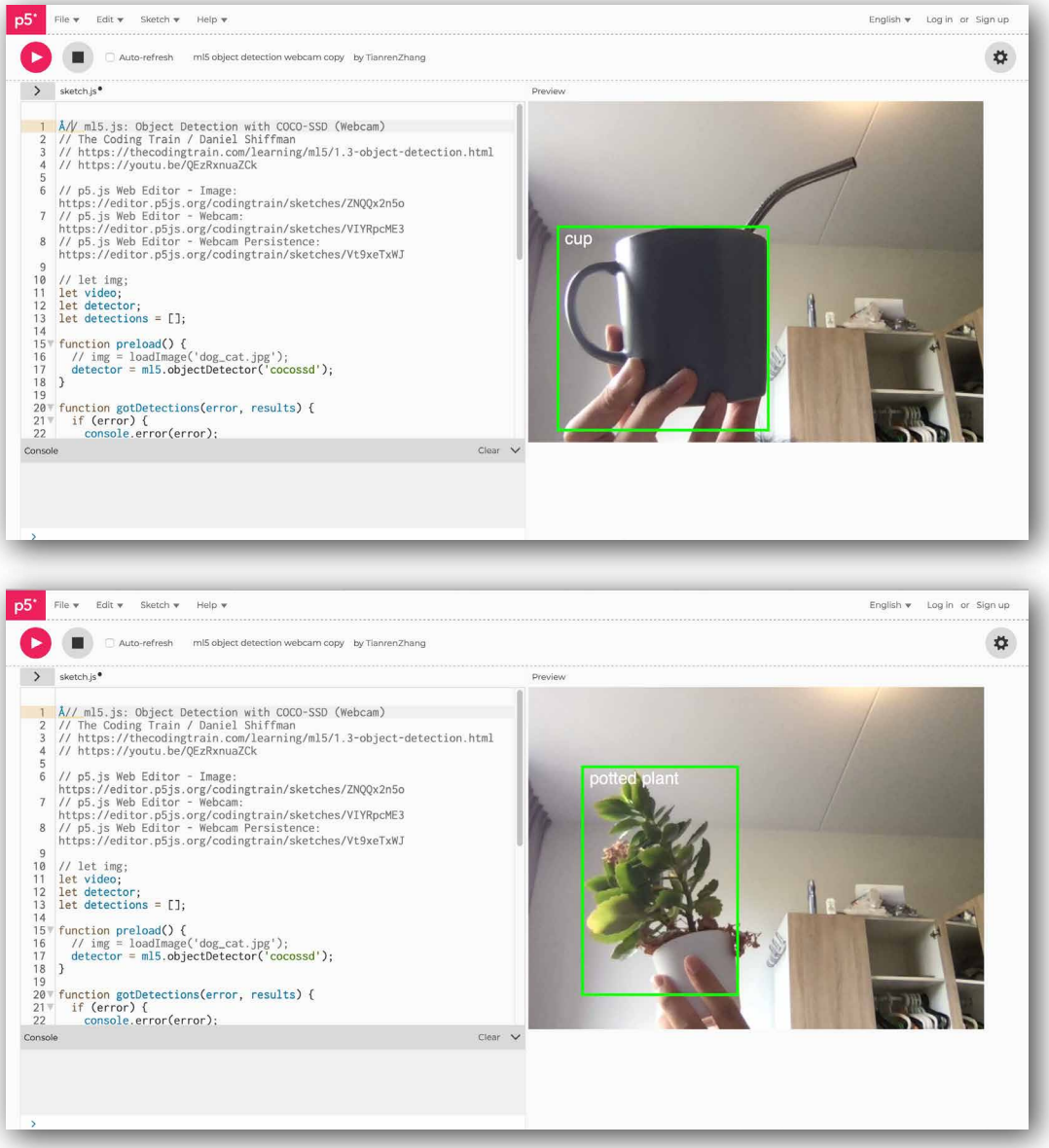


Figure 22. Object detection experiements

4.4 Conclusion - Technology Requirements

Object Detection:

- In order to avoid the misdetection of the main object, for example, multiple objects, messy background situations, the system should judge the main object or allow the user to select the main object that the user wants to scan.

- Due to the differences in the detection model, the accuracy of the recognition may defer. A library of office objects and hospital objects is required to build the APP in a further development phase.

360° Panorama View:

- The basic ratio of making a panorama illustration requires a 2:1 view.

- With panorama perspective as a base, the user can enjoy the 360 views well. A normal 2-point perspective cannot provide an appropriate viewing experience in panorama spherical view. The spherical perspective technique should be applied in sketching.

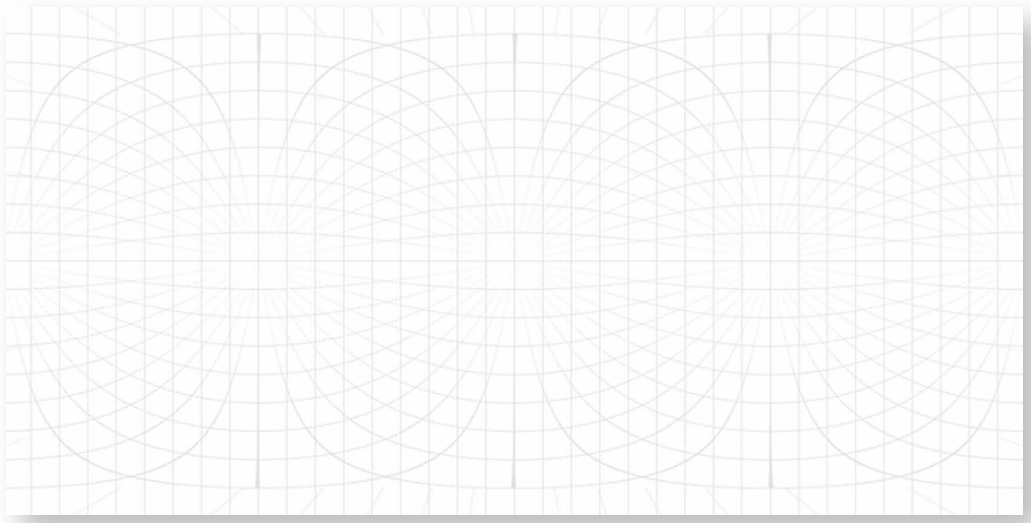


Figure 23. Spherical perspective for panorama sketching

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5. Audiovisual Design

In this chapter, research on potential objects in the hospital office context will be introduced. 4 objects are selected to make final panorama visuals and matched background music.

5.1 Objects in a hospital office environment

COVID-19 makes the whole design process a bit more challenging. Research in hospitals is dangerous and may affect hospital workers' normal work. Due to the concept of scanning objects in the hospital office environment, basic research about what kind of objects are there in the office is crucial. Here I referred to 3 Instagram accounts from Erasmus MC, Rotterdam, and found pictures and introductions about updating the nurse's normal work and the office setting.

Here in figure 24, a brief impression of the objects in Erasmus MC nurse's office can be learned. The iconic objects in the context are office chair, coffee cup, clock, plants, coach, door, window, paper documents(portfolio), computer screen, table, sky, etc. As the time limitation of the whole research and design process, here the researcher selected 4 objects for further audiovisual design and prototyping of the concept.

Figure 24. Objects in hospital office - from @we.care.for.you.on.the.icu @intensivecare_erasmusmc @erasmusmc

5.2 Audiovisual Design

In order to show users a novelty yet realistic experience through the panorama visual and background music, the researcher brainstormed about how to use selected objects to build matched imaginary scenarios. Inspired by music videos, sci-fi movies, and documentaries, the researcher decided to add fantastic elements to build an imaginary world, which relates to the specific object and also gives the user a sense of familiarity, in order to be engaged in and escape reality a bit.

Key Requirements in Audio Design

Michel Chion described his understanding of audio editing, matching audio with elements on visual in films, music videos, etc. in his book Audio-vision. Together, considering the design goals and the object-related scenarios, 4 important audio design requirements are listed:

- *The iconic sound effect stands for the major object.*

  Starting from the beginning but occasionally occurs in the middle to build up the connection with the scenario.

- *Scenario background relaxing music.*

  Not loud background music, but should temporalize the overall sound and use it as the main theme.

- *Scenario environmental iconic sound.*

  Recognizable volume matches with the theme.

- *Scenario environmental sound details.*

  Occasionally occurs to have some interesting associations with recognizable volume.

The scenario composition will start from the object's iconic sound effects, then gradually with scenario background relaxing music on, then comes the environmental iconic sound and details. The object's iconic sound effects will still occur in between to strengthen the connection in the user's mind. With a composition like this, to achieve a feeling that starts from an object, then feel that the user is interacting with it, then it brings the user to a special scenario and delivers interesting thoughts to him/her. The sound will last 60-90 seconds, matching with the behavior of looking around at the panorama visual.

Audiovisual Design

Selected Scenario 1:

Object: Office chair

Scenario: Space Odyssey on office chair

Audiovisual experience:

(Successfully Scanned Confirmation)

(UI shows only a dark background with a tag card on the front. With the iconic object sound occurring, it shows a short story in text……)

(Object Confirmation Short Story:)

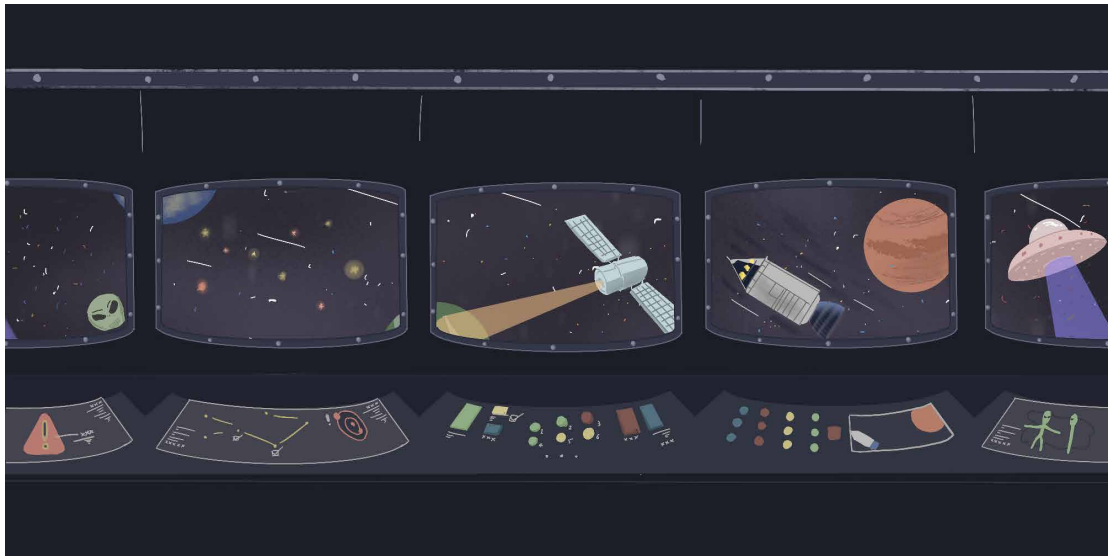
Space Odyssey on Office Chair

Phew…… You found an office chair and are sitting on it right now. You spin around, and then it takes you to a mysterious spaceship. Outer space has so many things to be explored. Look around and enjoy your journey.

(Chair sound)

(User press the confirmation button and it shows a space panorama view)

(satellite and planets in the first sight, look at the back, the user will see some unexpected creatures. See below for the final panorama visual.)



Chair sound

Chair sound

Chair sound

Intercom conversation

Intercom conversation

No scenario environmental sound details in this audio to avoid alarm sounds

Galaxy theme mysterious music

Mysterious space theme music in the background, the user will listen to the telecommunications sound effect. Occasionally chairs sound.

Figure 25. From chair to space ship-panorama visual sketch and music structure

Selected Scenario 2:

Object: Coffee Cup

Scenario: Vacation on the Coffee Beach

Audiovisual experience:

(Successfully Scanned Confirmation)

(UI shows only a dark background with a tag card on the front. With the iconic object sound occurring, it shows a short story in text……)

(Object Confirmation Short Story:)

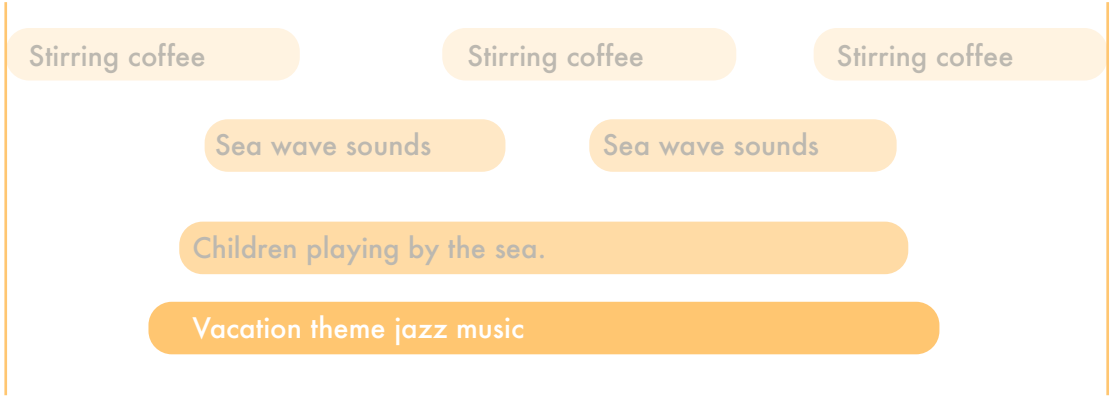
Vacation on the Coffee Beach

Relax…… You had a taste of your coffee and closed your eyes. Your coffee cup is bringing you to a beach, where the ocean is made by Cappuccino. You're relaxing on the towel with the beach vibe, enjoy the coffee smell with a deep breath at the same time.

(Stirring coffee sound)

(User press the confirmation button and it shows a beach panorama view)

(Boat and coffee sea at first sight. Look at the back, there are coconut trees. The user will see a towel and slippers, and a cup of coffee. See below for the final panorama visual.)



Jazz theme music in the background, the user will listen to the sea wave and children playing by the sea. Occasionally stirring coffee sound.

Figure 26. From cup to beach-panorama visual sketch and music structure

Selected Scenario 3:

Object: Plant

Scenario: Camping inside of the Plant

Audiovisual experience:

(Successfully Scanned Confirmation)

(UI shows only a dark background with a tag card on the front. With the iconic object sound occurring, it shows a short story in text……)

(Object Confirmation Short Story:)

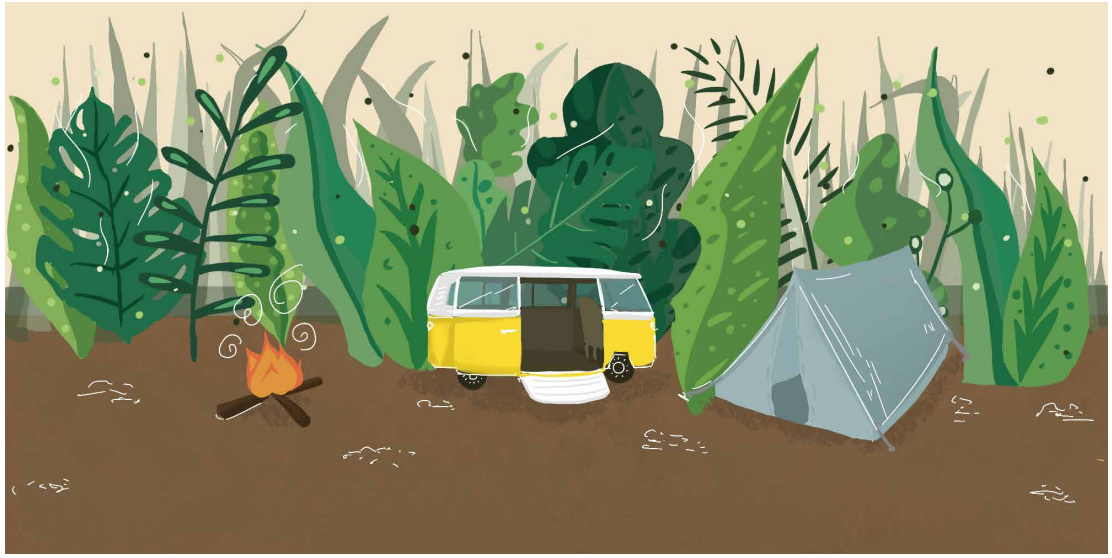
Camping inside of the Plant

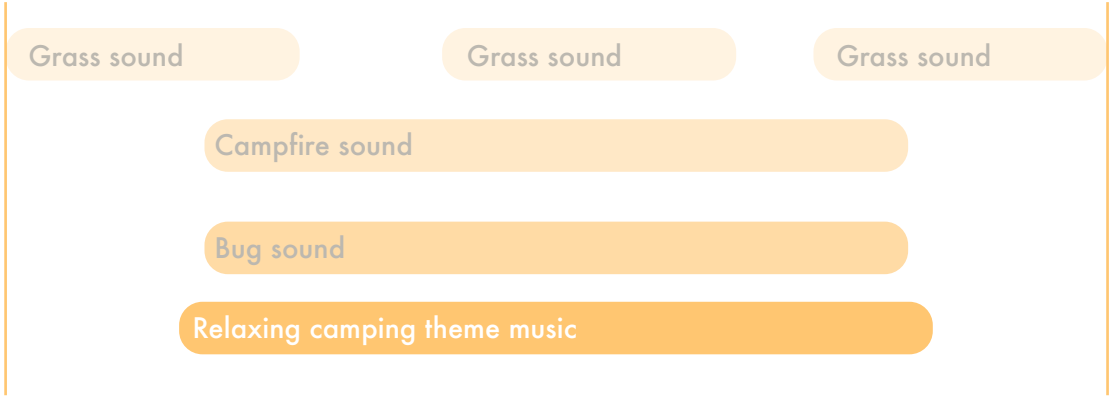
Wow…… You were just looking at the plant in your room and suddenly shrink and hid inside of it. You decide to go camping there with your RV. You are enjoying the mild wind, campfire and gradually feel relaxed.

(Walking through grasses sound)

(User press the confirmation button and it shows a space panorama view)

(satellite and planets in the first sight, look at the back, the user will see some unexpected creatures. See below for the final panorama visual.)





Calming forest-feeling music in the background, the user will hear the campfire sound effect and slight bugs sounds. Occasionally grass sounds.

Figure 27. From plant to camping-panorama visual sketch and music structure

Selected Scenario 4:

Object: Window

Scenario: Flying with fishes in the sky

Audiovisual experience:

(Successfully Scanned Confirmation)

(UI shows only a dark background with a tag card on the front. With the iconic object sound occurring, it shows a short story in text……)

(Object Confirmation Short Story:)

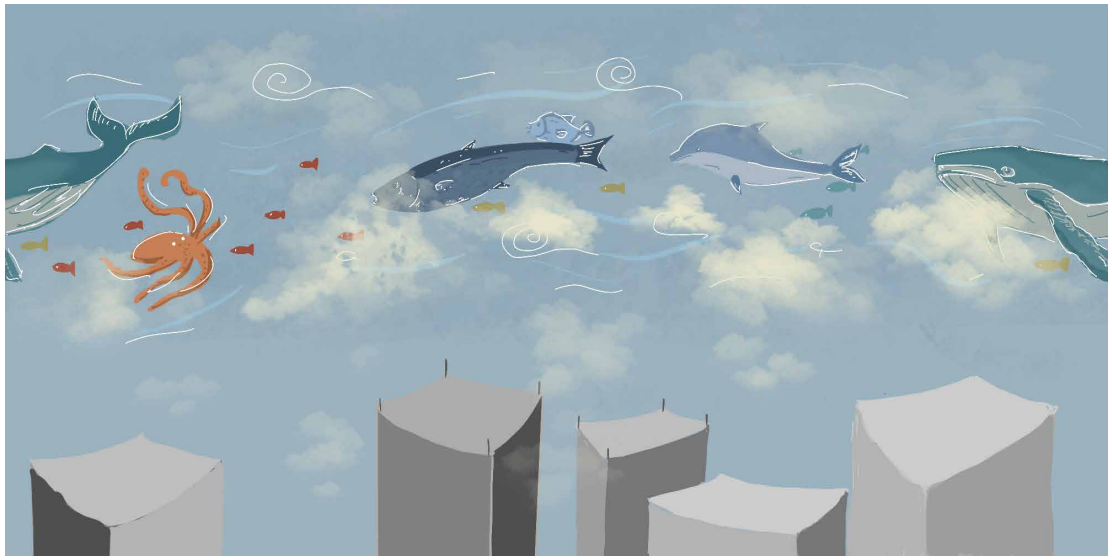
Flying with fishes in the sky

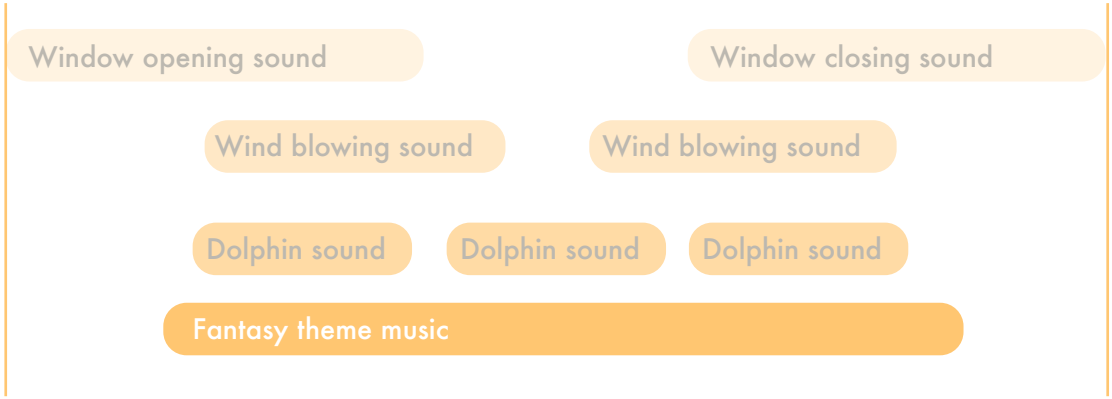
Creak…… You opened the window and your mind was flying above the sky. Fly to the top of the buildings and breathe the air above. You see fishes are flying around you. Relax and enjoy your moment.

(Window opening sound)

(User press the confirmation button and it shows a beach panorama view)

(Boat and coffee sea at first sight. Look at the back, there are coconut trees. The user will see a towel and slippers, and a cup of coffee. See below for the final panorama visual.)





Calming fantasy music in the background, the user will hear the wind sound effect and occasionally dolphin sounds. The window opens and closes at the beginning of the music and at the end of it.

Figure 28. From window to sky-panorama visual sketch and music structure

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6. Final Design

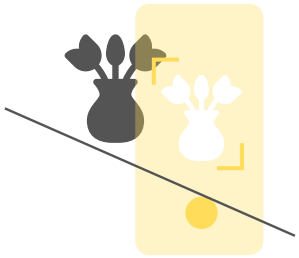
6.1 Key Features

Sound-driven relaxation experience.

Nurses can open the takeUthere APP whenever they feel stressed or need to refresh their mind, take a deep breath, and start a short daily trip from the sound of daily objects around.

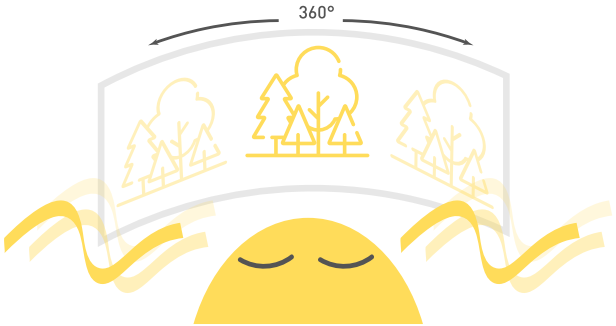
Use the sound of daily objects.

The product will avoid the sound from hospital working environment, medical devices sound, noisy unpleasant sound, alarms, etc., but will provide more interesting detailed sounds of everyday objects that people hardly ever noticed, such as window opening, spinning chair, stirring coffee, etc. takeUthere product provides these detailed sounds that let the user focus and find the object. The process keeps a good balance between easy and challenging.



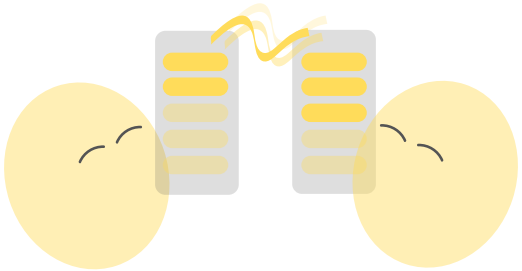
Listen, guess, find and scan.

After the user focuses on a random office object sound, he/she needs to guess the object, and find it in the room. takeUthere product uses the object scanning method to ask the user to put the object in the center of the APP frame. Machine learning will compare the object with the images in the database and give results to the user. Therefore, the experience for users is smooth and in a comfortable flow.



Imaginary world in a panorama view with scenario music on.

By scanning an object and confirming it, an imaginary world will be present through panorama view and scenario music. The user can explore the new reality by simply moving the smartphone and listening to the sonic story. With this audiovisual experience, the user will immerse himself/herself inside of it and have a short-term mind recovery.



Review favorite scenarios and share.

Users will have a feeling of control and achievement when seeing all the unlocked scenarios and objects. They can find their favorite scenario music and panorama view again and enjoy a few minutes. At the same time, they can share all the unlocked scenarios with their friends or colleagues. This creates a way to open a relaxing conversation in the office during spare time.

6.2 User Flow

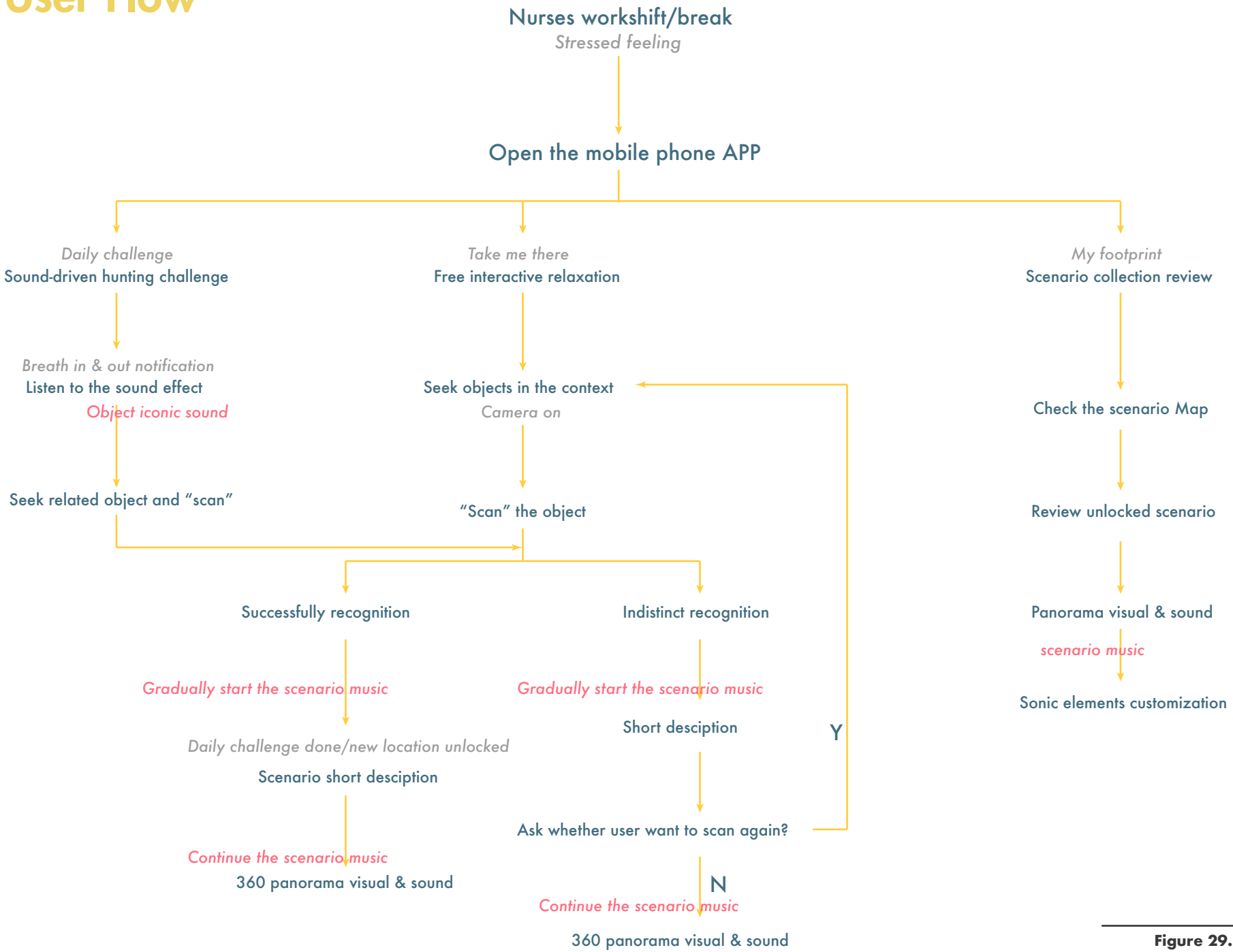


Figure 29. User flow

takeUthere experience starting from nurses' work shift or break during the day. Away from the stressful working schedule and tense atmosphere in the ward, nurses can finally have a short relief by entering the office room and have a short rest. Then he/she can open the takeUthere APP on the smartphone. The APP will introduce 3 different sections and show them on the bottom navigation bar, Daily, Scan, and Footprint, which stands for the daily sonic challenge, take me there scanning, and my footprint review. The nurse can choose which section to continue the APP journey.

In the section Daily, the nurse will have a short daily sonic challenge, starting from listening to a random object sound. The APP will guide the user to focus on the sound, allowing the user to reply and think. Then, after the user has a clear clue, he/she will find the object in the office room, can scan the object on the phone. The system will recognize it and at the same time to repeat this sound with a short explanation. The user will know whether the recognition is right through the repeating sound and textual explanation. Continuing with the scenario sound, the user can click the Go bottom for confirmation, and enjoy the panorama visual together with music in around 90 seconds. Therefore, if the user supposes that the recognition is not right, he/she can go back and find objects to scan again to finish this daily challenge.

If the nurse is exhausted and does not even want to think or guide by somebody/something anymore during the break, he/she can just go to the section Scan, to scan some random objects around, and enjoy the short-term freedom. Also, when the nurse doesn’t want to scan any things or look around in the room, he/she can just sit there and review some favorite scenarios via the panorama visual and music.

6.3 User Experience Design

APP Introduction

First-time use.

Basic functions from the APP will be introduced to the user for the first time he/she downloads the APP. It describes 4 main features all from the user perspective with short texts and illustrations. The user can interact with the pages by swipe on the left, or click the bottom "next" to continue the viewing experience. The simple and straightfor-ward introduction is the starting point of the whole innovative sound-driven relaxation experience.

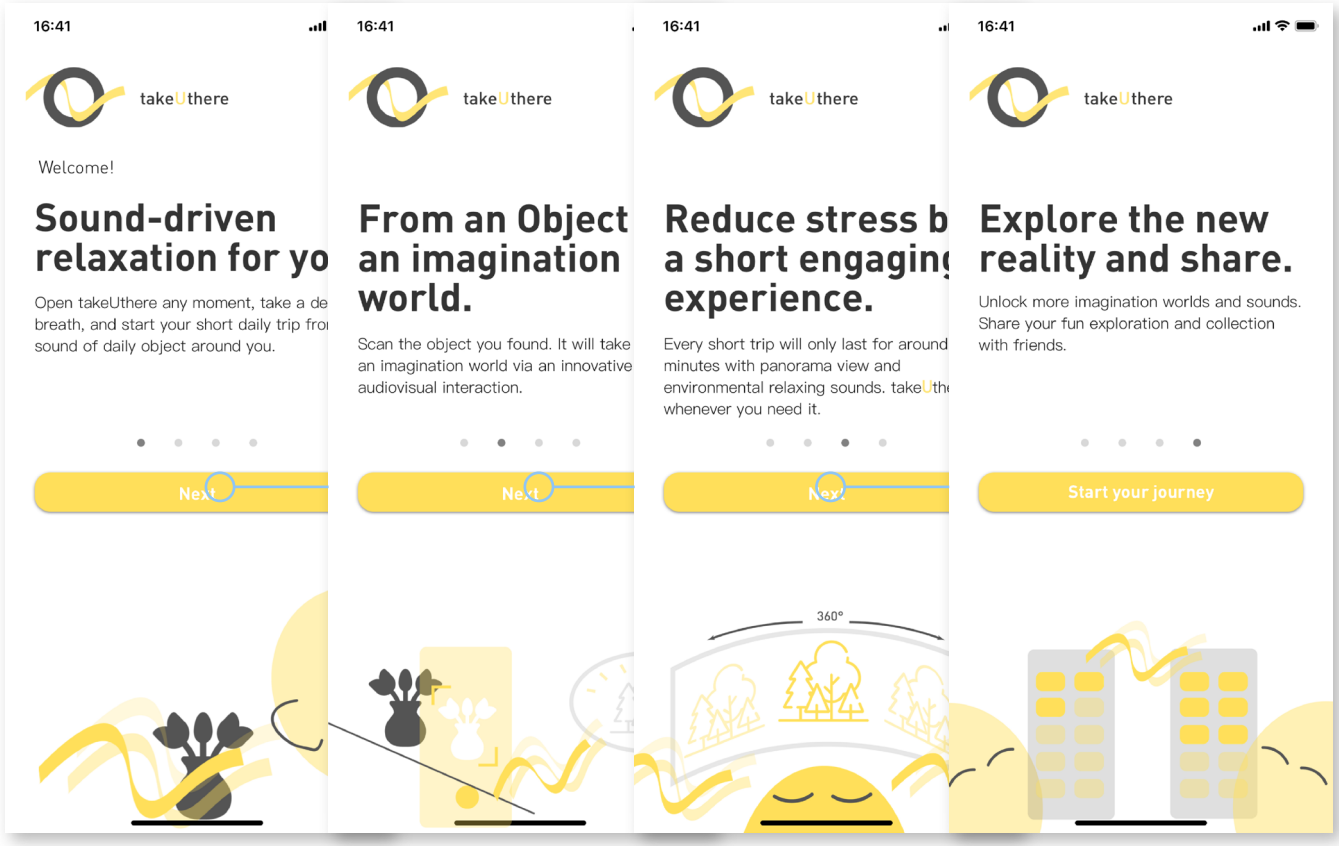


Figure 30. First-time use, introduce pages

Daily sonic trip experience

Home page-Daily

Daily sonic trip cards will be presented on the home page. The color clue also attracts users to finish it. Following with Your recent trips to give the user notification about the experience, from an object to relaxation. By clicking “GO”, the user will see a short guide, and start to play the sound of an object. The user can replay it to think more, and then press “scan the object” to the object scanning page.

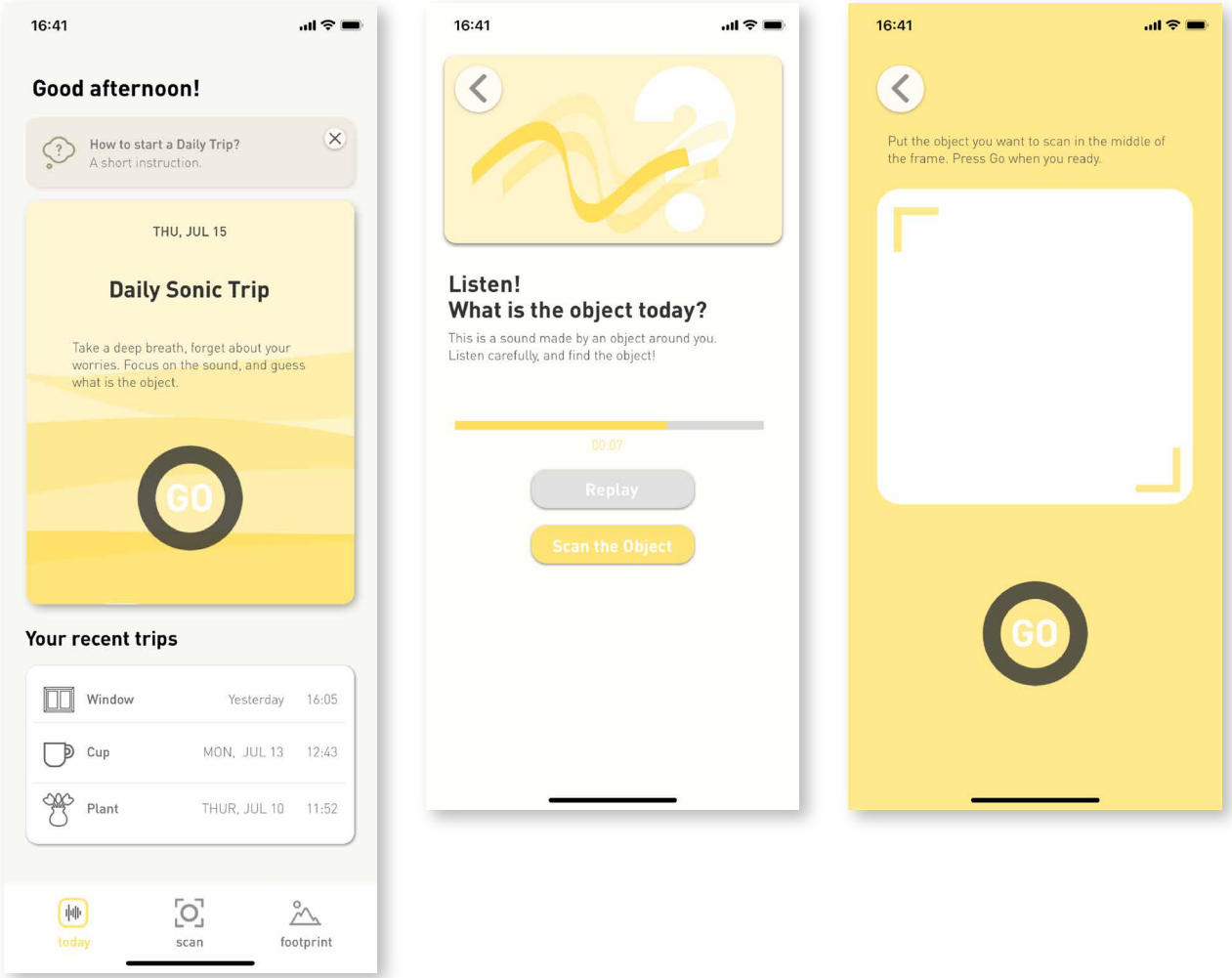


Figure 31. Daily sonic trip

Short story for confirmation, then with music on, enjoy the panorama visual.

After the scanning, the user will see a confirmation tag on the screen with the name of the object, the name of the object-related scenario, short story, and bottoms for the next steps. The user will hear the sound from the object again, with text reading to confirm the results, then “Go inside of this world” to enjoy the panorama visual. The user can hear scenario music through it, and take an immersive experience by moving around the smartphone.

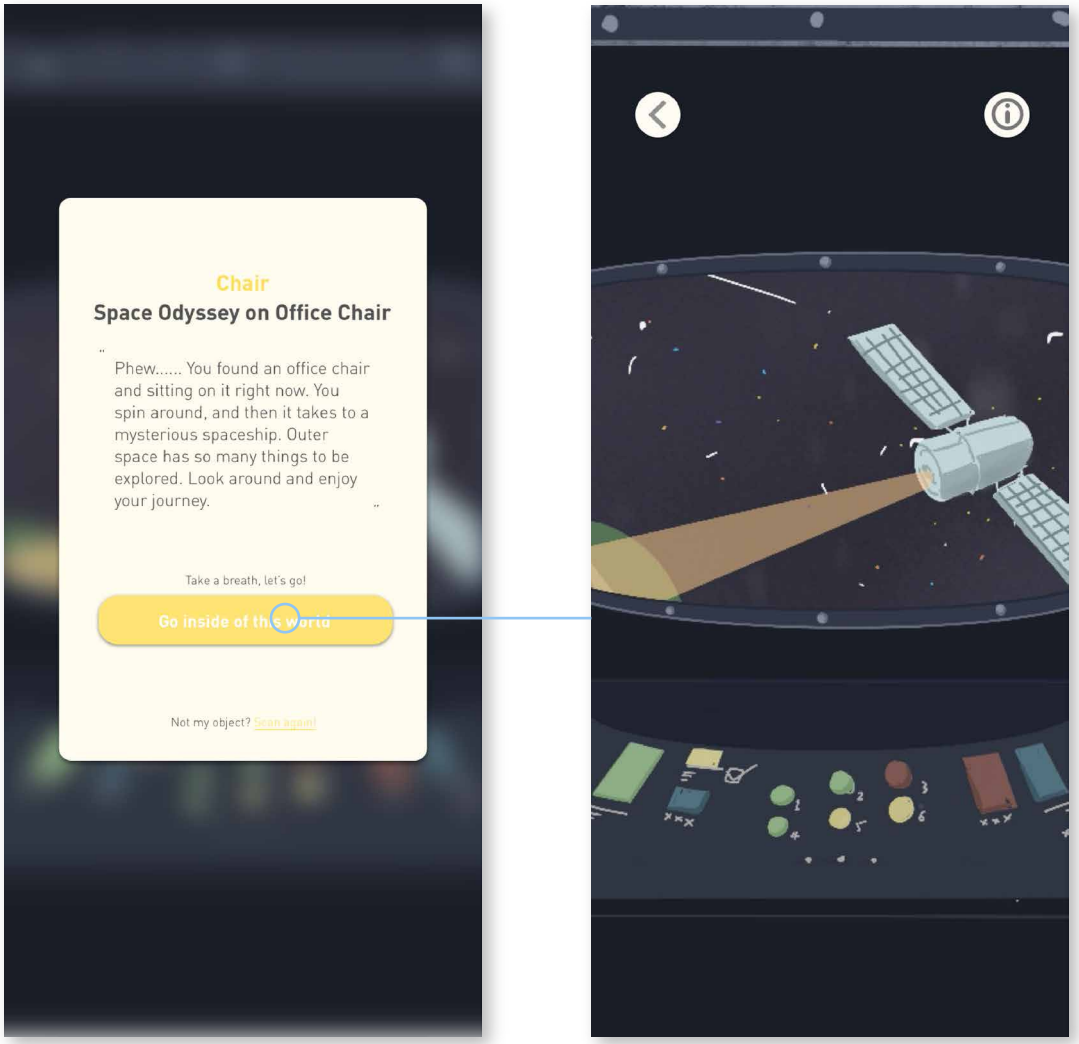


Figure 32. Story confirmation and panorama visual

Scan random objects

Directly scan and go.

To give more freedom to people who have busy and mind-blowing days, especially nurses, scanning random objects function simplified the sound-driven experience to directly “scan and go”.

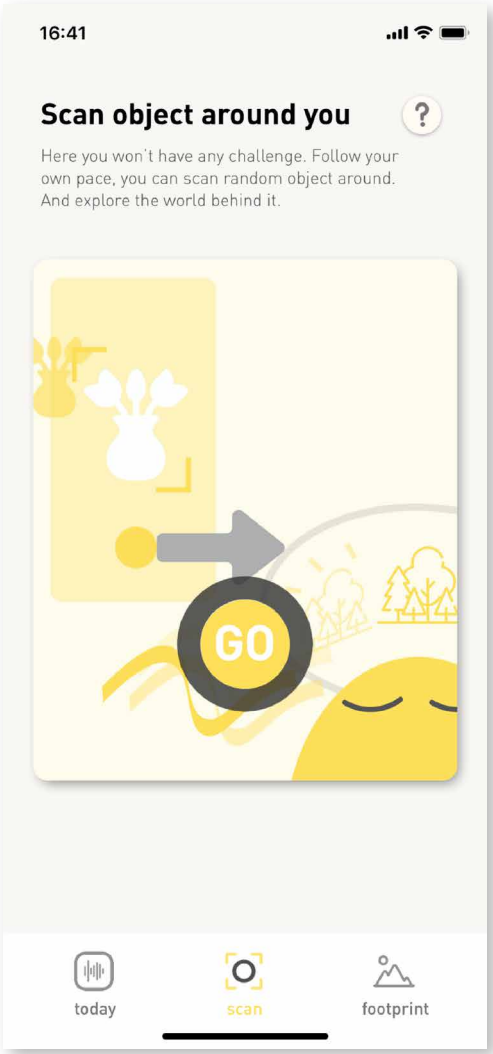


Figure 33. Random objects scanning page

Footprint review

Where have you been?

After finishing daily challenges and random scanning, the user will collect a lot of different object-related scenarios. The Footprint section gives the user an opportunity to review and enjoy the scene again. Also, they can share the scenario collections with their colleagues, discuss, compare, and start a new conversation that is relaxing and joyful during the break.

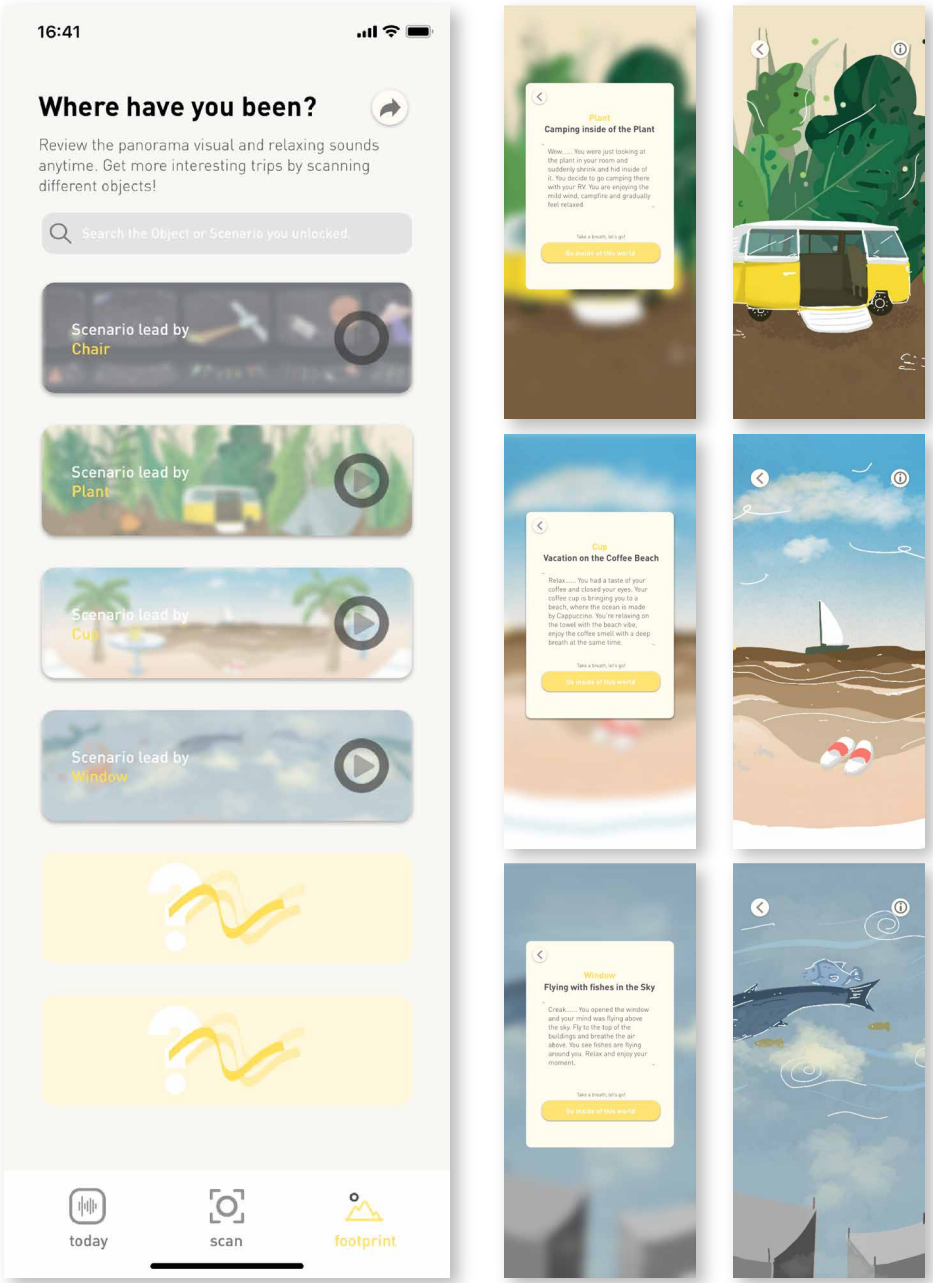


Figure 34. Footprint - scenario visual & music review

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7. Design Evaluation

In this chapter, a final evaluation is shown with goals, set-up, process, and results. The evaluation results are presented by charts and concluded product insights.

7.1 Evaluation Goal & Set-up

Evaluation Goal

- To verify the system logic and improve the whole user flow.
- Check the complexity of the sound-driven challenge.
- Check the user's preferred time for quick relaxation.
- The feeling and emotion during and after using the APP.
- Feeling about the sound-driven experience.
- Collect feedback from personal perspectives to refer to and improve the final design in future recommendations.

Method

Set-up

Materials: UI interface design on Sketch (Mac) and connect to iPhone Mirror APP to create a real experience. Mi Sphere Camera APP for the 360-degree panorama visual. And iPad on the table to simulate the sound playing quality while watching the panorama visuals.

Wizard of Oz method: All the software switching and music playing will be on the back-end controlled by the researcher. But the user will have an overall APP using experience without seeing the control and switching.

Role-play test: For the participants, the experiment will use a role-play method. Let the participant empathize with the situation after a tiring day in the hospital office as a nurse.

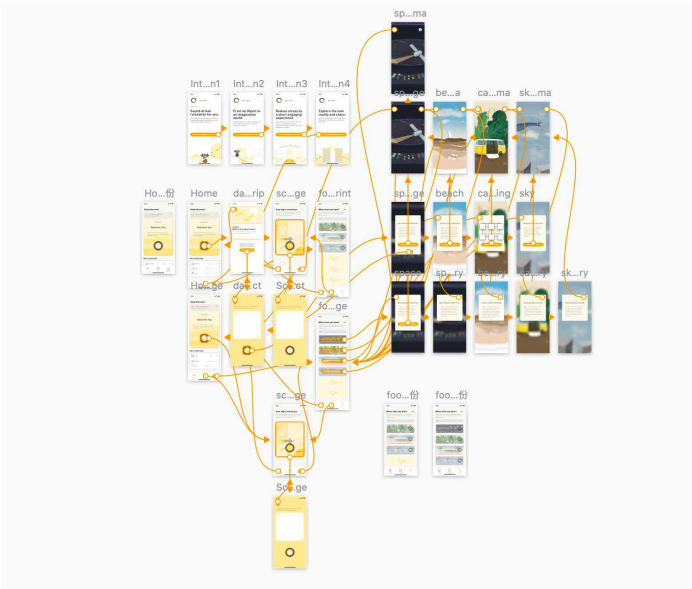

Figure 35. APP testing - interfaces with hotspot connection

Experiment Process

- Pre-experiment: Empathize as a nurse.

  Introduce the busy work of nurses in the hospital context to the participant, play hospital scenario sounds at the same time, and let the participant empathize with the situation of a nurse. Then start the main experiment.

- APP overall product experience test.

  The participant starts to experience the APP product acting as a nurse during the work break. The requirement is that the participant needs to speaks aloud about what he/she sees and interactions. Interact with the product with hands, but also by verbal descriptions.

- Panorama visual and scenario music test.

  By seamlessly switching programs controlled by the researcher, the participant will start to view the panorama visual and move the phone around. At the same time, the tablet in front of the user will start to play the matched music.

- Post-experiment: Questionnaire and interview

  After the whole experiment, the participant will fill in a rating questionnaire (see details in Appendix). The questionnaire is designed with questions and a scale rating of 1-10. The feeling/emotion scale of the answers varies from different questions. Then following with an interview to understand their considerations and deeper insights.

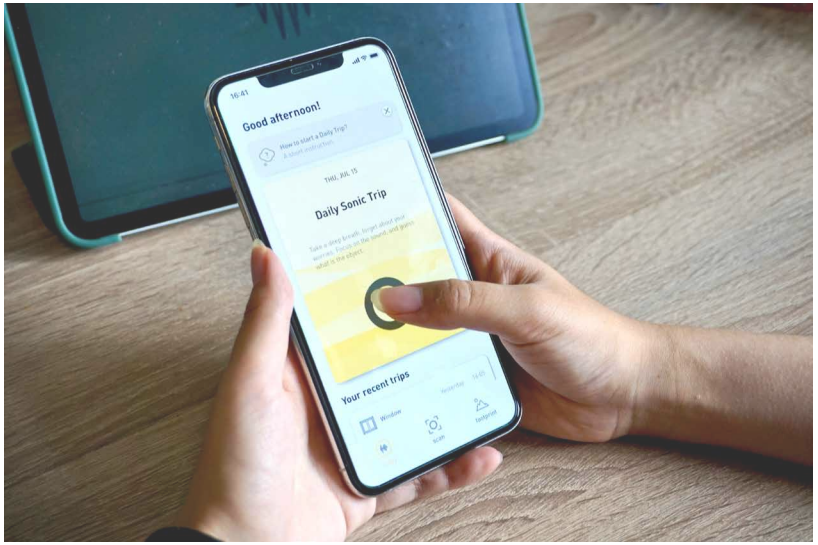

Figure 36. APP testing on the phone

Participants

The testing is a role-play test, which means no target group user participants in the testing. The user testing involves 8 people age 21-29, including 3 males and 5 females. Their occupations are students and office workers.

The participants are informed of the data collection and usage in this project-based research and design thesis. The whole experiment is face-to-face testing, COVID-19 regulations are strictly followed to ensure the participants' and the researcher's safety.

7.2 Evaluation Results

Results on Audiovisual Design

The Experience of sound-driven challenge

Interesting to guess office objects through sound. Not hard to find, yet challenging.

People praise the idea of playing a detailed sound from an everyday object first for a small challenge. They act really focused on the sound and feel ambitious to find the object in the room. Due to the selected objects being normal in the office room, the difficulty of guessing and finding maintains an acceptable level.

"After listening to the object sound, I can immediately relate to action with the object. Yet the sound is a bit confusing for me. But still easy to find and I enjoy the process."

Feel magical when seeing the object scanning results.

Although participants all read the initial product introductions first in the test and understand well that object will bring them to a scenario, they still feel magical when hearing the music first with textual explanations, and then the music continues to check the panorama visual.

"It feels like checking the scanning results using both texts and sounds first, but when I kept reading the stories, music comes and really matches the scenario. It just likes enjoying an innovative graphical-sonic novel!"

Panorama visual with music

Rich-detailed visual and music to be explored more than once.

Every scenario experiencing time was limited by the length of music, around 90 seconds. Participants reflect that both the visual and music have so many detailed elements to be reviewed again. Some of them even let the researcher show them specific scenarios again after the test. They can explain well on the sonic stories and can discover more details every time after listening.

"It feels like you are drinking coffee by the sea and enjoy the sea sound on the beach. But the second time I realize that some children are playing far away and I really saw some children in the back direction of the panorama visual. Amazing!"

Panorama visual brings an immersive experience that lets users actively explore the scanning results.

Panorama visual on the mobile device allows the user to move around the phone to have different viewing perspectives, in order to have a detailed exploration of it. The participants all totally engaged themselves in the visuals and moved the phone with a rotated body in every direction that they can go.

During the interview, I asked one participant,"Did you notice that you rotate your body to a extraordinary position when you were trying to explore the scenario in the back direction?"

"I didn't notice it. I was just too curious to see the whole scenario. Maybe this is also a good way to move my body subconsciously to regulate the body."

People tend to focus more on the panorama visuals and stories the first time, but focus on music more in the review section.

When there's a new object and matched scenario occurs, people tend to confirm the results first by listening, but as the panorama visual presents, people will focus more on this physical interaction. However, when they review the scenario again, they started describing the sounds.

"For me, I definitely want to focus on the moving things, especially it moves with the phone direction. Music makes the scenario more realistic, but I can only have an overview for the first time. I can get more details when reviewing them again."

Strong storytelling and object-related music in the background. Calming and comfortable.

Most of the participants can describe the story well after the audiovisual experience. From the story confirmation to detailed object sound, then music occurs with the panorama view, the participants believe this is not only a simple picture with sounds but also a hidden story for them to stay calm and dig into the world.

Emotion and Feeling

The audiovisual evokes the positive side of personal memories well and successfully distracts people's minds in a short time.

All the demo scenarios shown in the testing (also can be seen in the chapter Audiovisual Design) are related to real-life situations but adding some fantastic elements. Participants said that the scenes can evoke personal memories about traveling, and dreaming, etc. These good memories distract people's minds away from the stress.

The time of experiencing scenarios varies from person to person.

Some people think this around 90-second-journey is a bit short, however, some people think it's a bit long. But the overall time of experiencing the audiovisual is acceptable for the participants.

"I think it is too short for me. When you start the exploration of the panorama visual, the music has already started. So it's like only one minute for me to look around. I can finish it directly when the music stops. I wish it can be a bit longer, but not too much."

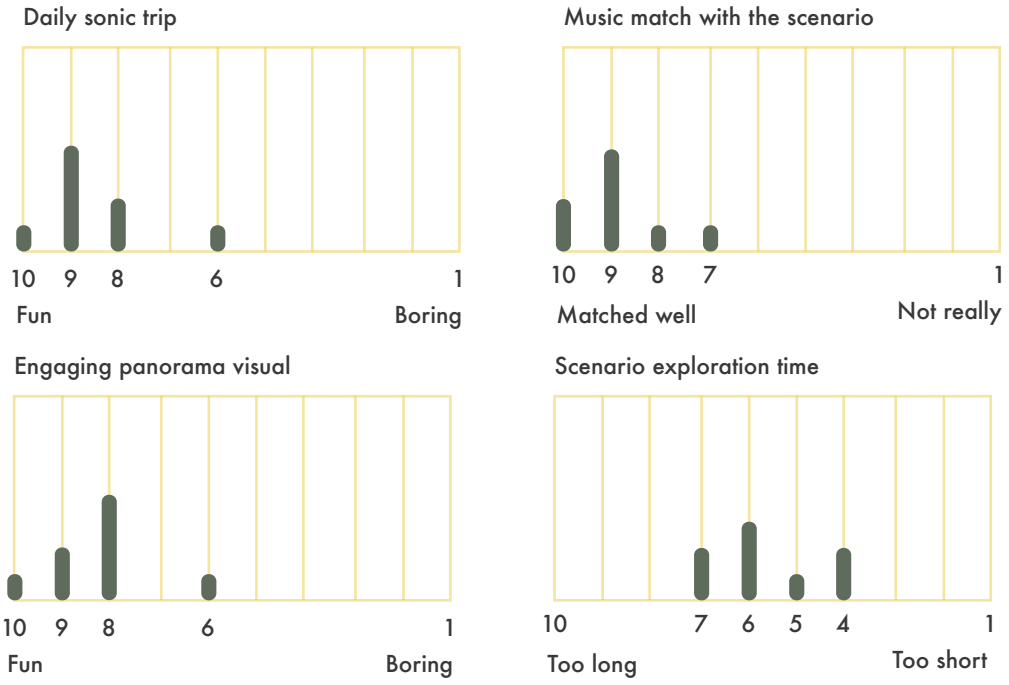

Figure 37. Evaluation results (see full results in the Appendix)

Results on overall user experience

A stressless gamified experience like treasure hunting, but not complex.

Most people assume this sound-driven hunting experience is fascinating. In general, it is clear and effortless to guess. Participants seldom have sound guessing experiences in their lives, so they all think it is fun and innovative.

"By the time I saw the introduction page 'sound-driven experience', I started to curious. Then I tried the daily sonic game, it's not a difficult stressful game, but can arouse my interest of noticing more to my life away from work."

Enjoy the process of imaging with the music and visuals, even closing eyes.

Music increases the panorama viewing experience. Participants said that even without the panorama visual, they can still start to think about the scenario by themselves and create a unique story following the music.

More objects and scenarios in the database, the better feeling the user will get.

4 scenarios and music are presented in this prototype. Participants all explored completely and asked the researcher whether they can have more in the around 30 minutes experiment. More object and scenario in the system database, the better experience the user can have.

Common feeling stages from the overall experience: Curious, Joyful, Calm.

The researcher keeps on observing the emotional change on the participants' faces during the tests. On the phase introduction and daily sonic trip, their faces and verbal description all shows curiosity. They start to enjoy the scene when seeing the visual and listening to the music, and gradually relaxed after the experience. This is consistent with the overall user experience expected by the researcher.

The experience not only offers short-term relaxation but also increases the expectation of life after hours.

Participants rate high scores for the degree of relaxation question in the questionnaire. One person said that it is not only a short-term effect for him, but also let him start to imagine and plan the vacation during the weekend on the beach. So this experience can increase the proportion of focusing on lives: life is not just about the stressed work, especially for nurses.

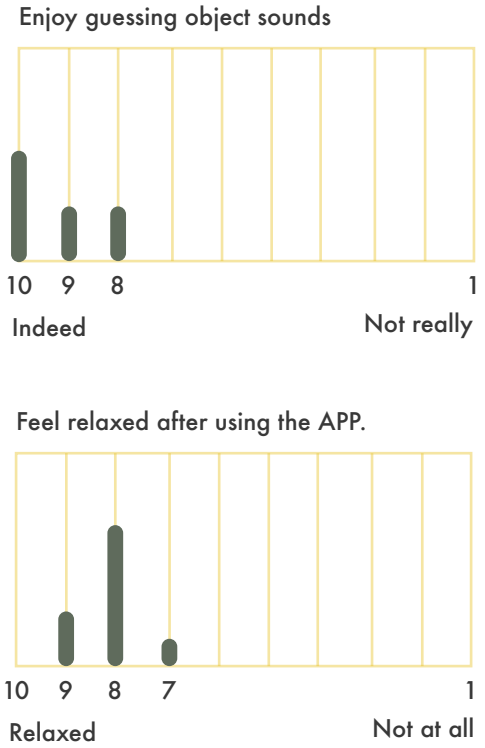

Figure 38. Evaluation results (see full results in the Appendix)

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8. Conclusions and Future Recommendations

In this final chapter, conclusions about the overall project and design are presented . Following project & research limitations, more future recommendations are described to inspire future design researchers.

8.1 Conclusions

Away from stress - design for nurses to use during work break.

The short work break requires nurses to regulate personal mood in time. The sound-driven experience introduced in the design is to help out. From listening to object seeking, then immersing minds inside a world by panorama visual and music, one complete experience can be finished within 5 minutes, but can successfully evoke a positive mood afterward. The user can be distracted from the stress by the multimedia interaction, therefore successfully 'escaping from reality'.

Suitable for different types of user habits.

A positive working attitude is also a key requirement of a nurse's work. The design provides a way of relaxation in the context of the office room. Nurses with different personalities or habits can all get benefit from it. Those who want to have a personal moment during the break can wear the earpods, and can enjoy the interactive experience alone. Those who want to share stories with others can find some interesting objects together and start a relaxing conversation from the audiovisual results. Multiple product usage scenarios can be found by using takeUthere to broaden the implementation.

Simplified interaction yet targeting the problem.

Starting from opening the APP to get a calming mood, the interaction process should be simplified. The influence should focus more on the cognitive and mental perspectives by using limited interactive processes. In this design, it offers an experience from passively receiving short sonic information, to actively thinking and searching in a real context, finally to an object-based relaxation. The switching between passively receiving information to actively get involved in the small activity brings a sense of Unity and Order, which also matched the fundamental needs at the beginning of the project.

Be engaged in the short story.

Although the specific audiovisual form should be researched more for future research, the storytelling in the audiovisual design is still an important feature. People point out that getting some stories totally different from the things you are worried about is a good way to distract. Modern social media also gets these needs, then designed some features like short video stories for fragmented viewing. The storytelling through the panorama visual and musical compositions should be improved.

8.2 Limitations & Future Recommendations

Limitation of the study-Target user group research

This project included a limited number of nurses from RdGG hospital in delft by online research. As COVID-19 regulation's influences, hospital visiting and face-to-face context study was a big challenge in the study. Therefore, role-play as the final evaluation was conducted with people aged 21-29. The different occupations will give different research results according to their own experience and understanding. In a word, the study needs to involve more target users to iterate, verify the product to introduce a more suitable and forceful design solution.

Scientific evidence of regulating mood.

During the final evaluation, a short questionnaire was used to understand the participants' feelings after using the product demo. However, during the study, as inspired by other music and mood-related research, scientific evidence is used to show the forceful results, for example, heart rate monitoring, brain wave monitoring, etc. These quantized data will be a possibility to find out.

Database of office objects and matched audiovisual.

Databases of office objects are required in the design solution. Using the current object detection model is not very suitable for this specific application since the name of the results may differ. A new database should be prepared by further research about hospital office objects. Furthermore, the audiovisual should also keep on updating to match these objects.

Visual possibility - abstract or concrete?

A concrete type of visual is shown in the design solution by the panorama view with music. The idea is to help the user to get a direct-viewing impression of the new reality that he/she is going to visit. However, with the music on, it can already build up an imaginary world by focusing on sound. Abstract visuals may also have an opportunity to be implemented to match the music. Comparison research may be conducted in the future to verify the idea.

Interface layout and colors.

As the goal of the product is to regulate the nurse's mood, then every detail of the product should convey this idea. Limited project execution time and different project focus don't allow the research to go deeper on the interface design perspective. Theoretically, colors and layout style also have an influence on people's moods. Related research should be considered to introduce a more complete design solution.

Project Reflection

As a graduate student in Master Integrated Product Design major from the Delft University of Technology, I decided to choose this project which focuses more on the user perspective. The initial aim of exploring more on this aspect is to learn the difference between experience design and tangible product design engineering. Although the whole project process was structured referring to the Advanced Concept Design and Advanced Embodiment Design course during my previous IPD study, the overall experience of the graduation project was still smooth. From STEM bachelor study to design engineering study in master, design thinking is the most important mindset that I get here. With the support of the Critical Alarms Lab team, I can have the opportunity to explore more on the area that I really like.

Before the project, I made a schedule planning and tried to consider the possible influences on it. During this around 5-month study, personal issues and regulation issues all affect the progress. But in general, all the processes are on track as planned before.

During the researching process, as I'm new in the domain of sound-driven research and design, I got a lot of help from my project Chair and Mentor. Literature, research questions are all inspired by discussion and conversations with them. Regular project meetings also help me to remove doubts in time. It was a fortune to be part of my Mentor, Stefano Delle Monache, the research team on the co-creation workshop preparation, which gave me a lot of design insights on users from my own project perspective during this COVID-19 time.

As an IPD master student, a solid and reasonable design solution is essential to consider. In the final design, I focused more on the interface interaction and audiovisual demo design. It also showed a better user testing result in the end. There's no doubt that I learned a lot about UX design, audiovisual design skills in the project, which also built up myself as a designer and widened my scope of knowledge.

Acknowledgement

After completing this graduation project, I would like to thank Elif for providing me with the opportunity to participate in the Critical Alarms Lab team. Thank Stefano for providing me with timely advice and carings during the project, and thank Yoko for her very inspirational ideas and creativity. As a student from China studying in the Netherlands, I also want to thank my family and friends for their support. Thanks to all the previous project mentors and coaches for their guidance. They structured my mind on design. Finally, I'd like to thank myself for not being overwhelmed by emotions in the face of pressure and difficulties.

Stay humble, and keep on exploring!

TIANREN ZHANG
张 天 任

25.08.2021

takeUthere

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The scenario music is using recording elements from Freesound.org and remix by the author. The panorama illustrations are designed by the author.

Chair - spaceship scenario music

Object iconic sound: Chair - Dig2008
https://freesound.org/people/Dig2008/sounds/67239/

Scenario iconic sound: Mars Pioneer - celldroid
https://freesound.org/people/celldroid/sounds/134951/

Scenario detailed sound: no detailed sound in this music to avoid sound similar to alarms

Scenario background music: Stasis music for space - Darkensson
https://freesound.org/people/Drakensson/sounds/547029/

Cup - coffee beach scenario music

Object iconic sound: Stirring in coffee - jvdicke
https://freesound.org/people/jvdicke/sounds/455009/

Scenario iconic sound: Water wave beach peoples ships field recording - szegvari
https://freesound.org/people/szegvari/sounds/530705/

Scenario detailed sound: Italian beach with children playing people talking and some wind - MarcoSensi
https://freesound.org/people/MarcoSensi/sounds/535583/

Scenario background music: Jazz street musicians - reinsamba
https://freesound.org/people/reinsamba/sounds/54066/

Plant - camping in the plant scenario music

Object iconic sound: rustling leaves - giddster
https://freesound.org/people/giddster/sounds/437356/

Scenario iconic sound: Light rain camping - Santi_SF
https://freesound.org/people/Santi_SF/sounds/546036/

Scenario detailed sound: Bugs buzzing loud - longshot
https://freesound.org/people/longshot/sounds/104642/

Scenario background music: Relaxing piano guitar - Migfus20
https://freesound.org/people/Migfus20/sounds/559840/

Window - flying in the sky scenario music

Object iconic sound: Open close window - voxhumanamusicurators

https://freesound.org/people/VoxHumanaMusiCurators/sounds/529785/

Scenario iconic sound: Wind synth high altitude - android_lime

https://freesound.org/people/android_lime/sounds/570890/

Scenario detailed sound: Dolpin chirps vocal pe024601 - BFDICream123

https://freesound.org/people/BFDICream123/sounds/577519/

Scenario background music: Sky loop - foolboymedia

https://freesound.org/people/FoolBoyMedia/sounds/264295/

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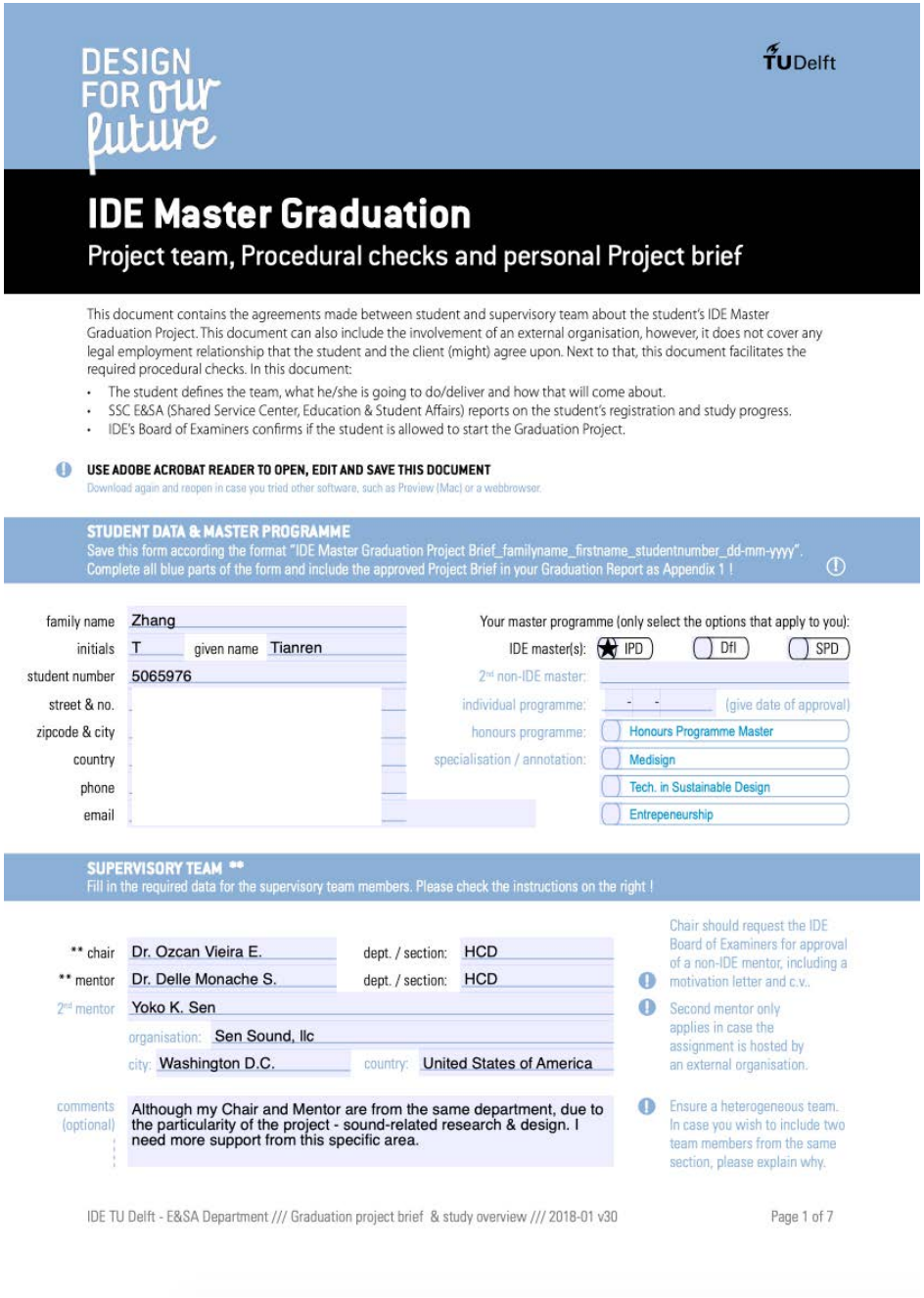
Appendix

Appendix 1 - Project Brief



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	Zhang
initials	T
given name	Tianren
student number	5065976
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. Ozcan Vieira E.	dept. / section:	HCD
** mentor	Dr. Delle Monache S.	dept. / section:	HCD
2nd mentor	Yoko K. Sen		
organisation:	Sen Sound, llc		
city:	Washington D.C.	country:	United States of America

comments (optional): Although my Chair and Mentor are from the same department, due to the particularity of the project - sound-related research & design. I need more support from this specific area.

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.

IDE TU Delft - E&SA Department /// Graduation project brief & study overview /// 2018-01 v30 Page 1 of 7

Procedural Checks - IDE Master Graduation

TU Delft

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

chair Dr. Ozcan Vieira E. date - - signature

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

Initials & Name T Zhang Student number 5065976
Title of Project Regulating nurses' mood through sound and music

Personal Project Brief - IDE Master Graduation

TU Delft

Regulating nurses' mood through sound and music — 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 9 - 03 - 2021 — 23 - 08 - 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, ...).

The project "Regulating nurses' mood through sound and music" is cooperating with TU Delft Critical Alarms Lab. It focuses on sound-related research and design, in the area of healthcare, academic hospitals, etc. The project aims to reduce the daily working pressure of nurses through sound and music, therefore create a positive mood to face their work.

As the professions that help people solve health problems, the hospital staff pay attention to the patient's physical condition all the time. Including doctors and nurses, they face complex and difficult tasks every day. New diseases and cases force them to focus the mind on patients and medical equipment. After the doctor completed the diagnosis, except for the operation, the nursing and care of the later period fell to the nurses. This makes nurses experience a lot of pressure when facing daily works, which will undoubtedly cause negative emotions, make it more difficult to empathize with the patients under care, and even affect their follow-up work and their normal lives. (Jill Suttie, 2017) The profession of a nurse requires a professional level of operation, empathy for patients, and a calm working attitude. All these require nurses to have strong self-regulation ability, to switch freely between complex tasks, and to maintain their calm emotions at all times to ensure work efficiency. However, this is an ideal working environment, but in fact, there are many factors that affect the psychological pressure of nurses.

In the hospital environment, people usually feel a sense of seriousness and coldness. Patients usually face the diagnosis and treatment with a calm, nervous, or even an extreme attitude. In order not to affect the judgment or treatment of doctors and nurses, the hospital is usually very quiet, but accompanied by warning sounds from medical equipment. This will greatly affect the mental health of people who have been working in this environment for a long time. As mental health is an essential issue for everyone to pay attention to these days, the increasing working pressure will cause a lot of people to find it hard to balance their life and work and therefore experience uncertainty, effortlessness, or even depression. (Susan Klitzman, James S. House, 1989) They need to have appropriate relaxation or recovery of their senses during the working hours for example, visual and auditory.

In terms of sense recovery, it often uses sound/music as a media, with the environmental elements, for example, lighting and other visuals, received by the user, therefore, changing the brainwaves and nerves to create dopamine and regulate the user's mood. Study shows that introducing positive music and sound can bring relaxation and alleviate the stress response. (Elliott Salamon, Minsun Kim, 2002) Potentials to implement sound and music into nurses' daily working brings it unique values.

Overall, the graduation project will focus on helping nurses in the hospital decrease the rate of pressure from daily work and design a product-service system that they can use during working hours without paying too much attention but can increase the working efficiency and refresh their minds to some extent.

As the project starting date is still affected by the COVID-19 outbreak. Unpredictable challenges that occur in the whole design process should not be ignored.

space available for images / figures on next page

Initials & Name T Zhang Student number 5065976

Title of Project Regulating nurses' mood through sound and music

introduction (continued): space for images

image / figure 1: Nurses dealing with complex missions every day

image / figure 2: Exhausted and negative feelings occurs during the day

Initials & Name T Zhang Student number 5065976

Title of Project Regulating nurses' mood through sound and music

Personal Project Brief - IDE Master Graduation

TU Delft

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.

Nurses in the hospital always experience sensory overload during the working hours. Personal mental health cannot be secured means more chances to make mistakes in normal work. However, the lack of awareness and appropriate method to recover their senses increase the high-pressure conditions. The challenge will be to create both an interactive experience and service through sound and music for them. So within the assignment, I aim to explore how to use sound/music as a medium to deliver positive interaction, therefore bringing positive attitudes towards daily missions and release working pressure.

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.

Within the scope of the project, it will result in a product/service system that introduces sound/music to nurses during daily work but without adding any burden to follow or receive, comparing with their current routines, and create a feeling of mind-recovering. The outcome will involve user experience design, product-service system design.

Research the working context of the current hospital, and analyze the pressure sources of nurses, understand the relationship between sound and emotion/feelings.

Product-service system design
Deliver the concept for nurses to use, also create a complete background service for them to interact, experience or play with. The whole systematic thinking of the final delivery.

User experience design
Introduce new product-service experience to nurses, therefore effectively reduce the working pressure and regulate their mood.

Initials & Name T Zhang Student number 5065976

Title of Project Regulating nurses' mood through sound and music

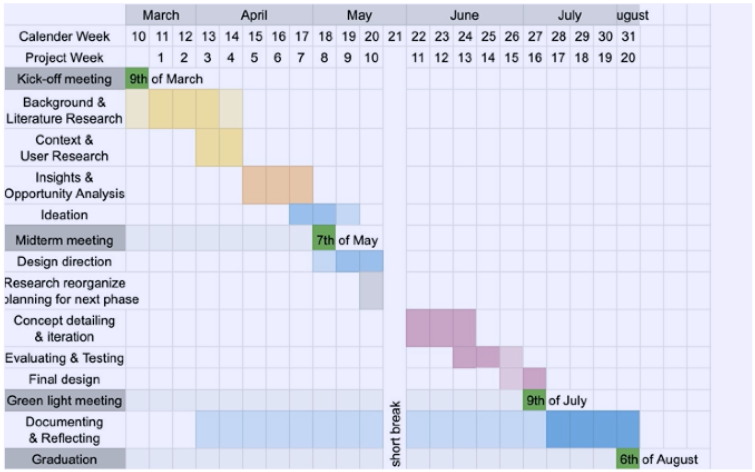
Personal Project Brief - IDE Master Graduation

TU Delft

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 9 - 3 - 2021 23 - 8 - 2021 end date



Followed by (more than) 100 working days. The project stages can be divided into: Define the project scope and background knowledge understanding, Context & User research to gather insights and design opportunities, Design Vision and requirements analysis, Idea exploration and design direction, Choose design direction for the iteration, Detailing concept, Evaluating & Testing for final delivery.

As the project is a problem/issue-driven design, I take the IPD master course Advanced Concept Design as the main reference, also refer to the evaluation process of Advanced Embodiment Design, in order to deliver a feasible, viable and desirable design solution. The outcome should be acceptable for nurses, hospital supervisors, and consider issues from cultural & societal, ergonomic & user experience, technology possibilities, and product/service viability perspectives.

The Kick-off meeting is on the 9th of March. After finishing the project research and ideation, the midterm meeting will be scheduled on project week 8 (around 40 working days) and support me to check the design ideas and choose the concept direction. Following the next phase of iteration and evaluation, I will detail the concept to the final design with the testing and prototyping. The green light meeting will be in project week 16 (over 80 working days). Finally, I'll continue the final finishing process to document, visualize and deliver the final documents and prepare the graduation presentation which will be scheduled at the beginning of August (over 100 working days).

Initials & Name T Zhang Student number 5065976

Title of Project Regulating nurses' mood through sound and music

Personal Project Brief - IDE Master Graduation

TU Delft

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.

I'm a multidisciplinary designer and experienced STEM study before. I enjoy solving complex problems with design methods and deliver innovative solutions that suit different stakeholders' needs. As a thoughtful observer of life, I love to explore insights into the details of things. The goal of my master's study is not only to go deeper into the design world but also to learn human-centered product-service design thinking and use it to improve normal people's daily experience naturally. I would like to use what I've learned about design engineering, visual communicating, and service thinking to provide a better experience towards small aspects of daily behaviors, habits.

From my personal perspective, I consider myself a music-lover. I dig into all kinds of music /sounds and enjoy the feelings that different types of instrumentals deliver to me. I always want to work on sound/music-related areas, no matter it is a record player design or a sound-based feedback system.

During the COVID-19 outbreak, I experienced a whole year of online (or semi-online) master study. This requests every individual a strong set of mind to continue and support each other even though without the face-to-face connection. The planned family visits and trips canceled, which makes everyone around me feel uncomfortable, depressed, and anxious. I realized that the mental health of a person is a cornerstone to support daily works and livings.

Start with my goal of the study, my personal experience, and personal interests, I ideated my graduation topic related to individual wellbeing and music/sound therapy. After sending my thinking to Dr. Elif Ozcan Vieira from the Critical Alarm Lab, we agreed on designing for nurses in the hospital will add more social value to the project since they undergo a lot of working pressure and noises every day from both medical devices and patients.

In this graduation project, I'll mainly explore how to use a product-service system to solve complex problems related to human-centered design and systematic thinking. The user experience will be mainly considered in the design, to make the solution logical, feasible, viable, and desirable for the hospital to implement and for nurses to accept. Another goal of the project is to understand the difference between designing a tangible product and a digital product, and how to consider product aesthetics and experience without a tangible form, therefore prepare for my future career.

FINAL COMMENTS

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

Initials & Name T Zhang Student number 5065976

Title of Project Regulating nurses' mood through sound and music

Appendix 2 - Participant's introduction of tasks in the workshop

Week 1

SOUND HUNTER via WhatsApp

Stressful, Relaxing, Playful

Sounds & Behaviors

Week 1 - Brief

SOUND HUNTER via WhatsApp

- **6** days activities.
- **Raise your awareness** of sounds around you, and the behaviors relate to it.
- **Online** activity via WhatsApp.

Week 1

SOUND HUNTER via WhatsApp

Day 1 & 2 activities

Stressful

adjective

causing a lot of anxiety and worry

Day 1

Hunt Sounds

"What type of sound do you **feel stressful** when you hear it during your work?"

Day 2

Notice Behaviors

"When is the **stressful moment** during your work?"

Week 1

SOUND HUNTER via WhatsApp

Day 3 & 4 activities

Relaxing

adjective

helping you to rest and become less anxious

Day 3

Hunt Sounds

"What type of sound do you **feel relaxed** when you hear it during your work?"

Day 4

Notice Behaviors

"When is the **relaxing moment** during your work?"

Week 1

SOUND HUNTER via WhatsApp

Day 5 & 6 activities

Playful/Joyful

adjective

very happy; full of fun

Day 5	Day 6
Hunt Sounds	**Notice Behaviors**
"What type of sound do you **feel playful/joyful** when you hear it during or after work?"	"When is the **playful/joyful moment** during or after your work?"

Week 1

SOUND HUNTER via WhatsApp

Rules

- The task will be sent every morning **8 am.** via WhatsApp from **next Monday**. Please finish each activity within 24 hours.
- Send the sounds you found by **audio/video recording** in WhatsApp.
- Send your behavior by **video/picture** in WhatsApp.
- Add explanations about **what/when/why** with texts/verbal description.

Appendix 3 - Context mapping results

Day 1&2 - Stressful

	Sounds	Behaviors
M. (Nurse)	No response	 A lot of work to do, focusing on reporting/monitoring and lunch at the same time. But want to hear the sound of a quiet sea. - Multi-sense overwhelming. - Doing different tasks at the same time. - Mess from the brain, also from the table.
H.	Super loud machine sound. Like the interior decoration sound. (electric drill) - Loud - High pitch and frequency - Very unpleasant	No response
D.	Cannot find stressful sounds (due to holiday)	He was late for the consultation hour. He was running on the stairs and in a hurry. Hard bottom shoes made sounds with cement ground. - Stress from personal mistakes and trying to catch up. - In a hurry, so that need to run. - Mentally stressful due to work issues, physically stressful due to running, and increasing heart rate.
B.	No stressing sounds due to holiday	No stressful situation
I.	Ventilation system noise from home, but same as the one in the office. The system automatically turns off at 5 pm in the office, but she also heard that in her home after 5 and made her feel stressed. - Hard to recognize the sound from the recording. - Feel stressed due to she supposed to have a good time at home, but heard the noise as the same as the one she hates in the office during working hours.	No response
MJ.	No specific stressful sounds at home. The most stressful sound is the telephone ringing, especially when in	In the morning, too much to do but don't have enough time to finish. At the same time, her husband was

	a zoom meeting. (no recording) - When a sound comes to an activity reminder, especially the activity always needs the person to focus the mind to tackle, the person will consider the sound as stressful.	making musical recordings with a singer in the living room. The sound seemed to increase the stress. (no pictures/recordings) - High workload causes stress. If uncontrollable sounds occur, it will only increase the stress. (Unity & Order)
W.	The air conditioner working super loud and sharp in the hospital. - unpleasant machine sounds - uncontrollable	No response
L. **(Nurse)**	Lisa missed the first "stressful" topic assignment	
K.	No recording. Explanations: I tried to record it, but the sound is too short. The sound of tiptoeing of a mouse while I work back home on the computer, very distracting.	

Day 3&4 - Relaxing

	Sounds	Behaviors
M. **(Nurse)**	"relaxing sound for me is silence" In the recording, it is only silence with super slightly talking sound and objects moving.	 Baking cookies, relaxing moment to start the weekend. Listening to a dutch station radio. - have time to do some personal habits while listening to some music and talking as the background is relaxing. - Relaxing - the task is easy to handle. the person has the confidence to finish. degree of difficulty is suitable for the person.
H.	no response	"After a busy week, alone at home. Watching slow television about nature and birds. When I look out of the window I see ducks and people walking the dog. I feel relaxed because nobody wants something of me. I don't have to listen or talk." The sound recording is from tv, birds sounds. - A typical situation that "escape from reality" is a relaxing moment for a person.
D.	Sound recording: raining sound hearing from the	Personal issues that cannot pay attention to the

	room, raindrop sometimes drops against the window, slightly people talking. Explanation: Dizzle against the window makes me think of a rainy relaxed vacation. - Raining sound is an environmental white noise. It does help people to calm and relax. But obviously, it recalls different memories/scenarios due to personal habits and experiences.	assignment.
B.	 Sound recording: outside sound with a slight wind, birds singing, sounds like a very good morning in the forest. Explanations: sound from birds whistling while sitting in trees. - nature sounds, pure and no disturb	 Video: holding the handle and turning it in circles, the sound like grinding something Explanation: Making fresh coffee in the morning by using an antique grinder. Made me feel very comfortable and ready for the new day. The setting is our holiday house in the middle of the forest, surrounded by a big lake, sun rising up from behind

		the trees. - the environment is satisfied with his imagination. good vibes to start the day. - the interaction with the grinder is only holding and turning. The person likes it because of the curiosity of using things that not familiar but understand the basic function and suitable for needs.
I.	No recording, only explanations. (busy schedule) Explanations: Silence, but also rumor on the hallway (hearing it but not being part of it) nature sounds during the lunch break outside.	Explanations: at Friday having a less busy schedule and being able to have a good conversation with my colleagues, normally we can't find the time to do this. Relaxed because we can trust each other and no other appointment is rushing us. Having the time to really listen and express. So what do I hear? Each other and no distractions.
MJ.	The best sound is simply no sound, silence, when I'm at work or working at home, at my computer, alone in my room	Day off at home, listening to classical music.
W.	no reply	coffee and thee brake(coffee break?) Just a little bit talking with my colleagues, the noise of the airco is niet nice.
L. **(Nurse)**	Sound recording: basically silence, with slightly talking in the background and a laughter Explanations: Good morning, this is my sound from yesterday. This was	This morning I showered before work. It is completely quiet in the house because my friend was still asleep. I felt relaxed because I just got out of bed and had no worries here. In the shower I hear the water flowing to

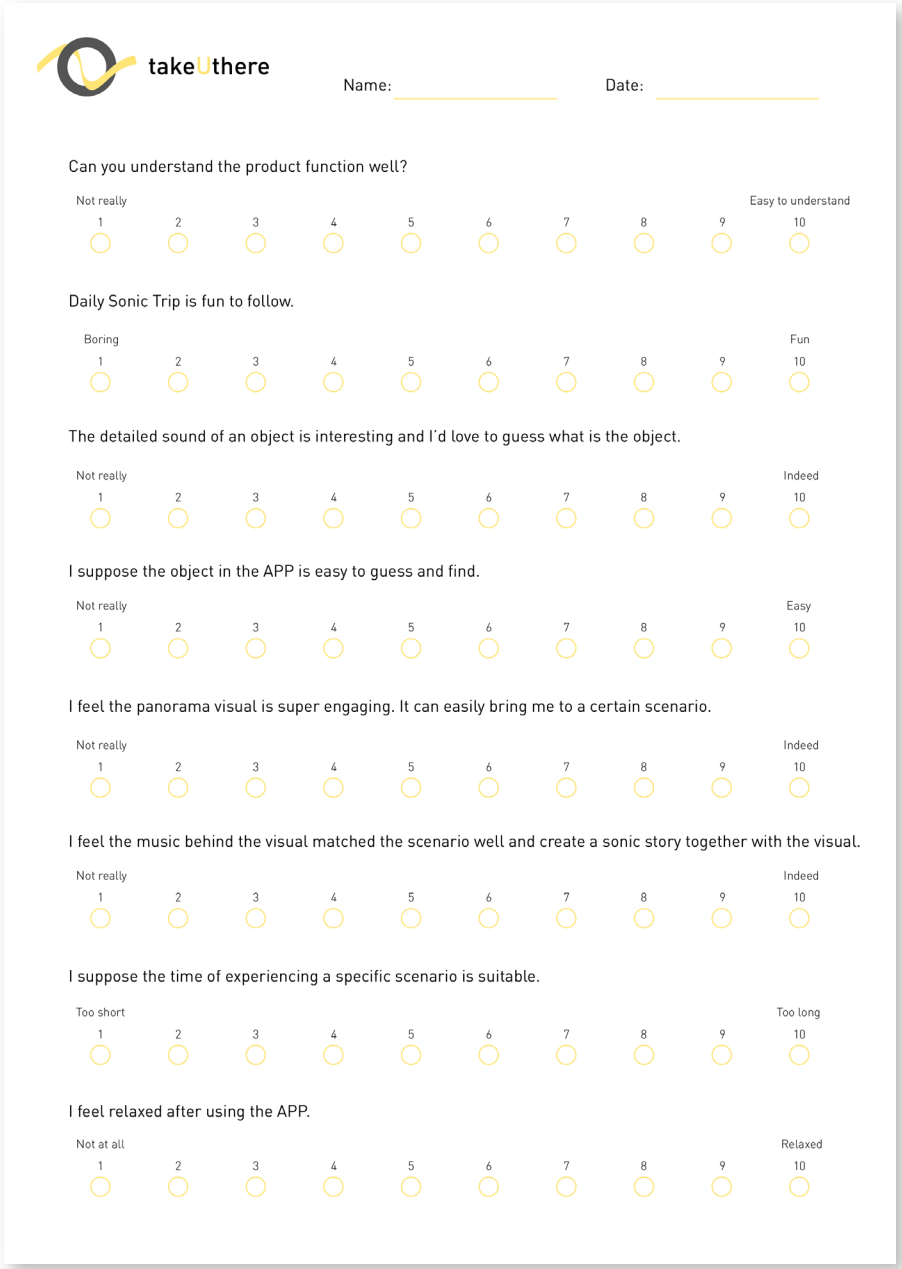
	made around 6:00 PM. This was the time when the patients, nurses and doctors were eating. This is a nice moment because the crowds in the department are not present for a while, but there is time to laugh.	the tap, the water falling on my head and body. Finally, I hear the water falling in the shower.
K.		

Day 5&6 - Joyful/playful

	Sounds	Behaviors
M. (Nurse)	Recording: slightly wind with loud bird sounds Explanations: The is from the weekend. The sounds of birds in the morning give me a feeling of joy and happiness.	no response
H.	no response	no response
D.	Sound recording 1: birds singing loud with slightly traffic sounds and wind Explanation: The sound of singing birds when I wake up in the morning. Sound recording 2: water sounds, baby sounds. like moving in the water. Explanation: bathing of my 7 days old grandson by the father: cute! Sound recording 3: Italian song. (I cannot find the name match) Explanations: Favorite Italian songs accompany dinner. It brings back visions of seashores, mountains, Italian cities, cafés, lost loves.	no response
B.	no response	no response
I.	no response	no response
MJ.	no response	Driving in my car, listening to the radio, singing out loud. Also, walking through nature, hearing birds sing.
W.		

L. **(Nurse)**	Explanations: Today I received a present from a friend for my wedding. A nice sound is unwrapping a gift. When unpacking, I heard the paper tear. This sound was nice because after a year I finally got to unwrap the gift because the wedding is now soon to follow.	Explanations: Since tomorrow my friend's grandmother and grandfather have been married for sixty years, we went today for lunch on a terrace. I sit quietly in a chair in the sun. Around me are a number of tables where other people eat. There are beach chairs in the grass on which people are having a drink. There are also many trees and shrubs and a pond on the right. I see a male peacock and female peacock. The female approaches the male, causing the male to spread his feathers and call the female. I feel relaxed because since Corona I can enjoy the sun with a drink on the terrace and all the sounds that go with it, such as the wind blowing through the trees and the calling of the male peacock.
K.		

Appendix 4 - Final Evaluation Questionnaire



takeUthere

Name: _____ Date: _____

Can you understand the product function well?

Not really — Easy to understand

1 2 3 4 5 6 7 8 9 10

Daily Sonic Trip is fun to follow.

Boring — Fun

1 2 3 4 5 6 7 8 9 10

The detailed sound of an object is interesting and I'd love to guess what is the object.

Not really — Indeed

1 2 3 4 5 6 7 8 9 10

I suppose the object in the APP is easy to guess and find.

Not really — Easy

1 2 3 4 5 6 7 8 9 10

I feel the panorama visual is super engaging. It can easily bring me to a certain scenario.

Not really — Indeed

1 2 3 4 5 6 7 8 9 10

I feel the music behind the visual matched the scenario well and create a sonic story together with the visual.

Not really — Indeed

1 2 3 4 5 6 7 8 9 10

I suppose the time of experiencing a specific scenario is suitable.

Too short — Too long

1 2 3 4 5 6 7 8 9 10

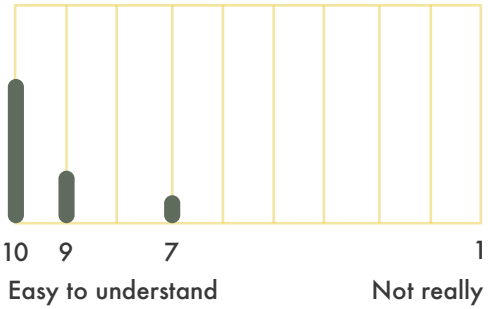
I feel relaxed after using the APP.

Not at all — Relaxed

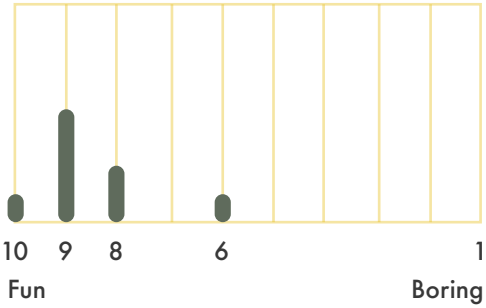
1 2 3 4 5 6 7 8 9 10

Appendix 5 - Final Evaluation Statistics Results

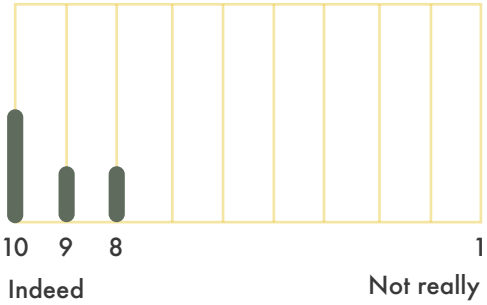
Understanding about product function



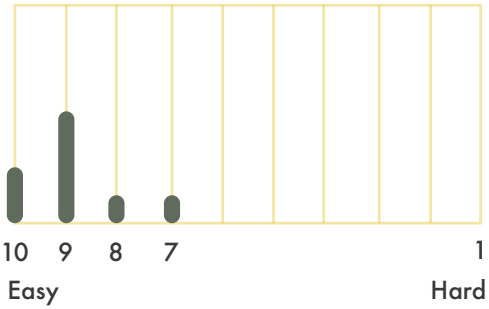
Daily sonic trip



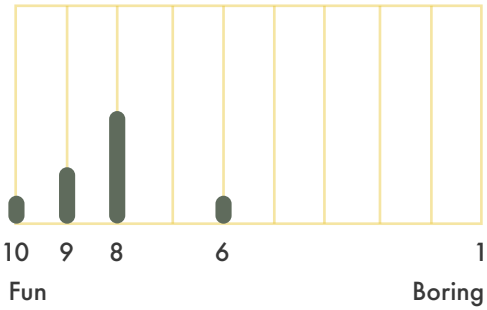
Enjoy guessing object sounds



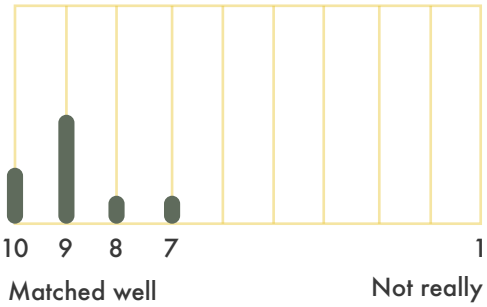
Simplicity of listening and guessing



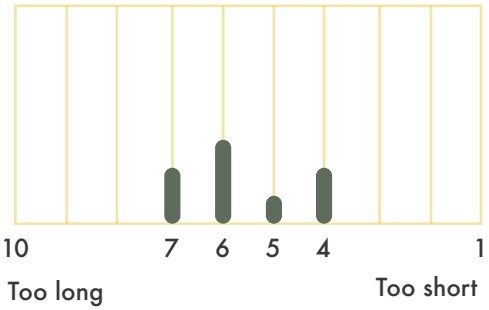
Engaging panorama visual



Music match with the scenario



Scenario exploration time



Feel relaxed after using the APP.